

SHOP MANUAL

KOMATSU

LW250-5

MACHINE MODEL

SERIAL NUMBER

LW250-5

X-shaped outrigger specification 50001 and up

H-shaped outrigger specification 53001 and up

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require.
Materials and specifications are subject to change without notice.
- LW250-5 mounts the S6D125-2 engine.
For details of the engine, see the 6D125-2 Series Engine Shop Manual.

CONTENTS

	No. of page
01 GENERAL	01-1
10 STRUCTURE AND FUNCTION	10-1
20 TESTING AND ADJUSTING	20-1
30 DISASSEMBLY AND ASSEMBLY	30-1
40 MAINTENANCE STANDARD	40-1
90 OTHERS	90-1

023S05

The affected pages are indicated by the use of the following marks. It is requested that necessary actions be taken to these pages according to the table below.

Mark	Indication	Action required
○	Page to be newly added	Add
●	Page to be replaced	Replace
()	Page to be deleted	Discard

Pages having no marks are those previously revised or made additions.

LIST OF REVISED PAGES

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
●	00-1	⑤		01-11	④		10-23			10-69			10-109	
	00-2	③		01-12			10-24			10-70			10-110	
●	00-2-1	⑤		01-13			10-26			10-71			10-111	
●	00-2-2	⑤		01-14			10-27			10-72			10-112	
●	00-2-3	⑤		01-15			10-28			10-73			10-113	
●	00-2-4	⑤		01-16	④		10-29			10-74			10-114	
●	00-2-5	⑤		01-17	④		10-30			10-75			10-115	
●	00-2-6	⑤		01-17-1	④		10-31			10-76			10-116	
●	00-2-7	⑤		01-17-2	④		10-32			10-77			10-117	
●	00-2-8	⑤		01-18	④		10-33			10-78			10-118	
	00-3			01-19	④		10-34			10-79			10-119	
	00-4			01-19-1	④		10-36			10-80			10-120	
	00-5			01-19-2	④		10-37			10-81			10-121	
	00-6			01-20			10-38			10-82			10-122	
	00-7			01-21			10-39			10-83			10-123	
	00-8			01-22			10-40			10-84			10-124	
	00-9			01-23			10-42			10-85			10-125	
	00-10			01-24			10-43			10-86			10-126	
	00-11			01-25	④		10-44			10-87			10-127	
	00-12			01-26	④		10-45			10-88			10-128	
	00-13						10-46			10-89			10-129	
	00-14			10-1			10-48			10-90			10-130	
	00-15			10-2	④		10-49			10-91	④		10-131	
	00-16			10-4			10-50			10-92			10-132	
	00-17			10-5			10-52			10-93			10-133	
	00-18			10-6			10-53			10-93-1	④		10-134	
	00-19			10-7			10-54			10-93-2	④		10-135	
				10-8			10-55			10-93-3	④		10-136	
	01-1			10-9			10-56			10-94			10-137	
	01-2	④		10-10			10-57			10-95			10-138	
	01-3	④		10-12			10-58			10-96	④		10-139	
	01-3-1	④		10-13			10-59			10-97	④		10-140	
	01-3-2	④		10-14			10-60			10-98			10-141	
	01-4	④		10-15			10-61			10-99			10-142	
	01-5			10-16			10-62			10-100	④		10-143	
	01-6			10-17			10-63			10-101			10-144	
	01-7			10-18			10-64			10-102			10-145	
	01-8			10-19			10-65			10-104	④		10-146	
	01-9			10-20			10-66			10-105			10-147	
	01-10	④		10-21			10-67			10-106			10-148	
	01-10-1	④		10-22			10-68			10-108			10-149	

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
10-150			10-207			10-256			10-266			10-321		
10-152			10-208			10-257			10-267			10-322		
10-153			10-209			10-258 ④			10-268			10-323		
10-154			10-210			10-258-1 ④			10-269			10-324		
10-155			10-211			10-258-2 ④			10-270			10-325		
10-156			10-212			10-258-3 ④			10-271			10-326		
10-157			10-213			10-258-4 ④			10-272			10-327		
10-158			10-214			10-258-5 ④			10-273 ④			10-328		
10-159			10-215			10-258-6 ④			10-274			10-330		
10-160			10-216			10-258-7 ④			10-275			10-331		
10-161			10-217			10-258-8 ④			10-276			10-332		
10-162			10-218			10-258-9 ④			10-277			10-333		
10-164			10-219			10-258-10 ④			10-278			10-334 ④		
10-165			10-220			10-258-11 ④			10-279			10-335		
10-166			10-222			10-258-12 ④			10-280			10-336		
10-167			10-223			10-258-13 ④			10-281			10-337		
10-168			10-224			10-258-14 ④			10-282			10-338		
10-169			10-225			10-258-15 ④			10-283			10-339		
10-170			10-226			10-258-16 ④			10-284			10-340		
10-171			10-228			10-258-17 ④			10-285			10-341		
10-172			10-229			10-258-18 ④			10-286			10-342		
10-173			10-230			10-258-19 ④			10-288			10-343		
10-174			10-231			10-258-20 ④			10-289			10-344		
10-175			10-232			10-258-21 ④			10-290			10-345		
10-176			10-234			10-258-22 ④			10-292			10-346		
10-177			10-235			10-258-23 ④			10-293			10-347		
10-178 ④			10-235-1 ④			10-258-24 ④			10-294			10-348		
10-179			10-235-2 ④			10-258-25 ④			10-295			10-349		
10-180			10-236			10-258-26 ④			10-296					
10-182			10-237			10-258-27 ④			10-297			20-1 ①		
10-183			10-238			10-258-28 ④			10-298			20-2 ①		
10-184			10-239			10-258-29 ④			10-300			20-3 ①		
10-185			10-240			10-258-30 ④			10-301			20-4 ①		
10-186			10-241			10-258-31 ④			10-302			20-5 ①		
10-187			10-242			10-258-32 ④			10-303			20-6 ①		
10-188			10-243			10-258-34 ④			10-304			20-7 ①		
10-189			10-244			10-258-35 ④			10-305			20-8 ①		
10-190			10-245			10-258-36 ④			10-306			20-9 ①		
10-191			10-246			10-258-37 ④			10-307			20-10 ①		
10-192			10-247 ④			10-258-38 ④			10-308			20-11 ①		
10-193			10-248			10-258-39 ④			10-309 ④			20-12 ①		
10-194			10-249			10-258-40 ④			10-309-1 ④			20-13 ①		
10-195			10-250			10-258-41 ④			10-310			20-14 ①		
10-196			10-251			10-258-42 ④			10-311			20-15 ①		
10-197			10-252			10-258-43 ④			10-312			20-16 ①		
10-198			10-253			10-258-44 ④			10-313			20-17 ①		
10-199			10-253-1 ④			10-259			10-314			20-18 ①		
10-200			10-253-2 ④			10-260			10-315			20-19 ①		
10-202			10-253-3 ④			10-261			10-316			20-20 ①		
10-203			10-253-4 ④			10-262			10-317			20-21 ①		
10-204			10-253-5 ④			10-263			10-318			20-22 ①		
10-205			10-254			10-264			10-319			20-23 ①		
10-206			10-255			10-265			10-320			20-24 ①		

023505

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
	20-25	①		20-78	①		20-131	①		20-253	②		20-376	②
	20-26	①		20-79	①		20-201	②		20-254	②		20-377	②
	20-27	①		20-80	①		20-202	②		20-255	②		20-378	②
	20-28	①		20-81	①		20-203	②		20-256	②		20-379	②
	20-29	①		20-82	①		20-204	②		20-301	②		20-380	②
	20-30	①		20-83	①		20-205	②		20-302	②		20-381	②
	20-31	①		20-84	①		20-206	②		20-303	②		20-382	②
	20-32	④		20-85	①		20-207	②		20-304	②		20-383	②
	20-33	①		20-86	①		20-208	②		20-305	②		20-384	②
	20-34	①		20-87	①		20-209	②		20-306	②		20-385	②
	20-35	①		20-88	①		20-210	②		20-307	②		20-386	②
	20-36	①		20-89	①		20-211	②		20-308	②		20-387	②
	20-37	①		20-90	①		20-212	②		20-309	②		20-388	②
	20-38	①		20-91	①		20-213	②		20-310	②		20-389	②
	20-39	①		20-92	①		20-214	②		20-311	②		20-390	②
	20-40	①		20-93	①		20-215	②		20-312	②		20-392	②
	20-41	①		20-94	①		20-216	②		20-313	②		20-393	②
	20-42	①		20-95	①		20-217	②		20-314	②		20-394	②
	20-43	①		20-96	①		20-218	②		20-315	②		20-395	②
	20-44	①		20-97	①		20-219	②		20-316	②		20-396	②
	20-45	①		20-98	①		20-220	②		20-317	②		20-397	②
	20-46	①		20-99	①		20-221	②		20-318	②		20-398	②
	20-47	①		20-100	①		20-222	②		20-319	②		20-399	②
	20-48	①		20-101	①		20-223	②		20-320	②		20-400	②
	20-49	①		20-102	①		20-224	②		20-321	②		20-401	②
	20-50	①		20-103	①		20-225	②		20-322	②		20-402	②
	20-51	①		20-104	①		20-226	②		20-323	②		20-403	②
	20-52	①		20-105	①		20-227	④		20-324	②		20-404	②
	20-53	①		20-106	①		20-228	②		20-351	②		20-405	②
	20-54	①		20-107	①		20-229	②	●	20-352	⑤		20-406	②
	20-55	①		20-108	①		20-230	②		20-353	②		20-407	②
●	20-56	⑤		20-109	①		20-231	②		20-354	②		20-408	②
	20-57	①		20-110	①		20-232	②		20-355	②		20-409	②
	20-58	①		20-111	①		20-233	④		20-356	②		20-410	②
	20-59	①		20-112	①		20-234	②		20-357	②		20-411	②
	20-60	①		20-113	①		20-235	②		20-358	②		20-412	②
	20-61	①		20-114	①		20-236	②		20-359	②		20-413	②
	20-62	①		20-115	①		20-237	②		20-360	②		20-414	②
	20-63	①		20-116	①		20-238	②		20-361	②		20-415	②
	20-64	①		20-117	①		20-239	②		20-362	②		20-416	②
	20-65	①		20-118	①		20-240	②		20-363	②		20-417	②
	20-66	①		20-119	①		20-241	②		20-364	②		20-418	②
	20-67	①		20-120	①		20-242	②		20-365	②		20-419	②
	20-68	①		20-121	①		20-243	②		20-366	②		20-420	②
	20-69	①		20-122	①		20-244	②		20-367	②		20-421	②
	20-70	①		20-123	①		20-245	②		20-368	②		20-422	②
	20-71	①		20-124	①		20-246	②		20-369	②		20-423	②
	20-72	①		20-125	①		20-247	②		20-370	②		20-424	②
	20-73	①		20-126	①		20-248	②		20-371	②		20-425	②
	20-74	①		20-127	④		20-249	②		20-372	②		20-426	②
	20-75	①		20-128	④		20-250	②		20-373	②		20-427	②
	20-76	①		20-129	①		20-251	②	●	20-374	⑤		20-428	②
	20-77	①		20-130	①		20-252	②		20-375	②		20-429	②

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
	20-430	②		20-532	②		20-586	②		20-637	②		20-707	②
	20-431	②		20-533	②		20-587	②		20-638	②		20-708	②
	20-432	②		20-534	②		20-588	②		20-639	②		20-709	②
●	20-433	⑤		20-535	②		20-589	②		20-640	②		20-710	②
●	20-434	⑤		20-536	②		20-590	②		20-641	②		20-711	②
	20-435	②		20-537	②		20-591	②		20-642	②		20-712	②
	20-436	②		20-538	②		20-592	②		20-643	②		20-713	②
	20-437	②		20-539	②		20-593	②		20-644	②		20-714	④
	20-438	②		20-540	②		20-594	②		20-645	②		20-715	②
	20-439	②		20-541	②		20-595	②		20-646	②		20-716	②
	20-440	②		20-542	②		20-596	②		20-647	②		20-717	②
	20-441	②		20-543	②	○	20-596-1	⑤		20-648	②		20-718	②
	20-442	②		20-544	②	○	20-596-2	⑤		20-649	②		20-719	②
	20-444	②		20-545	②		20-597	②		20-650	②		20-720	②
	20-445	②		20-546	②		20-598	②		20-651	②		20-721	②
	20-446	②		20-547	②		20-599	②		20-652	②		20-722	②
	20-447	②		20-548	②		20-600	④		20-653	②		20-723	②
	20-448	②	●	20-549	⑤		20-601	④		20-654	②		20-724	②
	20-449	②		20-550	②		20-602	②		20-655	②		20-725	②
	20-450	②		20-551	②		20-603	②		20-656	②		20-726	②
	20-451	②		20-552	②		20-604	②		20-657	②		20-727	②
	20-452	②		20-553	②		20-605	②		20-658	②		20-728	②
●	20-501	⑤		20-554	②		20-606	②		20-659	②		20-729	②
●	20-502	⑤		20-555	②		20-607	②		20-660	②		20-730	②
	20-503	②		20-556	②		20-608	②		20-661	②		20-731	②
	20-504	②		20-557	②		20-609	②		20-662	②		20-732	②
●	20-505	⑤		20-558	②		20-610	②		20-663	②		20-733	②
●	20-506	⑤		20-559	②		20-611	②		20-664	②		20-734	②
●	20-507	⑤		20-560	②		20-612	②		20-665	②		20-735	②
●	20-508	⑤		20-562	②		20-613	②		20-666	②		20-736	②
●	20-509	⑤		20-563	②		20-614	②		20-667	②		20-737	②
●	20-510	⑤		20-564	②		20-615	②		20-668	②		20-738	②
●	20-511	⑤		20-565	②		20-616	②		20-669	②		20-739	②
	20-512	②		20-566	②		20-617	②		20-670	②		20-740	②
	20-513	②		20-567	②		20-618	②		20-671	②		20-741	④
	20-514	②		20-568	②		20-619	②		20-672	②		20-742	②
	20-515	②		20-569	②		20-620	②		20-673	②		20-743	②
	20-516	②		20-570	②		20-621	②		20-674	②		20-744	②
	20-517	②		20-571	②		20-622	②		20-675	②		20-745	②
	20-518	②		20-572	②		20-623	②		20-676	②		20-746	②
	20-519	②		20-573	②		20-624	②		20-677	②		20-747	②
●	20-520	⑤		20-574	②		20-625	②		20-678	②		20-748	②
●	20-521	⑤		20-575	②		20-626	②		20-680	②		20-749	②
	20-522	②		20-576	②		20-627	②		20-681	②		20-750	②
	20-523	②		20-577	②		20-628	②		20-682	②		20-751	②
	20-524	②		20-578	②		20-629	②		20-683	②		20-752	②
	20-525	②		20-579	②		20-630	②		20-684	②		20-753	②
	20-526	②		20-580	②		20-631	②		20-701	②		20-754	②
	20-527	②		20-581	②		20-632	②		20-702	②		20-755	②
	20-528	②		20-582	②		20-633	②		20-703	②		20-756	②
	20-529	②		20-583	②		20-634	②		20-704	②		20-757	②
	20-530	②		20-584	②		20-635	②		20-705	②		20-758	②
	20-531	②		20-585	②		20-636	②		20-706	②		20-759	②

023S05

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
20-760	②		20-813	②		20-867	②		20-924	②		20-977	②	
20-761	②		20-814	②		20-868	②		20-925	②		20-978	②	
20-762	②		20-815	②		20-869	②		20-926	②		20-979	②	
20-763	②		20-816	②		20-870	②		20-927	②		20-1001	②	
20-764	④		20-817	②		20-872	②		20-928	②		20-1002	②	
20-765	②		20-818	②		20-873	②		20-929	②		20-1003	②	
20-766	②		20-819	②		20-874	②		20-930	②		20-1004	②	
20-767	②		20-820	②		20-875	②		20-931	②		20-1005	②	
20-768	②		20-821	②		20-876	②		20-932	②		20-1006	②	
20-769	②		20-822	②		20-877	②		20-933	②		20-1007	②	
20-770	②		20-823	②		20-878	②		20-934	②		20-1008	②	
20-771	②		20-824	②		20-879	②		20-935	②		20-1009	②	
20-772	②		20-825	②		20-880	②		20-936	②		20-1010	②	
20-773	②		20-826	②		20-882	②		20-937	②		20-1011	②	
20-774	②		20-827	②		20-883	②		20-938	②		20-1012	②	
20-775	②		20-828	②		20-884	②		20-939	②		20-1013	②	
20-776	②		20-829	②		20-885	②		20-940	②		20-1014	②	
20-777	②		20-830	②		20-886	②		20-941	②		20-1015	②	
20-778	②		20-831	②		20-887	②		20-942	②		20-1016	②	
20-779	②		20-832	②		20-888	②		20-943	②		20-1017	②	
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20-781	②		20-834	②		20-890	②		20-945	②		20-1019	②	
20-782	②		20-835	②		20-891	②		20-946	②		20-1020	②	
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20-784	②		20-837	②		20-893	②		20-948	②		20-1022	②	
20-785	②		20-838	②		20-894	②		20-949	②		20-1023	②	
20-786	②		20-839	②		20-895	②		20-950	②		20-1024	②	
20-787	②		20-840	②		20-896	②		20-951	②		20-1025	②	
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20-793	②		20-846	②		20-903	②		20-957	②		20-1031	②	
20-794	②		20-847	②		20-904	②		20-958	②		20-1033	②	
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20-796	②		20-849	②		20-906	②		20-960	②		20-1035	④	
20-797	②		20-850	②		20-907	②		20-961	②		20-1036	②	
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20-799	②		20-852	②		20-909	②		20-963	②		20-1038	②	
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20-801	②		20-854	②		20-911	②		20-965	②		20-1040	②	
20-802	②		20-855	②		20-912	②		20-966	②		20-1041	②	
20-803	②		20-856	②		20-913	②		20-967	②		20-1042	②	
20-804	②		20-857	②		20-914	②		20-968	②		20-1043	⑤	
20-805	②		20-858	②		20-915	②		20-969	②		20-1044	②	
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20-811	②		20-865	②		20-922	②		20-975	②		20-1050	②	
20-812	②		20-866	②		20-923	②		20-976	②		20-1051	②	

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
20-1052	②		20-1123	②		20-1312	②		20-1369	②		30-37	③	
20-1053	②		20-1124	②		20-1313	②		20-1370	②		30-38	③	
20-1054	②		20-1125	②		20-1314	②		20-1371	②		30-39	③	
20-1055	②		20-1126	②		20-1315	②		20-1372	②		30-40	③	
20-1056	②		20-1127	②		20-1316	②		20-1373	②		30-41	③	
20-1057	②		20-1128	②		20-1317	②		20-1374	②		30-42	③	
20-1058	②		20-1129	②		20-1319	②		20-1376	②		30-43	③	
20-1059	②		20-1130	②		20-1320	②		20-1377	②		30-44	③	
20-1060	②		20-1131	②		20-1321	②		20-1378	②		30-45	③	
20-1061	②		20-1132	②		20-1322	②		20-1379	②		30-46	③	
20-1062	②		20-1133	②		20-1324	②		20-1380	②		30-47	③	
20-1063	②		20-1134	②		20-1325	②		20-1381	②		30-48	③	
20-1064	②		20-1135	②		20-1326	②		20-1382	②		30-49	③	
20-1065	②		20-1136	②		20-1328	②		20-1383	②		30-50	③	
20-1066	②		20-1137	②		20-1329	②		20-1384	②		30-51	③	
20-1067	②		20-1138	②		20-1330	②		20-1385	②		30-52	③	
20-1068	②		20-1139	②		20-1331	②					30-53	③	
20-1069	②		20-1140	②		20-1332	②		30-1	③		30-54	③	
20-1070	②		20-1201	②		20-1333	②		30-2	③		30-55	③	
20-1071	②		20-1202	②		20-1334	②	●	30-3	⑤		30-56	③	
20-1072	②		20-1203	②		20-1335	②	●	30-4	⑤		30-57	③	
20-1073	②		20-1204	②		20-1336	②		30-5	③		30-58	③	
20-1074	②		20-1205	②		20-1337	②		30-6	③		30-59	③	
20-1075	②		20-1206	②		20-1338	②		30-7	③		30-60	③	
20-1076	②		20-1207	②		20-1339	②		30-8	③		30-61	③	
20-1077	②		20-1208	②		20-1340	②		30-9	③		30-62	③	
20-1078	②		20-1209	②		20-1341	②		30-10	③		30-63	③	
20-1079	②		20-1210	④		20-1342	②		30-11	③		30-64	③	
20-1080	②		20-1211	②		20-1343	②		30-12	③		30-65	③	
20-1081	②		20-1212	②		20-1344	②		30-13	③		30-66	③	
20-1082	②		20-1214	②		20-1345	②		30-14	③		30-67	③	
20-1083	②		20-1215	②		20-1346	②		30-15	③		30-68	③	
20-1101	②		20-1216	②		20-1347	②		30-16	③		30-69	③	
20-1102	②		20-1217	②		20-1348	②		30-17	③		30-70	③	
20-1103	②		20-1218	②		20-1349	②		30-18	③		30-71	③	
20-1105	②		20-1219	②		20-1350	②		30-19	③		30-72	③	
20-1106	②		20-1220	②		20-1351	②		30-20	③		30-73	③	
20-1107	②		20-1221	②		20-1352	②		30-21	③		30-74	③	
20-1108	②		20-1222	②		20-1353	②		30-22	③		30-75	③	
20-1109	②		20-1223	②		20-1354	②		30-23	③		30-76	③	
20-1110	②		20-1224	②		20-1355	②		30-24	③		30-77	③	
20-1111	②		20-1225	②		20-1356	②		30-25	③		30-78	③	
20-1112	②		20-1226	②		20-1357	②		30-26	③		30-79	③	
20-1113	②		20-1301	②		20-1358	②		30-27	③		30-80	③	
20-1114	②		20-1302	②		20-1359	②		30-28	③		30-81	③	
20-1115	②		20-1303	②		20-1360	②		30-29	③		30-82	③	
20-1116	②		20-1304	②		20-1361	②		30-30	③		30-83	③	
20-1117	②		20-1305	②		20-1362	②		30-31	③		30-84	③	
20-1118	②		20-1306	②		20-1363	②		30-32	③		30-85	③	
20-1119	②		20-1307	②		20-1364	②		30-33	③		30-86	③	
20-1120	②		20-1308	②		20-1365	②		30-34	③		30-87	③	
20-1121	②		20-1309	②		20-1367	②		30-35	③		30-88	③	
20-1122	②		20-1310	②		20-1368	②		30-36	③		30-89	③	

023S05

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
30-90		③	30-144		③	30-198		③	30-251		③	30-306		③
30-91		③	30-145		③	30-199		③	30-252		③	30-307		③
30-92		③	30-146		③	30-200		③	30-253		③	30-308		③
30-93		③	30-147		③	30-201		③	30-254		③	● 30-309		⑤
30-94		③	30-148		③	30-202		③	30-255		③	30-310		③
30-95		③	30-149		③	30-203		③	30-256		③	30-311		③
30-96		③	30-150		③	30-204		③	30-257		③	30-312		③
30-97		③	30-151		③	30-205		③	30-258		③	30-313		③
30-98		③	30-152		③	30-206		③	30-259		③	30-314		③
30-99		③	30-153		③	30-207		③	30-260		③	30-315		③
30-100		③	30-154		③	30-208		③	30-261		③	30-316		③
30-101		③	30-155		③	30-209		③	30-262		③	30-317		③
30-102		③	30-156		③	30-210		③	30-263		③	30-318		③
30-103		③	30-157		③	30-211		③	30-264		③	30-319		③
30-104		③	30-158		③	30-212		③	30-265		③	30-320		③
30-105		③	30-159		③	30-213		③	30-266		③	30-321		③
30-106		③	30-160		③	30-214		③	30-267		③	30-322		③
30-107		③	30-161		③	30-215		③	30-268		③	30-323		③
30-108		③	30-162		③	30-216		③	30-269		③	30-324		③
30-109		③	30-163		③	30-217		③	30-270		③	30-325		③
30-110		③	30-164		③	30-218		③	30-271		③	30-326		③
30-111		③	30-165		③	● 30-219		⑤	30-272		③	30-327		③
30-112		③	30-166		③	30-220		③	30-273		③	30-328		③
30-113		③	30-167		③	30-221		③	30-275		③	30-329		③
30-114		③	30-168		③	30-222		③	30-276		③	30-330		③
30-115		③	30-169		③	30-223		③	30-277		③	30-331		③
30-116		③	30-170		③	30-224		③	30-278		③	30-332		③
30-117		③	30-171		③	30-225		③	30-280		③	○ 20-332-1		⑤
30-118		③	● 30-172		⑤	30-226		③	30-281		③	○ 20-332-2		⑤
30-119		③	30-173		③	30-227		③	30-282		③	○ 20-332-3		⑤
30-120		③	30-174		③	30-228		③	30-283		③	○ 20-332-4		⑤
30-122		③	30-175		③	30-229		③	30-284		③	○ 20-332-5		⑤
30-123		③	30-176		③	30-230		③	30-285		③	○ 20-332-6		⑤
30-124		③	30-177		③	30-231		③	30-286		③	○ 20-332-7		⑤
30-125		③	30-178		③	30-232		③	30-287		③	○ 20-332-8		⑤
30-126		③	30-179		③	30-233		③	30-288		③	○ 20-332-9		⑤
30-127		③	30-180		③	30-234		③	30-289		③	○ 20-332-10		⑤
30-128		③	30-181		③	30-235		③	30-290		③	○ 20-332-11		⑤
30-129		③	30-182		③	30-236		③	● 30-291		⑤	○ 20-332-12		⑤
30-130		③	30-183		③	30-237		③	30-292		③	○ 20-332-13		⑤
30-131		③	30-184		③	30-238		③	30-293		③	○ 20-332-14		⑤
30-132		③	30-185		③	30-239		③	30-294		③	○ 20-332-15		⑤
30-133		③	30-186		③	30-240		③	30-295		③	○ 20-332-16		⑤
30-134		③	30-187		③	30-241		③	● 30-296		⑤	○ 20-332-17		⑤
30-135		③	30-188		③	30-242		③	30-297		③	○ 20-332-18		⑤
30-136		③	30-189		③	30-243		③	30-298		③	○ 20-332-19		⑤
30-137		③	30-190		③	30-244		③	30-299		③	○ 20-332-20		⑤
30-138		③	30-191		③	30-245		③	30-300		③	○ 20-332-21		⑤
30-139		③	30-192		③	30-246		③	30-301		③	○ 20-332-22		⑤
30-140		③	30-193		③	30-247		③	30-302		③	○ 20-332-23		⑤
30-141		③	30-194		③	30-248		③	30-303		③	○ 20-332-24		⑤
30-142		③	30-195		③	30-249		③	30-304		③	○ 20-332-25		⑤
30-143		③	30-196		③	30-250		③	30-305		③	○ 20-332-26		⑤

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30-333		③	40-4			90-73								
30-334		③	40-5			90-75		④						
30-335		③	40-6			90-77								
30-336		③	40-7			90-79								
30-337		③	40-8			90-81								
30-338		③	40-9			90-83								
30-339		③	40-10			90-85		④						
30-340		③	40-11			90-201		②						
30-341		③	40-12			90-203		②						
30-342		③	40-13			90-205		②						
30-343		③	40-14			90-207		②						
30-344		③	40-15			90-401		②						
30-345		③	40-16			90-403		②						
30-346		③	40-17			90-405		②						
30-347		③	40-18			90-407		②						
30-348		③	40-19			90-409		②						
30-349		③	40-20											
30-350		③	40-21											
30-351		③	40-22											
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30-356		③	40-27											
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30-362		③	40-33											
30-363		③												
30-364		③	90-1		④									
30-365		③	90-3											
30-366		③	90-5											
30-367		③	90-11		④									
			90-13											
40-1		④	90-15		④									
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40-1-2		④	90-19											
40-1-3		④	90-21											
40-1-4		④	90-23											
40-1-5		④	90-25		④									
40-1-6		④	90-51											
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40-1-8		④	90-55											
40-1-9		④	90-57											
40-1-10		④	90-59											
40-1-11		④	90-61		④									
40-1-13		④	90-63											
40-1-14		④	90-65											
40-1-15		④	90-67											
40-2			90-69											
40-3			90-71											


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SAFETY

SAFETY NOTICE

IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

To prevent injury to workers, the symbol  is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
 - Always wear safety glasses when hitting parts with a hammer.
 - Always wear safety glasses when grinding parts with a grinder, etc.
3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, hand shield, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.

6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
Wait for the oil and water to cool before carrying out any work on the oil or water circuits.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (-) terminal first.
14. When raising heavy components, use a hoist or crane.
Check that the wire rope, chains and hooks are free from damage.
Always use lifting equipment which has ample capacity.
Install the lifting equipment at the correct places. Use a hoist or crane and operate slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places.
Replace any damaged parts with new parts.
 - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly installed.
21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. Take care when removing or installing the tracks of track-type machines.
When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

FOREWORD

GENERAL

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop. For ease of understanding, the manual is divided into the following chapters; these chapters are further divided into the each main group of components.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

TESTING AND ADJUSTING

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs.

Troubleshooting charts correlating "Problems" to "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

MAINTENANCE STANDARD


This section gives the judgement standards when inspecting disassembled parts.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Use the specifications given in the book with the latest date.

HOISTING INSTRUCTIONS

HOISTING

Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg or more is indicated clearly with the symbol .

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
 - 1) Check for removal of all bolts fastening the part to the relative parts.
 - 2) Check for existence of another part causing interference with the part to be removed.

WIRE ROPES

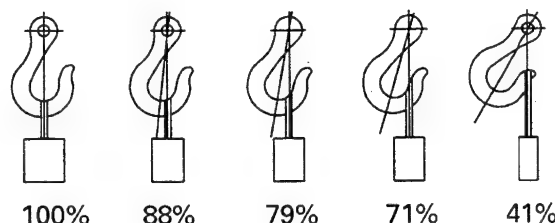
- 1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

Wire ropes (Standard "Z" or "S" twist ropes without galvanizing)		
Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.2	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.


- 2) Sling wire ropes from the middle portion of the hook.

Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



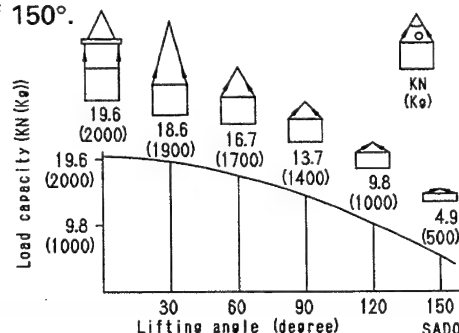
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- 3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.

 Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

- 4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles.

When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



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COATING MATERIALS

★ The recommended coating materials such as adhesives, gasket sealants and greases used for disassembly and assembly are listed below.

★ For coating materials not listed below, use the equivalent of products shown in this list.






Category	Komatsu code	Part No.	Q'ty	Container	Main applications, features
Adhesives	LT-1A	790-129-9030	150 g	Tube	• Used to prevent rubber gaskets, rubber cushions, and cock plug from coming out.
	LT-1B	790-129-9050	20 g (2 pes.)	Polyethylene container	• Used in places requiring an immediately effective, strong adhesive. Used for plastics (except polyethylene, polypropylene, tetrafluoroethylene and vinyl chloride), rubber, metal and non-metal.
	LT-2	09940-00030	50 g	Polyethylene container	• Features: Resistance to heat and chemicals • Used for anti-loosening and sealant purpose for bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardening agent)	Adhesive: 1 kg Hardening agent: 500 g	Can	• Used as adhesive or sealant for metal, glass and plastic.
	LT-4	790-129-9040	250 g	Polyethylene container	• Used as sealant for machined holes.
	Holtz MH 705	790-126-9120	75 g	Tube	• Used as heat-resisting sealant for repairing engine.
	Three bond 1735	790-129-9140	50 g	Polyethylene container	• Quick hardening type adhesive • Cure time: within 5 sec. to 3 min. • Used mainly for adhesion of metals, rubbers, plastics and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	• Quick hardening type adhesive • Quick cure type (max. strength after 30 minutes) • Used mainly for adhesion of rubbers, plastics and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	• Features: Resistance to heat, chemicals • Used at joint portions subject to high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	• Used as adhesive or sealant for gaskets and packing of power train case, etc.
	LG-3	790-129-9070	1 kg	Can	• Features: Resistance to heat • Used as sealant for flange surfaces and bolts at high temperature locations, used to prevent seizure. • Used as sealant for heat resistance gasket for high temperature locations such as engine precombustion chamber, exhaust pipe, etc.

Category	Komatsu code	Part No.	Q'ty	Container	Main applications, features
Gasket sealant	LG-4	790-129-9020	200 g	Tube	<ul style="list-style-type: none"> • Features: Resistance to water, oil • Used as sealant for flange surface, thread. • Also possible to use as sealant for flanges with large clearance. • Used as sealant for mating surfaces of final drive case, transmission case.
	LG-5	790-129-9080	1 kg	Polyethylene container	<ul style="list-style-type: none"> • Used as sealant for various threads, pipe joints, flanges. • Used as sealant for tapered plugs, elbows, nipples of hydraulic piping.
	LG-6	09940-00011	250 g	Tube	<ul style="list-style-type: none"> • Features: Silicon based, resistance to heat, cold • Used as sealant for flange surface, tread. • Used as sealant for oil pan, final drive case, etc.
	LG-7	09920-00150	150 g	Tube	<ul style="list-style-type: none"> • Features: Silicon based, quick hardening type • Used as sealant for flywheel housing, intake manifold, oil an, thermostat housing, etc.
	Three bond 1211	790-129-9090	100 g	Tube	<ul style="list-style-type: none"> • Used as heat-resisting sealant for repairing engine.
Molybdenum disulphide lubricant	LM-G	09940-00051	60 g	Can	<ul style="list-style-type: none"> • Used as lubricant for sliding portion (to prevent from squeaking).
	LM-P	09940-00040	200 g	Tube	<ul style="list-style-type: none"> • Used to prevent seizure or scuffing of the thread when press fitting or shrink fitting. • Used as lubricant for linkage, bearings, etc.
Grease	G2-LI	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI	Various	Various	<ul style="list-style-type: none"> • General purpose type
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYGA-160CNCA	Various	Various	<ul style="list-style-type: none"> • Used for normal temperature, light load bearing at places in contact with water or steam.
	Molybdenum disulphide lubricant	SYG2-400M	400 g (10 per case)	Belows type	<ul style="list-style-type: none"> • Used for places with heavy load


STANDARD TIGHTENING TORQUE

STANDARD TIGHTENING TORQUES OF BOLTS AND NUTS

Use these torques for metric bolts and nuts. (Always use torque wrench).

Thread diameter of bolt	Width across flats	    		
mm	mm	Nm		kgm
6	10	13.2 ± 1.4		1.35 ± 0.15
8	13	31 ± 3		3.2 ± 0.3
10	17	66 ± 7		6.7 ± 0.7
12	19	113 ± 10		11.5 ± 1
14	22	177 ± 19		18 ± 2
16	24	279 ± 30		28.5 ± 3
18	27	382 ± 39		39 ± 4
20	30	549 ± 59		56 ± 6
22	32	745 ± 83		76 ± 8.5
24	36	927 ± 103		94.5 ± 10.5
27	41	1320 ± 140		135 ± 15
30	46	1720 ± 190		175 ± 20
33	50	2210 ± 240		225 ± 25
36	55	2750 ± 290		280 ± 30
39	60	3290 ± 340		335 ± 35

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Thread diameter of bolt	Width across flats			
mm	mm	Nm		kgm
6	10	7.85 ± 1.95		0.8 ± 0.2
8	13	18.6 ± 4.9		1.9 ± 0.5
10	14	40.2 ± 5.9		4.1 ± 0.6
12	27	82.35 ± 7.85		8.4 ± 0.8

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TIGHTENING TORQUE OF HOSE NUTS

Use these torques for hose nuts.

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
02	14	19	24.5 ± 4.9	2.5 ± 0.5
03	18	24	49 ± 19.6	5 ± 2
04	22	27	78.5 ± 19.6	8 ± 2
05	24	32	137.3 ± 29.4	14 ± 3
06	30	36	176.5 ± 29.4	18 ± 3
10	33	41	196.1 ± 49	20 ± 5
12	36	46	245.2 ± 49	25 ± 5
14	42	55	294.2 ± 49	30 ± 5

TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

Use these torques for split flange bolts.

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
10	14	65.7 ± 6.8	6.7 ± 0.7
12	17	112 ± 9.8	11.5 ± 1
16	22	279 ± 29	28.5 ± 3

TIGHTENING TORQUE OF O-RING BOSS CONNECTOR

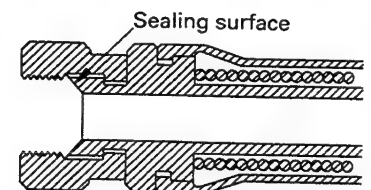
Use these torques for O-ring boss connector

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
02	14	Varies depending on type of connector.	34.3 ± 4.9	3.5 ± 0.5
03, 04	20		93.1 ± 9.8	9.5 ± 1
05, 06	24		142.1 ± 19.6	14.5 ± 2
10, 12	33		421.4 ± 58.8	43 ± 6
14	42		877.1 ± 132.3	89.5 ± 13.5

TIGHTENING TORQUE OF O-RING BOSS CONNECTOR

Use these torques for O-ring boss connector

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
08	8	14	7.35 ± 1.47	0.75 ± 0.15
10	10	17	11.27 ± 1.47	1.15 ± 0.15
12	12	19	17.64 ± 1.96	1.8 ± 0.2
14	14	22	22.54 ± 1.96	2.3 ± 0.2
16	16	24	29.4 ± 4.9	3 ± 0.5
18	18	27	39.2 ± 4.9	4 ± 0.5
20	20	30	49 ± 4.9	5 ± 0.5
24	24	32	68.6 ± 9.8	7 ± 1
30	30	32	107.8 ± 14.7	11 ± 1.5
33	33	—	127.4 ± 19.6	13 ± 2
36	36	36	151.9 ± 24.5	15.5 ± 2.5
42	42	—	210.7 ± 29.4	21.5 ± 3
52	52	—	323.4 ± 44.1	33 ± 4.5



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TIGHTENING TORQUES OF FLARE NUT

Use these torques for O-ring boss connector

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
14	19	24.5 ± 4.9	2.5 ± 0.5
18	24	49 ± 19.6	5 ± 2
22	27	78.5 ± 19.6	8 ± 2
24	32	137.3 ± 29.4	14 ± 3
30	36	176.5 ± 29.4	18 ± 3
33	41	196.1 ± 49	20 ± 5
36	46	245.2 ± 49	25 ± 5
42	55	294.2 ± 49	30 ± 5

TIGHTENING TORQUE FOR 102 ENGINE SERIES (BOLT AND NUTS)

Use these torques for bolts and nuts (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22

TIGHTENING TORQUE FOR 102 ENGINE SERIES (EYE JOINTS)

Use these torques for eye joints (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

TIGHTENING TORQUE FOR 102 ENGINE SERIES (TAPERED SCREWS)

Use these torques for tapered screws (unit: inch) of Cummins Engine.

Thread diameter	Tightening torque	
inch	Nm	kgm
1 / 16	3 ± 1	0.31 ± 0.10
1 / 8	8 ± 2	0.81 ± 0.20
1 / 4	12 ± 2	1.22 ± 0.20
3 / 8	15 ± 2	1.53 ± 0.41
1 / 2	24 ± 4	2.45 ± 0.41
3 / 4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

ELECTRIC WIRE CODE

In the wiring diagrams, various colors and symbols are employed to indicate the thickness of wires. This wire code table will help you understand WIRING DIAGRAMS.

Example: 5WB indicates a cable having a nominal number 5 and white coating with black stripe.

CLASSIFICATION BY THICKNESS

Nominal number	Copper wire			Cable O.D. (mm)	Current rating (A)	Applicable circuit
	Number of strands	Dia. of strands (mm)	Cross section (mm ²)			
0.85	11	0.32	0.88	2.4	12	Starting, lighting, signal etc.
2	26	0.32	2.09	3.1	20	Lighting, signal etc.
5	65	0.32	5.23	4.6	37	Charging and signal
15	84	0.45	13.36	7.0	59	Starting (Glow plug)
40	85	0.80	42.73	11.4	135	Starting
60	127	0.80	63.84	13.6	178	Starting
100	217	0.80	109.1	17.6	230	Starting

CLASSIFICATION BY COLOR AND CODE

Priority	Circuits		Charging	Ground	Starting	Lighting	Instrument	Signal	Other
	Classi- fication								
1	Pri- mary	Code	W	B	B	R	Y	G	L
		Color	White	Black	Black	Red	Yellow	Green	Blue
2	Auxi- liary	Code	WR	—	BW	RW	YR	GW	LW
		Color	White & Red	—	Black & White	Red & White	Yellow & Red	Green & White	Blue & White
3		Code	WB	—	BY	RB	YB	GR	LR
		Color	White & Black	—	Black & Yellow	Red & Black	Yellow & Black	Green & Red	Blue & Red
4		Code	WL	—	BR	RY	YG	GY	LY
		Color	White & Blue	—	Black & Red	Red & Yellow	Yellow & Green	Green & Yellow	Blue & Yellow
5		Code	WG	—	—	RG	YL	GB	LB
		Color	White & Green	—	—	Red & Green	Yellow & Blue	Green & Black	Blue & Black
6		Code	—	—	—	RL	YW	GL	—
		Color	—	—	—	Red & Blue	Yellow & White	Green & Blue	—

CONVERSION TABLE

METHOD OF USING THE CONVERSION TABLE

The Conversion Table in this section is provided to enable simple conversion of figures. For details of the method of using the Conversion Table, see the example given below.

EXAMPLE

- Method of using the Conversion Table to convert from millimeters to inches
1. Convert 55 mm into inches.
 - (1) Locate the number 50 in the vertical column at the left side, take this as (A), then draw a horizontal line from (A).
 - (2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
 - (3) Take the point where the two lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.
 2. Convert 550 mm into inches.
 - (1) The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.
 - (2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
 - (3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimeters to inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Millimeters to Inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liter to U.S. Gallon

1ℓ = 0.2642 U.S. Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Liter to U.K. Gallon

1ℓ = 0.21997 U.K. Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft. lb

1 kgm = 7.233 ft. lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kg/cm² to lb/in²1kg/cm² = 14.2233 lb/in²

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1010	1024	1038	1053	1067	1081	1095	1109	1124
80	1138	1152	1166	1181	1195	1209	1223	1237	1252	1266
90	1280	1294	1309	1323	1337	1351	1365	1380	1394	1408
100	1422	1437	1451	1465	1479	1493	1508	1522	1536	1550
110	1565	1579	1593	1607	1621	1636	1650	1664	1678	1693
120	1707	1721	1735	1749	1764	1778	1792	1806	1821	1835
130	1849	1863	1877	1892	1906	1920	1934	1949	1963	1977
140	1991	2005	2020	2034	2048	2062	2077	2091	2105	2119
150	2134	2148	2162	2176	2190	2205	2219	2233	2247	2262
160	2276	2290	2304	2318	2333	2347	2361	2375	2389	2404
170	2418	2432	2446	2460	2475	2489	2503	2518	2532	2546
180	2560	2574	2589	2603	2617	2631	2646	2660	2674	2688
190	2702	2717	2731	2745	2759	2773	2788	2802	2816	2830
200	2845	2859	2873	2887	2901	2916	2930	2944	2958	2973
210	2987	3001	3015	3030	3044	3058	3072	3086	3101	3115
220	3129	3143	3158	3172	3186	3200	3214	3229	3243	3257
230	3271	3286	3300	3314	3328	3343	3357	3371	3385	3399
240	3414	3428	3442	3456	3470	3485	3499	3513	3527	3542

Temperature

Fahrenheit-Centigrade Conversion ; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center or boldface column of figures.

These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

$$1^{\circ}\text{C} = 33.8^{\circ}\text{F}$$

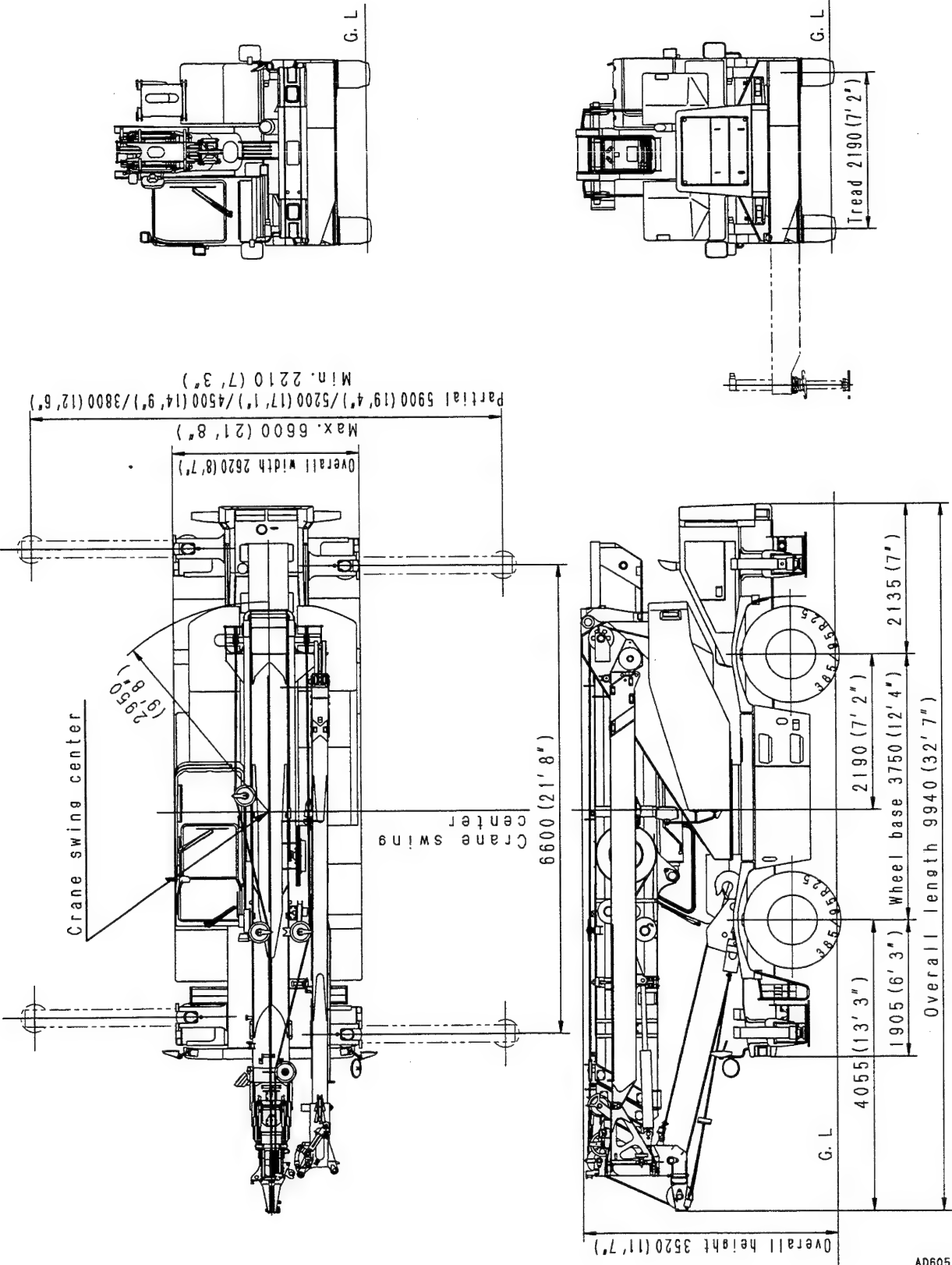
$^{\circ}\text{C}$		$^{\circ}\text{F}$	$^{\circ}\text{C}$		$^{\circ}\text{F}$	$^{\circ}\text{C}$		$^{\circ}\text{F}$	$^{\circ}\text{C}$		$^{\circ}\text{F}$
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	114.8	27.2	81	117.8
-37.2	-35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-7.2	19	66.2	12.2	54	129.2	31.7	89	192.2
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	93	199.4
-23.9	-11	12.2	-4.4	24	75.2	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	77.0	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	78.8	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	80.6	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	82.4	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	84.2	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	30	86.0	18.3	65	149.0	37.8	100	212.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	175	347.0

01 GENERAL

Specification drawing	01- 2
Specifications	01- 4
Working radius - lifting height chart	01-10
Rated overall load table	01-11
Minimum intersecting aisle width	01-22
Weight table	01-24
List of lubricants and water	01-26

023S05

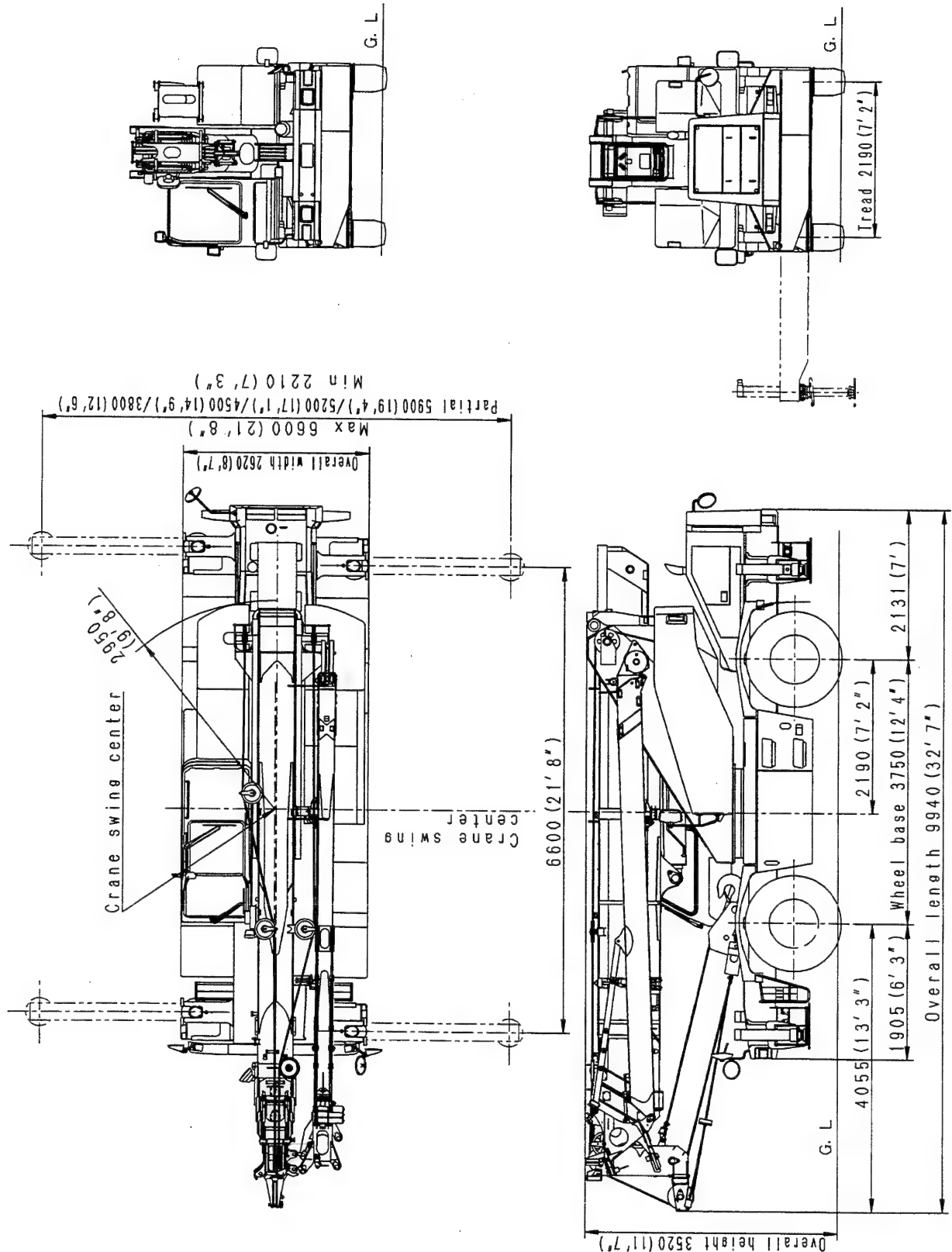
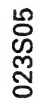
SPECIFICATION DRAWING
H-SHAPED OUTRIGGER SPECIFICATION (With power tilt jib)



AD60516B

023S05

H-SHAPED OUTRIGGER SPECIFICATION (With manual tilt jib)



AD62541B

Technical drawings of the M108-H1 self-propelled howitzer, showing side and front views with dimensions in feet and inches.

Side View Dimensions:

- Overall height: 3520 (11' 7")
- Overall length: 9940 (32' 7")
- Wheel base: 3750 (12' 4")
- Wheel diameter: 3850 (12' 5")
- Overall width: 2620 (8' 7")
- Max. width: 6600 (21' 8")
- Partial width: 5900 (19' 4") / 5200 (17' 1") / 4500 (14' 9") / 3800 (12' 6")
- Min. width: 2210 (7' 3")
- Crane swing center: 6600 (21' 8")
- Crane swing radius: 8950 (27' 1")
- Overall width: 2620 (8' 7")
- Max. width: 6600 (21' 8")
- Partial width: 5900 (19' 4") / 5200 (17' 1") / 4500 (14' 9") / 3800 (12' 6")
- Min. width: 2210 (7' 3")

Front View Dimensions:

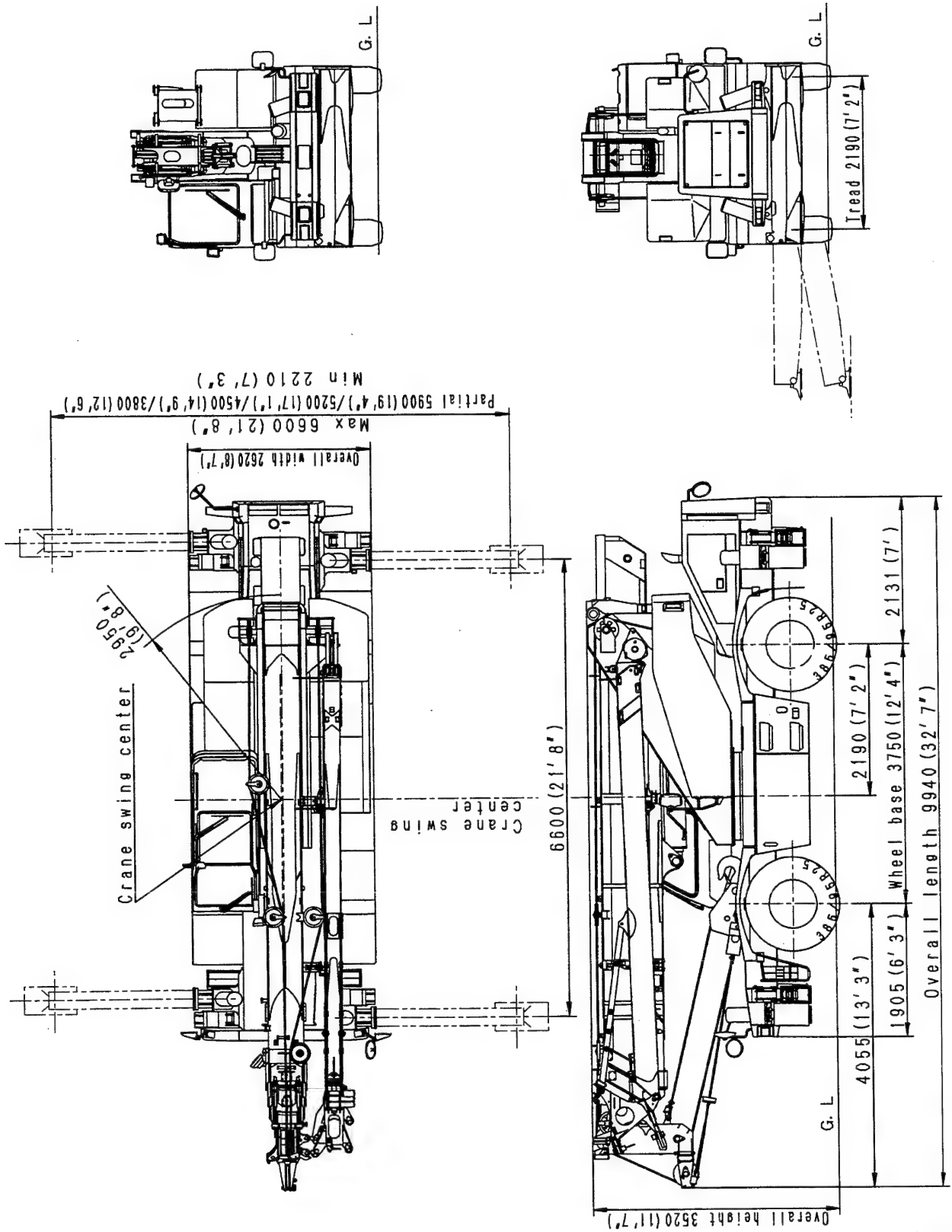
- Overall height: 3520 (11' 7")
- Overall length: 9940 (32' 7")
- Wheel base: 3750 (12' 4")
- Wheel diameter: 3850 (12' 5")
- Overall width: 2620 (8' 7")
- Max. width: 6600 (21' 8")
- Partial width: 5900 (19' 4") / 5200 (17' 1") / 4500 (14' 9") / 3800 (12' 6")
- Min. width: 2210 (7' 3")
- Crane swing center: 6600 (21' 8")
- Crane swing radius: 8950 (27' 1")
- Overall width: 2620 (8' 7")
- Max. width: 6600 (21' 8")
- Partial width: 5900 (19' 4") / 5200 (17' 1") / 4500 (14' 9") / 3800 (12' 6")
- Min. width: 2210 (7' 3")

023S05

AD60515B

X-SHAPED OUTRIGGER SPECIFICATION (With manual tilt jib)

023S05



AD62540B

SPECIFICATIONS

(Both machine with power tilt jib and manual tilt jib)

Machine model			LW250-5	
			H-shaped outrigger specification	X-shaped outrigger specification
Serial No.			53001 and up	50001 and up
Weight	Operating weight (not including operator)	kg	(Machine with power tilt jib) 26,870	(Machine with power tilt jib) 26,870
	Overall weight (including 2 operators)	kg	26,980	26,980
Travel performance	Max. speed	km/h	49	49
	Max. rimpull	kN{kg}	178.5{182,000}	178.5{182,000}
	Gradeability	%	60	60
	Min. turning radius - 2-wheel steering	m	9.3	9.3
	4-wheel steering	m	5.4	5.4
Operating performance	Crane capacity	360° operation with outriggers fully extended [boom length (m)]	t x m 26.0x3.0[7.6] 21.0x3.5[13.7] 14.5x4.5[19.8] 10.6x5.5[25.9] 7.0x8.8[30.5] 5.9x8.0[32.0]	26.0x3.0[7.6] 21.0x3.5[13.7] 14.5x4.5[19.8] 10.6x5.5[25.9] 7.0x8.8[30.5] 5.9x8.0[32.0]
		360° operation without outriggers [boom length (m)]	t x m 9.0 x 3.0[7.6]	9.0 x 3.0[7.6]
		Over-front operations without outriggers [boom length (m)]	t x m 14.0 x 3.0[7.6]	14.0 x 3.0[7.6]
	Boom length	m	7.6 – 32.0	7.6 – 32.0
	Jib length (1 stage/2 stages)	m	7.4/12.6 (Power tilt jib) 6.2/12.0 (Manual tilt jib)	7.4/12.6 (Power tilt jib) 6.2/12.0 (Manual tilt jib)
	Outrigger extension width (front-rear)	mm	6,600	6,600
	(left-right)	mm	6,600	6,600
	Max. lifting height (boom only)	m	33.4	33.4
	(with jib)	m	46.2 (Power tilt jib) 45.6 (Manual tilt jib)	46.2 (Power tilt jib) 45.6 (Manual tilt jib)
	Main winch line speed (high speed/low speed)	m/min	130/65	130/65
	Main winch hook speed (high speed/low speed)	m/min	16.3/8.1	16.3/8.1
	Auxiliary winch line speed (high speed/low speed)	m/min	130/65	130/65
	Auxiliary winch hook speed (high speed/low speed)	m/min	130/65	130/65
	Boom working range	deg	0 – 83	0 – 83
	Boom RAISE time	sec	44	44
	Boom EXTEND time (boom length 7.6 - 32.0 m)	sec	75	75
	Swing speed	rpm	2.5	2.5

023S05

Machine model			LW250-5		
			H-shaped outrigger specification	X-shaped outrigger specification	
Serial No.			53001 and up	50001 and up	
Dimensions	Overall length	mm	9,940	9,940	
	Overall width	mm	2,620	2,620	
	Overall height	mm	3,520	3,520	
	Wheelbase	mm	3,750	3,750	
	Tread (both front and rear wheels)	mm	2,190	2,190	
	Min. ground clearance	mm	350	350	
	Tail swing radius	mm	2,950	2,950	
Engine	Model		Komatsu S6D125-2		
	Type		4-cycle, water-cooled, in-line vertical, direct injection type, with turbocharger		
	No. of cylinders – bore x stroke	mm	6–125x150		
	Piston displacement	ℓ{cc}	11.04{11,040}		
	Performance	Rated horsepower	kW{HP}/rpm	184{246.5}/2,100	184{246.5}/2,100
		Max. torque	Nm{kgm}/rpm	1,030{105}/1,400	1,030{105}/1,400
		High idling	rpm	2,350 (when traveling) 1,750 (when working)	2,350 (when traveling) 1,750 (when working)
		Low idling	rpm	550	550
		Min. fuel consumption ratio	g/kW{HP}·h	208{155}	208{155}
	Starting motor		24V,7.5kW	24V,7.5kW	
	Alternator		24V,50A	24V,7.5kW	
	Battery		12V,120Ahx2	12V,120Ahx2	
	Radiator core type		CD type, corrugated fin type		
Power train	Torque converter (with lockup clutch)		3-element, 1-stage, 2-phase type (hydraulically actuated, wet-type, multiple disc clutch)		
	Transmission		Multishaft gear type, hydraulically actuated, lubricating pump force feed type		
	Transfer (included in transmission)		Spur gear, constant mesh type, splash lubrication, with Hi-Lo range		

Machine model			LW250-5	
			H-shaped outrigger specification	X-shaped outrigger specification
Serial No.			53001 and up	50001 and up
Power train	Reduction gear		Spiral bevel type, splash lubrication	
	Differential		Straight bevel gear, splash lubrication	
	Final drive		Planetary gear type, splash lubrication	
Travel • steering system	Steering system		Front, rear wheel, hydraulically actuated, rear steering lock air pressure actuated type	
	Axles • wheels	Drive type	Front wheel drive (2-wheel drive), front and rear wheel drive (4-wheel drive)	
		Axle type (both front and rear)	Fully floating axle	
		Suspension method (both front and rear)	Vertical semi-elliptical plate spring type (with hydraulic lock cylinder)	
		Tires (both front and rear)	385/95 R25	
	Tire inflation pressure	MPa{kg/cm ² }	0.9{9.0} (Standard)	
	Brakes	Main brake (both front and rear)	Air-over-hydraulic type, dry, disc type	
		Parking brake	Spring-boosted internal expanding drum type (acting on front wheel drive shaft)	
Swing system	Drive method		Hydraulic motor drive	
	Reduction gear method		2-stage planetary gear type	
	Braking method		Wet type, multiple disc, hydraulically actuated type	
Hydraulic system	Hydraulic pump	Type	Gear type	Gear type
		Delivery (liter/min) - set pressure MPa{kg/cm ² }	<div>For winch motor, boom, PPC: when engine is at 1,790 rpm; for others: when engine is at 2,100 rpm</div>	<div>For winch motor, boom, PPC: when engine is at 1,790 rpm; for others: when engine is at 2,100 rpm</div>
		• For winch motor (3-spool with boom and PPC) (SAR090)	164.9 – 20.6 {210}	164.9 – 20.6 {210}
		• For boom, jib (SAR090)	164.9 – 20.6 {210}	164.9 – 20.6 {210}
		• For PPC, swing brake release, boom telescope selection (SAR016)	29.6 – 2.9 {30}	29.6 – 2.9 {30}
		• For transmission, torque converter (SAR063) (3-spool with steering and swing)	142.5 – 3.2 {33}	142.5 – 3.2 {33}
		• For steering, outrigger, accumulator, suspension lock, air conditioner (SAR040)	90.8 – 20.6 {210}	90.8 – 20.6 {210}
		• For swing (SAR032)	72.3 – 20.6 {210}	72.3 – 20.6 {210}
		Drive method		
		• For winch motor, boom, jib, PPC, swing brake release, boom telescope selection	Driven by engine through clutch	Driven by engine through clutch
	• For transmission, torque converter, steering, outrigger, accumulator, suspension lock, air conditioner, swing	Connected directly to engine	Connected directly to engine	
	• For emergency steering	Electric motor drive	Electric motor drive	

023S05

Machine model			LW250-5		
			H-shaped outrigger specification	X-shaped outrigger specification	
Serial No.			53001 and up	50001 and up and up	
Hydraulic system	Control valve	Type x No.			
		• For main/auxiliary winch, boom hoist/telescope, jib hoist	5-spool PPC spool type		
		• For main/auxiliary winch clutch selection	2-spool mechanically operated spool type		
		• For outrigger extension selector	1-spool solenoid spool type		
		• For individual outrigger operation	1-spool solenoid spool type x4		
• For steering mode selection		1-spool mechanically operated solenoid spool type			
• For reverse steering compensation		1-spool mechanically operated solenoid spool type			
• For suspension selection		1-spool mechanically operated solenoid spool type			
• For suspension lock		1-spool mechanically operated solenoid spool type			
• For PTO clutch		1-spool mechanically operated solenoid spool type			
• For boom telescope selection		1-spool mechanically operated solenoid spool type			
• For power tilt jib		1-spool mechanically operated solenoid spool type x 4			
• For swing FREE/LOCK selection		1-spool mechanically operated solenoid spool type			
• For rear steering mode selection	1-spool mechanically operated solenoid spool type				
• For outrigger operation	1-spool mechanically operated solenoid spool type				
• For swing pump outrigger merge	1-spool mechanically operated solenoid spool type				
Hydraulic cylinder	Boom hoist cylinder	Type x No.	Double acting piston type x 1		
		• Bore x outside diameter of rodstroke	mm	280x210–1,998	
		• Max. distance between pins	mm	4,551	
		• Min. distance between pins	mm	2,553	
	Boom telescope cylinder	Type x No.	No. 1 telescope cylinder	No. 2 telescope cylinder	
		• Bore x outside diameter of rodstroke	mm	Double acting piston type x2	Double acting piston type x 1
		• Max. distance between pins	mm	130x110–6,114	160x135–6,114
		• Min. distance between pins	mm	6,440	6,319
	Power tilt cylinder (machines equipped with power tilt)	Type x No.	Double acting piston type x 1		
		• Bore x outside diameter of rodstroke	mm	130x80–860	
		• Max. distance between pins	mm	2,145	
		• Min. distance between pins	mm	1,285	
	H-shaped outrigger jack cylinder	Type x No.	Double acting piston type x 4		
		• Bore x outside diameter of rodstroke	mm	130x80–620	—
• Max. distance between pins		mm	745	—	
• Min. distance between pins		mm	125	—	

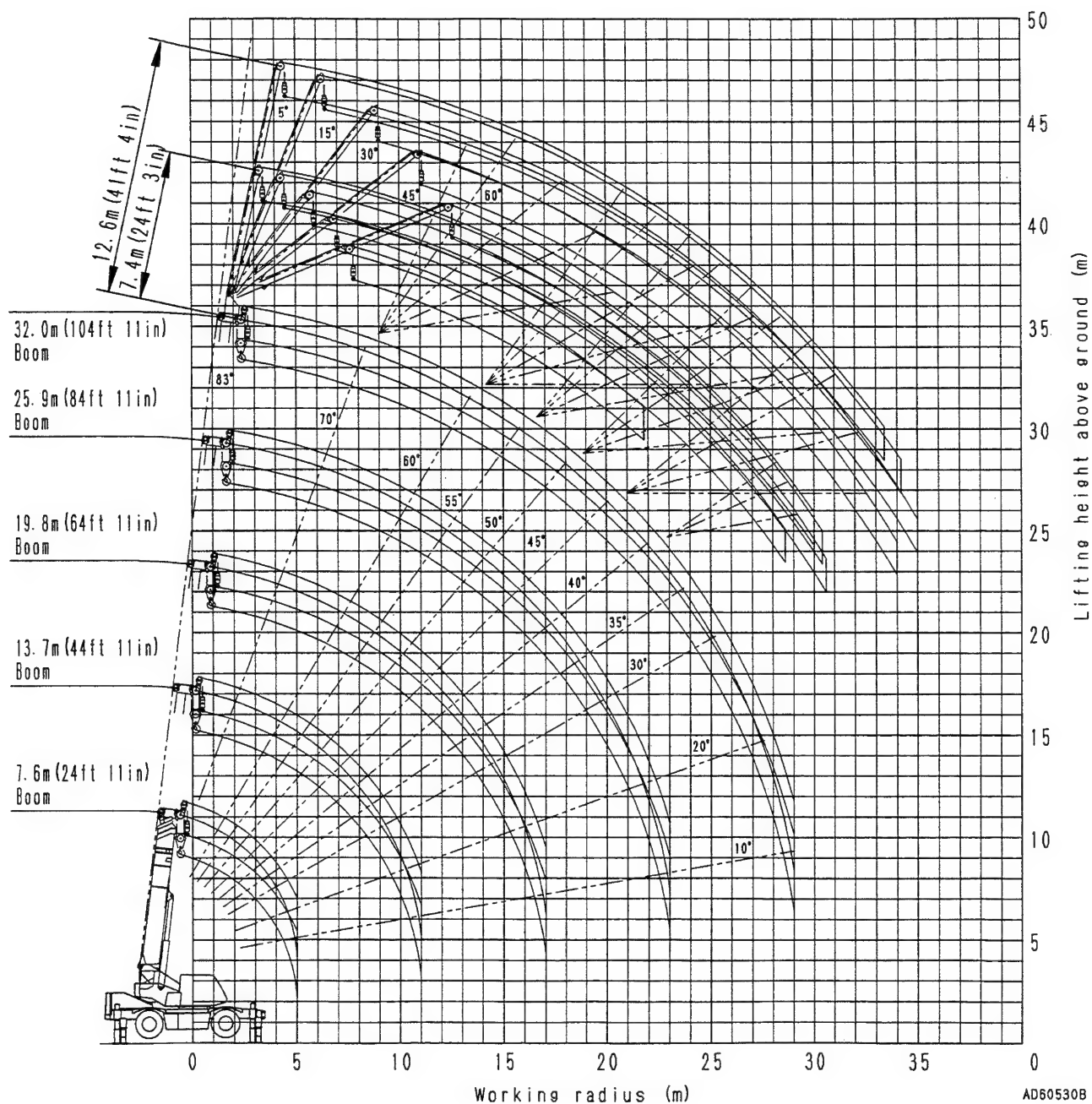
Machine model				LW250-5	
				H-shaped outrigger specification	X-shaped outrigger specification
Serial No.				53001 and up	50001 and up
Hydraulic system	Hydraulic cylinder	H-shaped outrigger slide cylinder	Type x No.	Double acting piston type x 4	—
		• Bore x outside diameter of rod - stroke	mm	60x45-2,178	—
		• Max. distance between pins	mm	4,362	—
		• Min. distance between pins	mm	2,177	—
		X-shaped outrigger jack cylinder	Type x No.	—	Double acting piston type x4
		• Bore x outside diameter of rod - stroke	mm	—	180x130-300
		• Max. distance between pins	mm	—	435
		• Min. distance between pins	mm	—	135
		X-shaped outrigger slide cylinder	Type x No.	—	Double acting piston type x4
		• Bore x outside diameter of rod - stroke	mm	—	60x45-2,175
		• Max. distance between pins	mm	—	4,550
		• Min. distance between pins	mm	—	2,420
	Suspension lock cylinder	Type x No.	Double acting piston type x4		
	• Bore x outside diameter of rod - stroke	mm	110x50-60		
	• Max. distance between pins	mm	470		
	• Min. distance between pins	mm	410		
	Steering cylinder	Type x No.	Double acting piston type x4		
	• Bore x outside diameter of rod - stroke	mm	80x50-246		
	• Max. distance between pins	mm	799		
	• Min. distance between pins	mm	567		
Hydraulic motor	Winch motor	mm	Bent axis plunger type, fixed type x 2		
	Swing motor	mm	Swash plate piston type, fixed type		
Hydraulic tank			Box shape, open type		
Hydraulic filter			Tank return side, 10 μ		

023S05

Machine model				LW250-5		
				H-shaped outrigger specification	X-shaped outrigger specification	
Serial No.				53001 and up	50001 and up	
Work equipment	Boom system	Boom	Type	Box shape, 5-stage		
			Telescope method	Hydraulically actuated, 2nd stage consecutive, 3rd, 4th stage synchronized telescope type combined with rope		
			Hoist method	Cylinder operated type		
		Jib	Type	Box shape, 2-stage type	Box shape, 2-stage type	
			Auxiliary jib (offset angle)	5°,25°,45°	5°,25°,45°	
			Power tilt type auxiliary jib (offset angle)	5° – 60°	5° – 60°	
	Stowing method		Folded back to left side of boom	Folded back to left side of boom		
	Extension method	Bottom swing-out extension type	Bottom swing-out extension type			
	Single top		Equipped			
	Hydraulic cylinder	Type, No.		Hydraulic motor drive, 2 motor, 2 drum		
		• Motor type (both main winch and auxiliary winch)		Plunger type, fixed type, hydraulic pressure: 20.6 MPa {210 kg/cm ² }		
		• Reduction gear type (both main winch and auxiliary winch)		2-stage planetary gear type		
		• Clutch type (both main winch and auxiliary winch)		Dry type, internal expanding drum type, hydraulically actuated		
		• Brake type (both main winch and auxiliary winch)		Dry type, disc type, foot-operated, spring-boosted (hydraulic automatic release) type		
		Drum dimensions	Drum diameter (both main winch and auxiliary winch)	mm	384	384
			Flange diameter (both main winch and auxiliary winch)	mm	608	608
			Drum width (main winch)	mm	382	382
	(auxiliary winch)		mm	247	247	
	Cable capacity (diameter x length) (main winch)		mm x m	16x240	16x240	
	(auxiliary winch)		mm x m	16x153	16x153	
Standard wire rope dimension (diameter x length) (main winch)		mm x m	16x176	16x176		
(auxiliary winch)		mm x m	16x98	16x98		
Standard wire rope specification (both main winch and auxiliary winch)		mm x m	JIS No. 18, 7x7+6x Fi (29), B type, normal Z lay, flame resistant	JIS No. 18, 7x7+6x Fi (29), B type, normal Z lay, flame resistant		
Outrigger	Type		H-shaped	X-shaped		
	Method of operation		Possible to operate individually (center of chassis, left side of operator's compartment)	Possible to operate individually (center of chassis, left side of operator's compartment)		

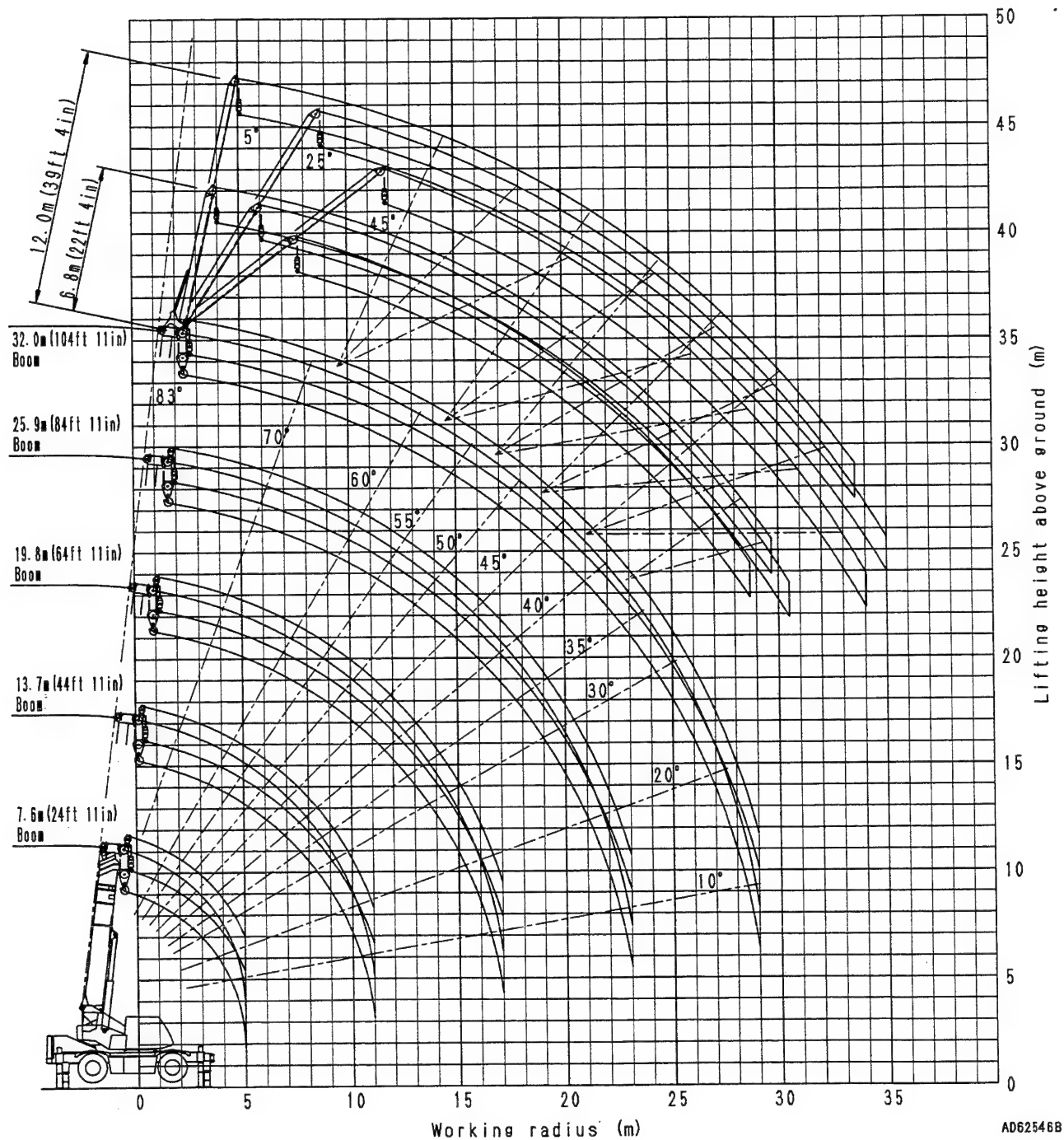
WORKING RADIUS - LIFTING HEIGHT CHART

AUXILIARY JIB (POWER TILT TYPE)



* The chart above shows the relationship between the working radius and lifting height when the outriggers are fully extended. The values do not include the deflection of the boom.

AUXILIARY JIB (MANUAL TILT TYPE)



* The chart above shows the relationship between the working radius and lifting height when the outriggers are fully extended. The values do not include the deflection of the boom.

RATED OVERALL LOAD TABLE (Both machine with power tilt jib and manual tilt jib)

BOOM OPERATIONS WITH OUTRIGGERS SET

(Unit:ton)							(Unit:ton)						
Outriggers fully extended							Outriggers partially extended						
6.6m (360) X, H type							5.9m (Over-side) X, H type						
Boom length (m) Working radius (m)	7.6	13.7	19.8	25.9	30.5	32.0	Boom length (m) Working radius (m)	7.6	13.7	19.8	25.9	30.5	32.0
2.5	26.00	21.00	14.50				2.5	26.00	21.00	14.50			
3.0	26.00	21.00	14.50	10.60			3.0	26.00	21.00	14.50	10.60		
3.5	25.40	21.00	14.50	10.60	7.00		3.5	25.40	21.00	14.50	10.60	7.00	
4.0	23.40	20.00	14.50	10.60	7.00	5.90	4.0	23.40	20.00	14.50	10.60	7.00	5.90
4.5	21.40	18.90	14.50	10.60	7.00	5.90	4.5	21.40	18.90	14.50	10.60	7.00	5.90
5.0	18.10	17.60	14.40	10.60	7.00	5.90	5.0	18.10	17.60	14.40	10.60	7.00	5.90
5.5		16.50	13.80	10.60	7.00	5.90	5.5		16.50	13.80	10.60	7.00	5.90
6.0		15.30	13.00	10.40	7.00	5.90	6.0		15.30	13.00	10.40	7.00	5.90
6.5		14.20	12.30	9.80	7.00	5.90	6.5		13.10	12.30	9.80	7.00	5.90
7.0		13.00	11.60	9.25	7.00	5.90	7.0		11.20	11.60	9.25	7.00	5.90
8.0		10.00	10.00	8.25	7.00	5.90	8.0		8.45	9.35	8.25	7.00	5.90
9.0		7.90	8.70	7.45	6.30	5.50	9.0		6.65	7.45	7.45	6.30	5.50
10.0		6.45	7.20	6.75	5.80	5.10	10.0		5.35	6.10	6.50	5.80	5.10
11.0		5.30	6.10	6.05	5.30	4.70	11.0		4.40	5.10	5.50	5.30	4.70
12.0			5.20	5.50	4.90	4.35	12.0			4.30	4.70	4.85	4.35
13.0			4.45	4.70	4.50	4.00	13.0			3.70	4.05	4.20	4.00
14.0			3.80	4.10	4.15	3.65	14.0			3.20	3.50	3.70	3.65
15.0			3.20	3.70	3.80	3.35	15.0			2.75	3.10	3.25	3.30
16.0			2.85	3.25	3.45	3.10	16.0			2.40	2.70	2.85	2.90
17.0			2.50	2.90	3.05	2.90	17.0			2.10	2.40	2.55	2.60
18.0				2.55	2.70	2.70	18.0				2.10	2.25	2.30
19.0				2.25	2.45	2.50	19.0				1.85	2.00	2.05
20.0				2.00	2.20	2.25	20.0				1.65	1.80	1.85
22.0				1.55	1.75	1.80	22.0				1.20	1.40	1.45
24.0					1.40	1.45	24.0					1.00	1.10
26.0					1.15	1.15	26.0					0.75	0.75
28.0						0.95	28.0						0.55
29.0						0.75	29.0						
Danger angle	---	---	---	---	---	---	Danger angle	---	---	---	---	---	10°

AD60517B

The above table is based on the actual working radius including the deflection of the boom and jib. The values given are the values when the outriggers are extended and set on firm, horizontal ground. The values above the bold line are the values based on the strength of the crane; the values below the bold line are based on the stability of the crane.

(Unit:ton)

Outriggers partially extended 5.2m (Over-side) X, H type						
Boom length (m) Working radius(m)	7.6	13.7	19.8	25.9	30.5	32.0
2.5	26.00	21.00	14.50			
3.0	26.00	21.00	14.50	10.60		
3.5	25.40	21.00	14.50	10.60	7.00	
4.0	23.40	20.00	14.50	10.60	7.00	5.90
4.5	21.40	18.90	14.50	10.60	7.00	5.90
5.0	17.75	17.60	14.40	10.60	7.00	5.90
5.5		15.05	13.50	10.60	7.00	5.90
6.0		12.50	12.70	10.40	7.00	5.90
6.5		10.50	11.05	9.80	7.00	5.90
7.0		9.05	10.00	9.25	7.00	5.90
8.0		6.90	7.75	7.80	7.00	5.90
9.0		5.40	6.20	6.50	6.30	5.50
10.0		4.30	5.10	5.50	5.65	5.10
11.0		3.55	4.25	4.60	4.80	4.70
12.0			3.60	3.95	4.15	4.15
13.0			3.05	3.35	3.55	3.60
14.0			2.60	2.90	3.10	3.15
15.0			2.20	2.55	2.70	2.75
16.0			1.85	2.20	2.40	2.45
17.0			1.55	1.95	2.10	2.15
18.0				1.70	1.80	1.85
19.0				1.45	1.60	1.65
20.0				1.20	1.40	1.45
22.0				0.80	1.00	1.05
24.0					0.70	0.75
26.0						0.50
28.0						
29.0						
Danger angle	---	---	---	---	18°	24°

(Unit:ton)

Outriggers partially extended 4.5m (Over-side) X, H type						
Boom length (m) Working radius(m)	7.6	13.7	19.8	25.9	30.5	32.0
2.5	26.00	21.00	14.50			
3.0	26.00	21.00	14.50	10.60		
3.5	25.40	21.00	14.50	10.60	7.00	
4.0	22.50	20.00	14.50	10.60	7.00	5.90
4.5	18.50	17.74	14.50	10.60	7.00	5.90
5.0	14.50	14.05	14.40	10.60	7.00	5.90
5.5		11.50	12.50	10.60	7.00	5.90
6.0		9.60	10.55	10.40	7.00	5.90
6.5		8.20	9.05	9.55	7.00	5.90
7.0		7.05	7.90	8.36	7.00	5.90
8.0		5.40	6.15	6.60	6.75	5.90
9.0		4.20	4.95	5.35	5.50	5.50
10.0		3.35	4.05	4.40	4.60	4.65
11.0		2.65	3.35	3.70	3.85	3.90
12.0			2.80	3.15	3.30	3.35
13.0			2.35	2.70	2.85	2.90
14.0			1.95	2.30	2.45	2.50
15.0			1.60	1.95	2.15	2.15
16.0			1.30	1.70	1.85	1.90
17.0			1.00	1.40	1.55	1.60
18.0				1.10	1.30	1.40
19.0				0.90	1.05	1.15
20.0				0.70	0.85	0.95
22.0					0.55	0.65
Danger angle	---	---	---	18°	34°	36°

AD60518B

The above table is based on the actual working radius including the deflection of the boom and jib. The values given are the values when the outriggers are extended and set on firm, horizontal ground. The values above the bold line are the values based on the strength of the crane; the values below the bold line are based on the stability of the crane.

023S05

(Unit:ton)							(Unit:ton)						
Outriggers partially extended 3.8m (Over-side) X, H type							Minimum extension of outriggers 2.21m (Over-side) (H type only)						
Boom length (m) Working radius (m)	7.6	13.7	19.8	25.9	30.5	32.0	Boom length (m) Working radius (m)	7.6	13.7	19.8	25.9	30.5	32.0
2.5	26.00	21.00	14.50				2.5	13.00	12.00	11.00			
3.0	26.00	21.00	14.50	10.60			3.0	12.50	11.70	11.00	8.30		
3.5	22.50	20.00	14.50	10.60	7.00		3.5	9.55	9.10	9.50	8.30	5.50	
4.0	17.50	16.65	14.50	10.60	7.00	5.90	4.0	7.70	7.10	7.50	7.30	5.50	4.30
4.5	13.70	12.95	13.50	10.60	7.00	5.90	4.5	6.25	5.65	6.10	6.30	5.50	4.30
5.0	10.90	10.45	11.10	10.60	7.00	5.90	5.0	5.00	4.60	5.10	5.45	5.50	4.30
5.5		8.65	9.40	9.65	7.00	5.90	5.5		3.80	4.30	4.65	4.75	4.30
6.0		7.30	8.05	8.30	7.00	5.90	6.0		3.15	3.70	4.00	4.15	4.30
6.5		6.20	7.00	7.20	7.00	5.90	6.5		2.60	3.10	3.50	3.65	3.70
7.0		5.35	6.10	6.45	6.60	5.90	7.0		2.15	2.70	3.00	3.20	3.25
8.0		4.05	4.80	5.10	5.30	5.40	8.0		1.30	2.00	2.30	2.50	2.55
9.0		3.15	3.85	4.15	4.35	4.40	9.0		0.70	1.40	1.80	1.95	2.00
10.0		2.45	3.10	3.40	3.60	3.65	10.0			1.00	1.45	1.55	1.60
11.0		1.80	2.50	2.85	3.00	3.05	11.0			0.60	1.05	1.20	1.25
12.0			2.05	2.40	2.55	2.60	12.0				0.70	0.90	0.95
13.0			1.60	2.00	2.15	2.20	13.0						
14.0			1.30	1.70	1.80	1.85	14.0						
15.0			1.00	1.40	1.50	1.55	15.0						
16.0			0.70	1.10	1.25	1.30	16.0						
17.0				0.85	1.05	1.10	17.0						
18.0				0.65	0.85	0.90	18.0						
19.0					0.65	0.70	19.0						
20.0						0.55	20.0						
22.0							22.0						
Danger angle	---	---	---	35°	42°	45°	Danger angle	---	35°	50°	58°	60°	61°

AD60519B

The above table is based on the actual working radius including the deflection of the boom and jib. The values given are the values when the outriggers are extended and set on firm, horizontal ground. The values above the bold line are the values based on the strength of the crane; the values below the bold line are based on the stability of the crane.

BOOM OPERATIONS WITHOUT OUTRIGGERS (MACHINE STATIONARY)

(Unit: ton)

Working radius (m)	Boom length (m)	Over-front			
		7.6	13.7	19.8	25.9
3.0		14.00	11.00	7.80	
3.5		12.00	10.20	7.80	5.70
4.0		10.75	9.70	7.80	5.70
4.5		9.65	9.30	7.80	5.70
5.0		8.70	8.20	7.40	5.70
5.5			6.90	6.80	5.70
6.0			5.90	6.20	5.70
6.5			5.10	5.60	5.30
7.0			4.40	5.00	4.95
8.0			3.40	4.00	4.15
9.0			2.55	3.20	3.40
10.0			2.00	2.60	2.85
11.0			1.50	2.15	2.35
12.0				1.80	2.00
13.0				1.40	1.70
14.0				1.05	1.45
15.0				0.75	1.15
16.0				0.50	0.90
17.0					0.65
18.0					0.45
Danger angle		---	---	20°	39°

(Unit: ton)

Working radius (m)	Boom length (m)	360			
		7.6	13.7	19.8	25.9
3.0		9.00	8.00	6.00	
3.5		7.40	6.80	6.00	3.50
4.0		6.10	5.40	5.85	3.50
4.5		5.05	4.40	4.75	3.50
5.0		4.00	3.60	4.10	3.50
5.5			3.00	3.50	3.50
6.0			2.50	3.00	3.20
6.5			2.10	2.55	2.75
7.0			1.75	2.15	2.40
8.0			1.00	1.60	1.80
9.0				1.15	1.40
10.0				0.75	1.05
11.0					0.75
12.0					
13.0					
14.0					
15.0					
16.0					
17.0					
18.0					
Danger angle		---	36°	52°	60°

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The above table is based on the actual working radius including the deflection of the boom and jib.
 The values given are the values when the outriggers are extended and set on firm, horizontal ground.
 The values above the bold line are the values based on the strength of the crane; the values below the bold line are based on the stability of the crane.

BOOM OPERATIONS WITHOUT OUTRIGGERS (TRAVELING AT LESS THAN 1.6km/h)

(Unit:ton)

Working radius (m)	Boom length (m)	Over-front			
		7.6	13.7	19.8	25.9
3.0		10.00	8.70	6.60	
3.5		9.00	8.20	6.60	5.00
4.0		8.00	7.50	6.60	5.00
4.5		7.10	6.80	6.60	5.00
5.0		6.40	6.15	6.30	5.00
5.5			5.50	5.70	5.00
6.0			4.80	5.15	4.80
6.5			4.10	4.65	4.50
7.0			3.60	4.10	4.25
8.0			2.75	3.30	3.45
9.0			2.15	2.60	2.85
10.0			1.70	2.15	2.35
11.0			1.30	1.80	2.00
12.0				1.50	1.70
13.0				1.25	1.45
14.0				0.95	1.20
15.0				0.65	1.00
16.0					0.75
17.0					0.55
Danger angle		---	---	28°	41°

(Unit:ton)

Working radius (m)	Boom length (m)	360			
		7.6	13.7	19.8	25.9
3.0		6.80	5.80	4.20	
3.5		5.55	5.00	4.20	2.55
4.0		4.65	4.20	4.20	2.55
4.5		3.95	3.50	3.95	2.55
5.0		3.35	3.00	3.30	2.55
5.5			2.50	2.90	2.55
6.0			2.10	2.50	2.55
6.5			1.75	2.10	2.30
7.0			1.45	1.80	2.00
8.0			0.80	1.30	1.50
9.0				0.90	1.10
10.0				0.50	0.80
11.0					0.60
12.0					
13.0					
14.0					
15.0					
16.0					
17.0					
Danger angle		---	42°	53°	61°

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023S05

The above table is based on the actual working radius including the deflection of the boom and jib. The values given are the values when the outriggers are extended and set on firm, horizontal ground. The values above the bold line are the values based on the strength of the crane; the values below the bold line are based on the stability of the crane.

**POWER TILT JIB OPERATIONS WITH OUTRIGGERS SET
(30.5 m BOOM + AUXILIARY JIB OPERATIONS)**

(Unit: ton)

Outriggers fully extended 6.6m (360) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	3.00	2.50	2.10	1.60	1.00	83.0	2.00	1.60	1.15	0.80	0.50
80.0	3.00	2.50	2.10	1.60	1.00	80.0	2.00	1.60	1.15	0.80	0.50
75.0	3.00	2.50	2.10	1.60	1.00	75.0	2.00	1.60	1.15	0.80	0.50
72.0	3.00	2.50	2.10	1.60	1.00	72.0	1.80	1.50	1.12	0.80	0.50
70.0	3.00	2.50	2.10	1.60	1.00	70.0	1.70	1.43	1.07	0.80	0.50
65.0	2.60	2.25	1.97	1.56	0.93	65.0	1.45	1.25	0.97	0.79	0.48
60.0	2.15	2.00	1.75	1.44	0.85	60.0	1.25	1.10	0.91	0.76	0.46
55.0	1.60	1.55	1.45	1.30		55.0	1.12	1.00	0.86	0.74	
50.0	1.15	1.13	1.05	1.02		50.0	0.87	0.82	0.78	0.72	
45.0	0.80	0.75	0.73	0.72		45.0	0.57	0.55	0.54	0.54	
40.0	0.50	0.50	0.48			40.0	0.40	0.38	0.37		
37.0	0.41	0.39	0.38								
35.0	0.35										
Danger angle	33°	35°	35°	43°	58°	Danger angle	38°	38°	38°	43°	58°

Outriggers partially extended 5.9m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	3.00	2.50	2.10	1.60	1.00	83.0	2.00	1.60	1.15	0.80	0.50
80.0	3.00	2.50	2.10	1.60	1.00	80.0	2.00	1.60	1.15	0.80	0.50
75.0	3.00	2.50	2.10	1.60	1.00	75.0	2.00	1.60	1.15	0.80	0.50
72.0	3.00	2.50	2.10	1.60	1.00	72.0	1.80	1.50	1.12	0.80	0.50
70.0	3.00	2.50	2.10	1.60	1.00	70.0	1.70	1.43	1.07	0.80	0.50
65.0	2.60	2.25	1.97	1.56	0.93	65.0	1.45	1.25	0.97	0.79	0.48
60.0	1.83	1.72	1.63	1.44	0.85	60.0	1.25	1.10	0.91	0.76	0.46
55.0	1.25	1.22	1.14	1.13		55.0	0.93	0.91	0.83	0.74	
50.0	0.81	0.79	0.76	0.75		50.0	0.58	0.57	0.55	0.53	
45.0	0.47	0.46	0.45	0.43		48.0	0.46	0.46	0.44	0.43	
Danger angle	43°	43°	43°	43°	58°	Danger angle	46°	46°	46°	46°	58°

Outriggers partially extended 5.2m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	3.00	2.50	2.10	1.60	1.00	83.0	2.00	1.60	1.15	0.80	0.50
80.0	3.00	2.50	2.10	1.60	1.00	80.0	2.00	1.60	1.15	0.80	0.50
75.0	3.00	2.50	2.10	1.60	1.00	75.0	2.00	1.60	1.15	0.80	0.50
72.0	3.00	2.50	2.10	1.60	1.00	72.0	1.80	1.50	1.12	0.80	0.50
70.0	3.00	2.50	2.10	1.60	1.00	70.0	1.70	1.43	1.07	0.80	0.50
65.0	2.15	2.00	1.85	1.56	0.93	65.0	1.45	1.25	0.97	0.79	0.48
60.0	1.40	1.35	1.21	1.21	0.85	60.0	1.00	0.97	0.87	0.75	0.46
55.0	0.85	0.82	0.75	0.75		55.0	0.61	0.60	0.53	0.51	
50.0	0.45	0.44	0.40	0.40		53.0	0.45	0.45	0.40	0.39	
Danger angle	48°	48°	48°	48°	58°	Danger angle	51°	51°	51°	51°	58°

AD60522B

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**POWER TILT JIB OPERATIONS WITH OUTRIGGERS SET
(30.5 m BOOM + AUXILIARY JIB OPERATIONS)**

(Unit:ton)

Outriggers partially extended 4.5m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	3.00	2.50	2.10	1.60	1.00	83.0	2.00	1.60	1.15	0.80	0.50
80.0	3.00	2.50	2.10	1.60	1.00	80.0	2.00	1.60	1.15	0.80	0.50
75.0	3.00	2.50	2.10	1.60	1.00	75.0	2.00	1.60	1.15	0.80	0.50
72.0	3.00	2.50	2.10	1.60	1.00	72.0	1.80	1.50	1.12	0.80	0.50
70.0	2.55	2.35	2.10	1.60	1.00	70.0	1.70	1.43	1.07	0.80	0.50
65.0	1.63	1.55	1.42	1.34	0.93	65.0	1.18	1.10	0.95	0.79	0.48
60.0	0.93	0.90	0.82	0.78	0.76	60.0	0.65	0.63	0.56	0.51	0.46
55.0	0.43	0.43	0.38	0.38							
Danger angle	53°	53°	53°	53°	58°	Danger angle	58°	58°	58°	58°	58°

Outriggers partially extended 3.8m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	3.00	2.50	2.10	1.60	1.00	83.0	2.00	1.60	1.15	0.80	0.50
80.0	3.00	2.50	2.10	1.60	1.00	80.0	2.00	1.60	1.15	0.80	0.50
75.0	3.00	2.50	2.10	1.60	1.00	75.0	2.00	1.60	1.15	0.80	0.50
72.0	2.45	2.23	1.92	1.60	1.00	72.0	1.80	1.50	1.12	0.80	0.50
70.0	1.95	1.83	1.66	1.52	1.00	70.0	1.50	1.35	1.05	0.80	0.50
65.0	1.05	1.03	0.94	0.86	0.80	65.0	0.75	0.72	0.61	0.56	0.45
60.0	0.45	0.45	0.40								
Danger angle	58°	58°	58°	63°	63°	Danger angle	63°	63°	63°	63°	63°

AD605238

**MANUAL TILT JIB OPERATION WITH OUTRIGGERS SET
(30.5 m BOOM + AUXILIARY JIB OPERATION)**

(Unit: ton)

Outriggers fully extended 6.6m (360) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	3.00	2.10	1.60	83.0	2.00	1.15	0.80
80.0	3.00	2.10	1.60	80.0	2.00	1.15	0.80
75.0	3.00	2.10	1.60	75.0	2.00	1.15	0.80
72.0	3.00	2.10	1.60	72.0	1.80	1.12	0.80
70.0	2.95	2.10	1.60	70.0	1.70	1.07	0.80
65.0	2.55	1.97	1.56	65.0	1.45	0.97	0.79
60.0	2.15	1.75	1.44	60.0	1.25	0.91	0.76
55.0	1.60	1.45	1.33	55.0	1.12	0.86	0.74
50.0	1.15	1.05	1.02	50.0	0.89	0.79	0.73
45.0	0.80	0.73	0.72	45.0	0.59	0.57	0.54
40.0	0.50	0.48		40.0	0.40	0.39	
37.0	0.41	0.38					
35.0	0.35						
Danger angle	33°	35°	43°	Danger angle	38°	38°	43°

Outriggers partially extended 5.9m (Over-side) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	3.00	2.10	1.60	83.0	2.00	1.15	0.80
80.0	3.00	2.10	1.60	80.0	2.00	1.15	0.80
75.0	3.00	2.10	1.60	75.0	2.00	1.15	0.80
72.0	3.00	2.10	1.60	72.0	1.80	1.12	0.80
70.0	2.95	2.10	1.60	70.0	1.70	1.07	0.80
65.0	2.55	1.97	1.56	65.0	1.45	0.97	0.79
60.0	1.83	1.65	1.44	60.0	1.25	0.91	0.76
55.0	1.25	1.15	1.10	55.0	0.95	0.85	0.74
50.0	0.83	0.76	0.75	50.0	0.61	0.55	0.53
45.0	0.50	0.47	0.45	48.0	0.48	0.45	0.43
Danger angle	43°	43°	43°	Danger angle	46°	46°	46°

Outriggers partially extended 5.2m (Over-side) X, H type							
Boom angle (°)	7.4m			Boom angle (°)	12.6m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	3.00	2.10	1.60	83.0	2.00	1.15	0.80
80.0	3.00	2.10	1.60	80.0	2.00	1.15	0.80
75.0	3.00	2.10	1.60	75.0	2.00	1.15	0.80
72.0	3.00	2.10	1.60	72.0	1.80	1.12	0.80
70.0	2.95	2.10	1.60	70.0	1.70	1.07	0.80
65.0	2.10	1.87	1.56	65.0	1.45	0.97	0.79
60.0	1.40	1.22	1.21	60.0	1.03	0.89	0.76
55.0	0.85	0.77	0.76	55.0	0.63	0.55	0.51
50.0	0.46	0.43	0.42	53.0	0.47	0.43	0.40
Danger angle	48°	48°	48°	Danger angle	51°	51°	51°

AD62542B

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**MANUAL TILT JIB OPERATION WITH OUTRIGGERS SET
(30.5 m BOOM + AUXILIARY JIB OPERATION)**

(Unit:ton)

Outriggers partially extended 4.5m (Over-side) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	3.00	2.10	1.60	83.0	2.00	1.15	0.80
80.0	3.00	2.10	1.60	80.0	2.00	1.15	0.80
75.0	3.00	2.10	1.60	75.0	2.00	1.15	0.80
72.0	2.90	2.10	1.60	72.0	1.80	1.12	0.80
70.0	2.50	2.10	1.60	70.0	1.70	1.07	0.80
65.0	1.61	1.42	1.31	65.0	1.18	0.95	0.79
60.0	0.93	0.85	0.78	60.0	0.65	0.58	0.51
55.0	0.44	0.40	0.40				
Danger angle	53°	53°	53°	Danger angle	58°	58°	58°

Outriggers partially extended 3.8m (Over-side) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	3.00	2.10	1.60	83.0	2.00	1.15	0.80
80.0	3.00	2.10	1.60	80.0	2.00	1.15	0.80
75.0	3.00	2.10	1.60	75.0	2.00	1.15	0.80
72.0	2.35	1.95	1.60	72.0	1.80	1.12	0.80
70.0	1.92	1.66	1.50	70.0	1.48	1.07	0.80
65.0	1.05	0.94	0.86	65.0	0.75	0.63	0.55
60.0	0.46	0.42					
Danger angle	58°	58°	63°	Danger angle	63°	63°	63°

AD62543B

023S05

**POWER TILT JIB OPERATIONS WITH OUTRIGGERS SET
(32.0 m BOOM + AUXILIARY JIB OPERATIONS)**

(Unit: ton)

Outriggers fully extended 6.6m (360) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	2.60	2.20	1.80	1.60	1.00	83.0	1.70	1.40	1.00	0.70	0.50
80.0	2.60	2.20	1.80	1.60	1.00	80.0	1.70	1.40	0.96	0.70	0.50
75.0	2.60	2.20	1.80	1.60	1.00	75.0	1.70	1.32	0.87	0.69	0.50
72.0	2.60	2.20	1.80	1.51	0.88	72.0	1.45	1.10	0.83	0.66	0.48
70.0	2.55	2.15	1.80	1.46	0.86	70.0	1.30	1.02	0.80	0.64	0.47
65.0	2.05	1.76	1.57	1.33	0.81	65.0	1.05	0.87	0.72	0.59	0.43
60.0	1.75	1.50	1.31	1.15	0.78	60.0	0.92	0.78	0.66	0.56	0.40
55.0	1.30	1.20	1.11	0.98		55.0	0.80	0.71	0.63	0.54	
50.0	0.97	0.92	0.88	0.81		50.0	0.64	0.58	0.53	0.51	
45.0	0.62	0.60	0.58	0.58		45.0	0.45	0.44	0.43	0.42	
40.0	0.37	0.37	0.37			42.5	0.38	0.38	0.37		
Danger angle	38°	38°	38°	43°	58°	Danger angle	41°	41°	41°	43°	58°

Outriggers partially extended 5.9m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	2.60	2.20	1.80	1.60	1.00	83.0	1.70	1.40	1.00	0.70	0.50
80.0	2.60	2.20	1.80	1.60	1.00	80.0	1.70	1.40	0.96	0.70	0.50
75.0	2.60	2.20	1.80	1.60	1.00	75.0	1.70	1.32	0.87	0.69	0.50
72.0	2.60	2.20	1.80	1.51	0.88	72.0	1.45	1.10	0.83	0.66	0.48
70.0	2.55	2.15	1.80	1.46	0.86	70.0	1.30	1.02	0.80	0.64	0.47
65.0	2.05	1.76	1.57	1.33	0.81	65.0	1.05	0.87	0.72	0.59	0.43
60.0	1.65	1.50	1.31	1.15	0.78	60.0	0.92	0.78	0.66	0.56	0.40
55.0	1.00	1.00	1.00	0.95		55.0	0.78	0.69	0.62	0.54	
50.0	0.60	0.60	0.60	0.60		50.0	0.46	0.44	0.43	0.40	
47.5	0.47	0.47	0.45	0.45							
Danger angle	46°	46°	46°	46°	58°	Danger angle	48°	48°	48°	48°	58°

Outriggers partially extended 5.2m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	2.60	2.20	1.80	1.60	1.00	83.0	1.70	1.40	1.00	0.70	0.50
80.0	2.60	2.20	1.80	1.60	1.00	80.0	1.70	1.40	0.96	0.70	0.50
75.0	2.60	2.20	1.80	1.60	1.00	75.0	1.70	1.32	0.87	0.69	0.50
72.0	2.60	2.20	1.80	1.51	0.88	72.0	1.45	1.10	0.83	0.66	0.48
70.0	2.55	2.15	1.80	1.46	0.86	70.0	1.30	1.02	0.80	0.64	0.47
65.0	1.90	1.76	1.57	1.33	0.81	65.0	1.05	0.87	0.72	0.59	0.43
60.0	1.22	1.15	1.07	1.02	0.78	60.0	0.86	0.78	0.66	0.56	0.40
55.0	0.68	0.66	0.61	0.60		55.0	0.45	0.45	0.42	0.40	
52.0	0.45	0.43	0.40	0.37							
Danger angle	50°	50°	50°	50°	58°	Danger angle	53°	53°	53°	53°	58°

AD60524B

023S05

**POWER TILT JIB OPERATIONS WITH OUTRIGGERS SET
(32.0 m BOOM + AUXILIARY JIB OPERATIONS)**

(Unit:ton)

Outriggers partially extended 4.5m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	2.60	2.20	1.80	1.60	1.00	83.0	1.70	1.40	1.10	0.70	0.50
80.0	2.60	2.20	1.80	1.60	1.00	80.0	1.70	1.40	0.96	0.70	0.50
75.0	2.60	2.20	1.80	1.60	1.00	75.0	1.70	1.32	0.87	0.69	0.50
72.0	2.60	2.20	1.80	1.51	0.88	72.0	1.45	1.10	0.83	0.66	0.48
70.0	2.30	2.10	1.80	1.46	0.86	70.0	1.30	1.02	0.80	0.64	0.47
65.0	1.40	1.35	1.25	1.20	0.81	65.0	1.05	0.87	0.72	0.59	0.43
60.0	0.76	0.72	0.68	0.65	0.63	60.0	0.51	0.47	0.46	0.40	
57.0	0.45	0.45	0.42	0.41							
Danger angle	55°	55°	55°	55°	58°	Danger angle	58°	58°	58°	58°	63°

Outriggers partially extended 3.8m (Over-side) X, H type											
Boom angle (°)	7.4m					Boom angle (°)	12.6m				
	Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°		Tilt 5°	Tilt 15°	Tilt 30°	Tilt 45°	Tilt 60°
83.0	2.60	2.20	1.80	1.60	1.00	83.0	1.70	1.40	1.00	0.70	0.50
80.0	2.60	2.20	1.80	1.60	1.00	80.0	1.70	1.40	0.96	0.70	0.50
75.0	2.60	2.20	1.80	1.60	1.00	75.0	1.70	1.32	0.87	0.69	0.50
72.0	2.15	1.95	1.69	1.51	0.88	72.0	1.45	1.10	0.83	0.66	0.48
70.0	1.73	1.60	1.45	1.35	0.86	70.0	1.30	1.02	0.80	0.64	0.47
65.0	0.90	0.84	0.76	0.70	0.69	65.0	0.58	0.58	0.50	0.45	
60.0	0.50	0.50	0.46	0.44							
Danger angle	60°	60°	60°	60°	63°	Danger angle	63°	63°	63°	63°	68°

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MANUAL TILT JIB OPERATION WITH OUTRIGGERS SET (32.0 m BOOM + AUXILIARY JIB OPERATION)

(Unit: ton)

Outriggers fully extended 6.6m (360) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	2.60	1.80	1.60	83.0	1.70	1.00	0.70
80.0	2.60	1.80	1.60	80.0	1.70	0.96	0.70
75.0	2.60	1.80	1.60	75.0	1.70	0.87	0.69
72.0	2.60	1.80	1.51	72.0	1.45	0.83	0.66
70.0	2.50	1.80	1.46	70.0	1.30	0.80	0.64
65.0	2.02	1.57	1.33	65.0	1.05	0.72	0.59
60.0	1.70	1.31	1.15	60.0	0.92	0.66	0.56
55.0	1.30	1.11	0.98	55.0	0.78	0.63	0.54
50.0	0.97	0.88	0.85	50.0	0.64	0.53	0.51
45.0	0.65	0.58	0.58	45.0	0.45	0.44	0.42
40.0	0.37	0.37		42.0	0.38	0.37	
Danger angle	38°	38°	43°	Danger angle	40°	40°	43°

Outriggers partially extended 5.9m (Over-side) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	2.60	1.80	1.60	83.0	1.70	1.00	0.70
80.0	2.60	1.80	1.60	80.0	1.70	0.96	0.70
75.0	2.60	1.80	1.60	75.0	1.70	0.87	0.69
72.0	2.60	1.80	1.51	72.0	1.45	0.83	0.66
70.0	2.50	1.80	1.46	70.0	1.30	0.80	0.64
65.0	2.02	1.57	1.33	65.0	1.05	0.72	0.59
60.0	1.65	1.31	1.15	60.0	0.92	0.66	0.56
55.0	1.05	1.00	0.95	55.0	0.80	0.63	0.54
50.0	0.65	0.62	0.60	50.0	0.51	0.45	0.42
47.5	0.51	0.48	0.47				
Danger angle	46°	46°	46°	Danger angle	48°	48°	48°

Outriggers partially extended 5.2m (Over-side) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	2.60	1.80	1.60	83.0	1.70	1.00	0.70
80.0	2.60	1.80	1.60	80.0	1.70	0.96	0.70
75.0	2.60	1.80	1.60	75.0	1.70	0.87	0.69
72.0	2.60	1.80	1.51	72.0	1.45	0.83	0.66
70.0	2.50	1.80	1.46	70.0	1.30	0.80	0.64
65.0	1.90	1.57	1.33	65.0	1.05	0.72	0.59
60.0	1.22	1.07	1.02	60.0	0.88	0.66	0.56
55.0	0.70	0.63	0.61	55.0	0.48	0.45	0.41
52.0	0.48	0.43	0.40				
Danger angle	50°	50°	50°	Danger angle	53°	53°	53°

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**MANUAL TILT JIB OPERATION WITH OUTRIGGERS SET
(32.0 m BOOM + AUXILIARY JIB OPERATION)**

(Unit: ton)

Outriggers partially extended 4.5m (Over-side) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	2.60	1.80	1.60	83.0	1.70	1.00	0.70
80.0	2.60	1.80	1.60	80.0	1.70	0.96	0.70
75.0	2.60	1.80	1.60	75.0	1.70	0.87	0.69
72.0	2.60	1.80	1.51	72.0	1.45	0.83	0.66
70.0	2.25	1.80	1.46	70.0	1.30	0.80	0.64
65.0	1.38	1.25	1.15	65.0	1.05	0.72	0.59
60.0	0.76	0.70	0.64	60.0	0.53	0.48	0.41
57.0	0.47	0.44	0.40				
Danger angle	55°	55°	55°	Danger angle	58°	58°	58°

Outriggers partially extended 3.8m (Over-side) X, H type							
Boom angle (°)	6.8m			Boom angle (°)	12.0m		
	Tilt 5°	Tilt 25°	Tilt 45°		Tilt 5°	Tilt 25°	Tilt 45°
83.0	2.60	1.80	1.60	83.0	1.70	1.00	0.70
80.0	2.60	1.80	1.60	80.0	1.70	0.96	0.70
75.0	2.60	1.80	1.60	75.0	1.70	0.87	0.69
72.0	2.10	1.73	1.51	72.0	1.45	0.83	0.66
70.0	1.70	1.45	1.35	70.0	1.30	0.80	0.64
65.0	0.87	0.78	0.72	65.0	0.60	0.52	0.43
62.0	0.53	0.48	0.41				
Danger angle	60°	60°	60°	Danger angle	63°	63°	63°

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PRECAUTIONS

Precautions when using outrigger

- (1) The overall rated load is the value when the machine is horizontal and the outriggers are extended and set on firm horizontal ground. The values above the bold line are the values based on the strength of the crane; the values below the bold line are based on the stability of the crane.
- (2) The overall rated load includes the weight of the lifting equipment and the hook (main winch hook: 240 kg; auxiliary hook: 60 kg).
- (3) The overall rated load is based on the actual working radius including the deflection of the boom.
- (4) If the length of the boom exceeds the specified length, carry out work using the overall rated load for either the specified length or for the next range of boom length, whichever is smaller rated load.
- (5) The overall rated load for the single top is 200 kg less than the rated load for the boom, with a maximum of 3.0 tons.
- (6) For work with the auxiliary jib, if the boom length is less than 30.5 m, use the rated load for the 30.5 m boom, and if it is greater than 30.5 m, use the rated load for the 32.0 m boom. Use only the boom angle as the base for the work.
- (7) The standard number of loops of wire rope for each boom length is as shown in the table below. The maximum load for one loop of wire rope is 3.25 tons for the main winch and 3.0 tons for the auxiliary winch.

Boom length (m)	From 7.6 up to 13.7	From 13.7 up to 19.8	From 19.8 up to 32.0	Auxiliary jib single top
Loops of wire rope	8	6	4	1

- (8) Free-fall work is basically used only when allowing the hook to fall. If it is necessary to carry out free-fall operations with a load, keep the load within a maximum of 1/5 of the rated load and be sure not to operate the brake suddenly.
- (9) When carrying out boom operations with an auxiliary jib till attached, subtract the weight of the lifting equipment in addition to 1,500kg from the rated load.
- (10) Even if there is no load, if the boom is lowered below the danger angle, there is danger that the machine may turn over, so be extremely careful.
- (11) For the lifting performance in the over-front or over-rear area, carry out operations using

the rated load table for "Outrigger fully extended".

- (12) If operations are carried out exceeding the rated load or are not carried out correctly, there is danger that the machine may turn over or may be damaged. Komatsu cannot warranty the machine for damage resulting from such actions.

Precautions when not using outrigger

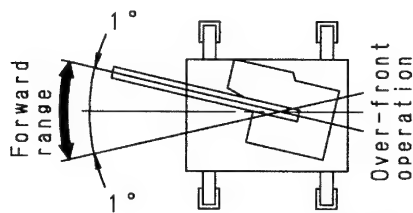
- (1) The overall rated load is the value when the tires are at the specified pressure, the suspension cylinders are fully retracted, and the machine is set on firm horizontal ground. The values above the bold line are the values based on the strength of the crane; the values below the bold line are based on the stability of the crane. When actually carrying out work, take the ground condition and operation conditions fully into consideration before using on-tire operations.

Specified tire inflation pressure	0.9 MPa {9.0 kg/cm ² }
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- (2) The overall rated load includes the weight of the lifting equipment and the hook (main winch hook: 240 kg; auxiliary hook: 60 kg).
- (3) The overall rated load is based on the actual working radius including the deflection of the boom and tires.
- (4) If the length of the boom exceeds the specified length, carry out work using the overall rated load for either the specified length or for the next range of boom length, whichever is smaller rated load.
- (5) The overall rated load for the single top is 200 kg less than the rated load for the boom, with a maximum of 3.0 tons.
- (6) If the boom length is more than 25.9 m, do not carry out free-fall operations when using the jib.
- (7) The standard number of loops of wire rope for each boom length is as shown in the table below. The maximum load for one loop of wire rope is 3.25 tons for the main winch and 3.0 tons for the auxiliary winch.

Boom length (m)	From 7.6 up to 13.7	From 13.7 up to 19.8	From 19.8 up to 25.9	Auxiliary jib single top
Loops of wire rope	8	6	4	1

- (8) The rated load is different for 360° operations and over-front operations. When swinging from the over-front area to the side, there is danger of overload, so be extremely careful to check the load. Over-front crane operations refers to operations with the boom within a range of 1° each to the left or right from the center of the machine.

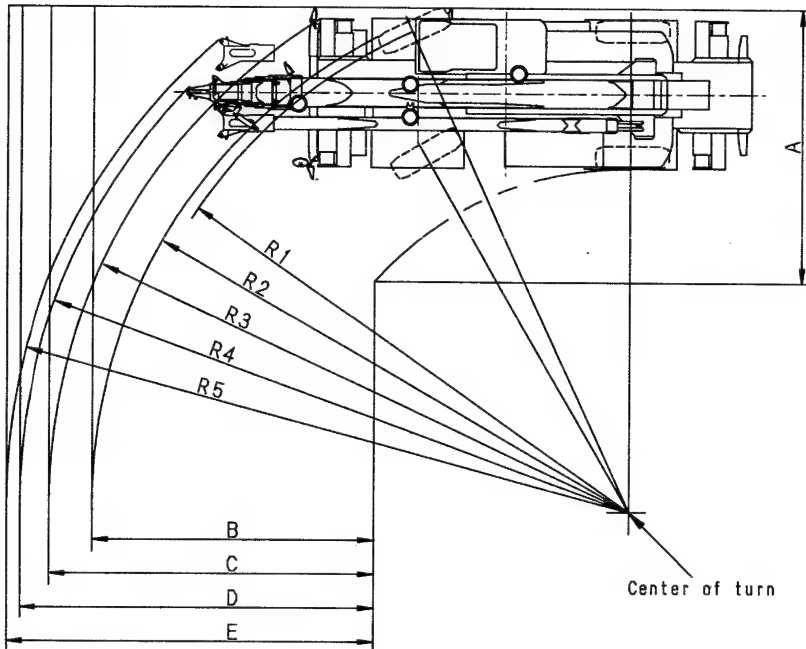


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- (9) When carrying out crane operations with the machine stationary, apply the parking brake securely.
- (10) When traveling with a raised load, apply the swing brake, keep the load close to the ground to prevent it from swaying, and travel at a maximum speed of 1.6 km/h. Never turn suddenly, start suddenly, brake suddenly, or operate the crane when traveling.
- (11) Even if there is no load, if the boom is lowered below the danger angle, there is danger that the machine may turn over, so be extremely careful.
- (12) If operations are carried out exceeding the rated load or are not carried out correctly, there is danger that the machine may turn over or may be damaged. Komatsu cannot warranty the machine for damage resulting from such actions.

MINIMUM INTERSECTING AISLE WIDTH

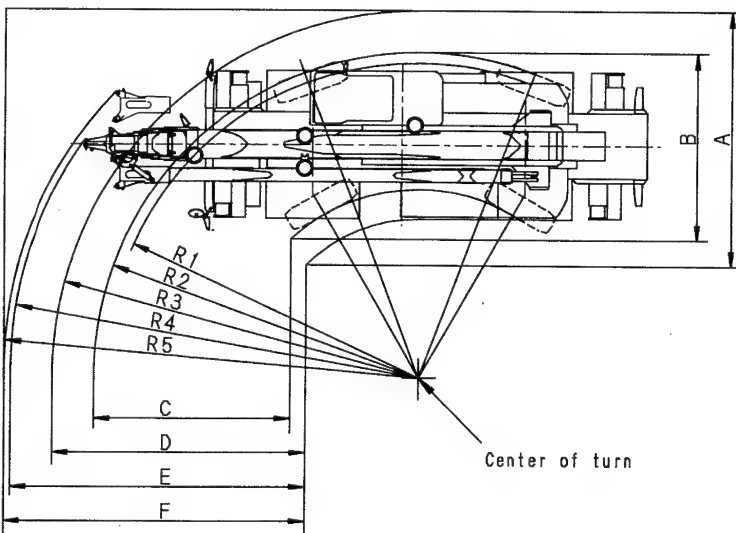
FRONT WHEEL (2-WHEEL) STEERING



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- R1 = 9.3 m (min. turning radius)
- R2 = 9.5 m (turning radius at outermost point)
- R3 = 10.2 m (machine turning radius)
- R4 = 10.7 m (turning radius at tip of boom, turning left)
- R5 = 11.0 m (turning radius at tip of boom, turning right)
- A = 4.8 m (entrance aisle)
- B = 4.8 m (wheel exit aisle)
- C = 5.6 m (machine exit aisle)
- D = 6.2 m (exit aisle at tip of boom, turning left)
- E = 6.4 m (exit aisle at tip of boom, turning right)

FRONT AND REAR (4-WHEEL) STEERING

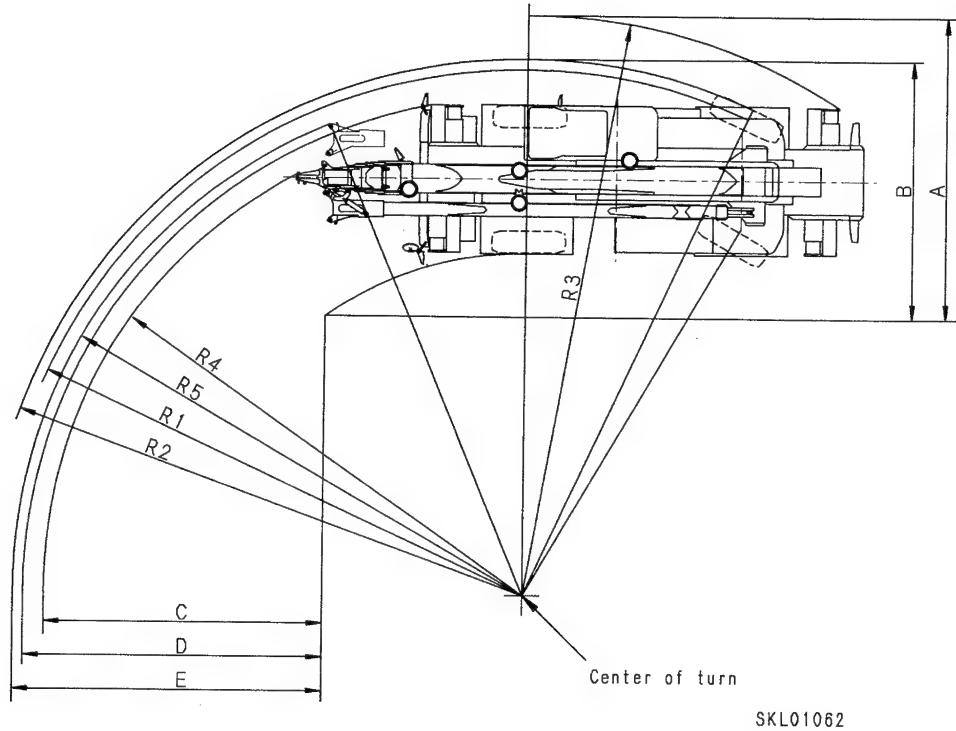


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- R1 = 5.5 m (min. turning radius)
- R2 = 5.6 m (turning radius at outermost point)
- R3 = 6.4 m (machine turning radius)
- R4 = 7.1 m (turning radius at tip of boom, turning left)
- R5 = 7.2 m (turning radius at tip of boom, turning right)
- A = 4.5 m (machine entrance aisle)
- B = 3.3 m (wheel entrance aisle)
- C = 3.3 m (wheel exit aisle)
- D = 4.5 m (machine exit aisle)
- E = 5.3 m (exit aisle at tip of boom, turning left)
- F = 5.4 m (exit aisle at tip of boom, turning right)

023S05

REAR WHEEL (2-WHEEL) STEERING



- R1 = 9.3 m (min. turning radius)
- R2 = 9.5 m (turning radius at outermost point)
- R3 = 10.3 m (machine turning radius)
- R4 = 8.5 m (turning radius at tip of boom, turning left)
- R5 = 9.0 m (turning radius at tip of boom, turning right)
- A = 5.3 m (machine entrance aisle)
- B = 4.5 m (wheel entrance aisle)
- C = 5.3 m (wheel exit aisle)
- D = 4.9 m (exit aisle at tip of boom, turning left)
- E = 5.5 m (exit aisle at tip of boom, turning right)

023S05

WEIGHT TABLE

Unit: kg

Machine model	LW250-5	
	H-shaped outrigger specification	X-shaped outrigger specification
Serial No.	53001 and up	50001 and up
Engine	1138	1138
Radiator	119	119
Fuel tank	33	33
Damper assembly	91	91
Torque converter assembly	90	90
Transmission assembly (including torque converter assembly)	530	530
Upper drive shaft	16.0	16.0
Front drive shaft	36.7	36.7
Rear drive shaft	14.2	14.2
Front axle assembly	1,062	1,062
Rear axle assembly	972	972
Rear steering lock cylinder assembly	17	17
Steering cylinder	18	18
Parking brake cylinder	7.7	7.7
Swing motor assembly	99	99
Swing circle	360	360
Steering unit	6.6	6.6
Swing valve	6.8	6.8
Tire	148	148
Wheel	88.2	88.2
Cab	276	276
Swivel joint assembly	130.5	130.5
Slip ring assembly	9.4	9.4
Hydraulic tank	129	129
Hydraulic pump (swing, steering, transmission)	20.3	20.3
Hydraulic pump (boom, winch, PPC)	34.2	34.2
Bodywork	671	671
Chassis (including swing circle)	3,521	3,521
Outrigger assembly (including cylinder)	3,165	2,920
Outrigger jack cylinder	85	120
Outrigger slide cylinder	55	50.5
Outrigger control valve	15	15

023S05

Unit: kg

Machine model	LW250-5	
	H-shaped outrigger specification	X-shaped outrigger specification
Serial No.	53001 and up	50001 and up
Suspension lock cylinder	18.1	18.1
Priority valve	5.5	5.5
PPC valve (power tilt, swing)	1.9	1.9
PPC valve (main, auxiliary winch, hoist)	2.9	2.9
Main control valve (for power tilt jib)	85.0	85.0
Main control valve (for manual tilt jib)	84.0	84.0
Charge valve	5.0	5.0
Air conditioner compressor drive motor	8.0	8.0
Winch brake master cylinder	9.4	9.4
Main winch assembly (including clutch, winch motor, brake valve)	654.5	654.5
Auxiliary winch assembly (including clutch, winch motor, brake valve)	547.5	547.5
Winch motor (both main and auxiliary)	57	57
Winch brake (both main and auxiliary)	47.5	47.5
Winch clutch (both main and auxiliary)	25	25
Clutch valve	10	10
PPC valve (foot operated)	1.6	1.6
Boom assembly (not including cylinder)	6,156	6,156
Boom hoist cylinder	551	551
Boom telescope cylinder (No. 1)	347	347
Boom telescope cylinder (No. 2)	449	449
Power tilt jib assembly (not including cylinder) (only for machine with power tilt jib)	547	547
Manual tilt jib assembly (only for machine with manual tilt jib)	515	515
Jib hoist cylinder	100	100
Jib rotation cylinder	11	11
Jib lock cylinder	5.6	5.6

023S05

LIST OF LUBRICANTS AND WATER

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE							CAPACITY (ℓ)	
		-20	-10	0	10	20	30	40°C	Specified	Refill
Engine oil pan	Engine oil								32.0	26.0
Transmission case	Engine oil								25.0	25.0
Final drive case Winch gear case Differential gear case Swing machinery case	Axle oil								7.0 each 7.0 each 35.0 each 3.0 each	7.0 each 7.0 each 25.0 each 3.0 each
Hydraulic system	Hydraulic oil								520	420
Travel brake	Brake fluid								1.6	1.6
Fuel tank	Diesel fuel								300.0	—
Cooling system	Water	Add Komatsu genuine super coolant (AF-ACL)							40.0	—

* For H046-HM, use the recommended oil. For details, see the Operation and Maintenance Manual.

※ ASTM D975 No.1

FUEL, OIL

Use the correct type for the ambient temperature as shown in the table above.

COOLANT

Komatsu genuine super coolant (AF-ACL) is added to the cooling water, so there is no need to change it for temperatures down to -10°C.

If the temperature goes below -10°C, adjust the density. For details, see the Operation and Maintenance Manual.

★ Specified capacity: Total amount of oil including oil for components and oil in piping
Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

★ When starting the engine in an ambient temperature of less than 0°C, always use SAE10W, SAE10W-30, or SAE15W-40, even though the temperature goes up to 10°C during the day-time.

★ Use tap water for the cooling water.

023S05

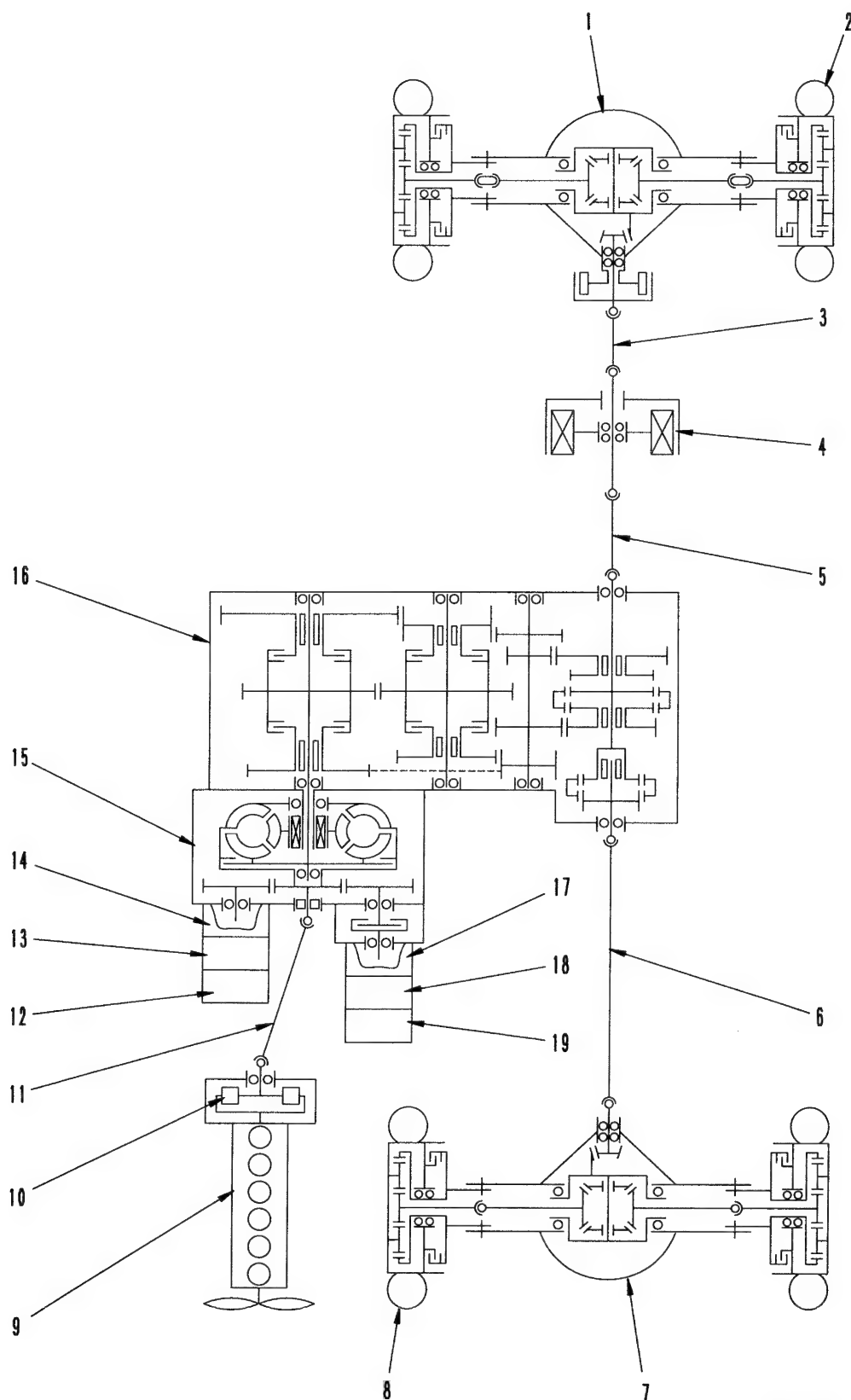
10 STRUCTURE AND FUNCTION

023S05

Power train	10- 4	Hydraulic circuit diagram	10- 96
Engine speed set cylinder	10- 6	Work equipment, steering hydraulic	
Damper	10- 9	equipment drawing	10-100
Transmission hydraulic piping diagram	10-10	Main control valve	10-104
Torque converter, transmission hydraulic		Swing hydraulic system	10-108
circuit diagram	10-12	Swing valve	10-110
Torque converter, transmission hydraulic		Swing motor, machinery	10-111
system schematic	10-14	Swing holding brake and brake solenoid	
Torque converter	10-16	valve	10-112
PTO clutch	10-20	Swing brake valve	10-114
Transmission	10-21	Swing FREE/LOCK selector valve	10-115
Transmission control valve	10-29	Steering hydraulic system	10-116
Proportional solenoid valve	10-31	Steering unit	10-118
Axle	10-36	Priority valve	10-126
Brake	10-40	Steering mode selector valve	10-129
Parking brake	10-42	Rear wheel steering selector valve	10-135
Tire	10-44	Reverse steering compensation valve	10-137
Swing circle	10-45	Suspension hydraulic system	10-140
Steering wheel	10-46	Suspension selector valve	10-142
Rear steering lock system	10-48	Suspension lock valve	10-144
Suspension system	10-50	Suspension pilot check valve	10-146
Air circuit diagram	10-52	Outtrigger hydraulic system	10-152
Air equipment piping drawing	10-54	Outtrigger selector valve	10-154
Air governor	10-56	Collection check valve	10-164
Accelerator control valve	10-58	Outtrigger individual valve	10-166
Accelerator control cylinder	10-61	Outtrigger merge selector valve	10-168
Exhaust brake selector valve	10-62	Outtrigger jack pilot check valve	10-170
Exhaust brake butterfly valve	10-63	Pedal PPC valve	10-172
Brake air system	10-65	Lever PPC valve	10-175
Brake control valve	10-67	Relief valve	10-180
Brake booster	10-71	Boom hydraulic system	10-182
Brake shuttle valve	10-78	Unload pilot valve	10-184
Auxiliary brake valve	10-79	Boom telescope selector valve	10-186
Parking brake valve	10-81	Boom cylinder	10-195
Parking brake chamber	10-83	Winch hydraulic system	10-202
Rear steering lock air system	10-85	Winch motor	10-204
Rear steering lock valve	10-86	Winch clutch valve	10-208
Rear steering lock cylinder	10-90	Winch brake master cylinder	10-213
Centralized greasing pump	10-91	Overrun prevention valve	10-217
Hydraulic, hot water, air center swivel		Flow priority valve	10-220
joint	10-94	Charge valve	10-222

Air conditioner	10-226
Boom	10-228
Jib	10-234
Main hook	10-236
Auxiliary hook	10-237
Winch	10-238
Winch drum	10-239
Winch clutch	10-240
Winch brake	10-241
Chassis, X-shape outrigger	10-242
Revolving frame, guide sheave	10-244
Electrical circuit diagram	10-246
Electrical component drawing	10-247
Overwind prevention system drawing	10-250
Overload safety system drawing	10-251
Electrical swivel joint (slip ring)	10-252
Multiple data transfer (MDT) system	10-253-1
Automatic gear shift system (AESC)	10-254
Gear shift lever (trim switch)	10-256
Outline, operation of electric circuits	10-259

POWER TRAIN



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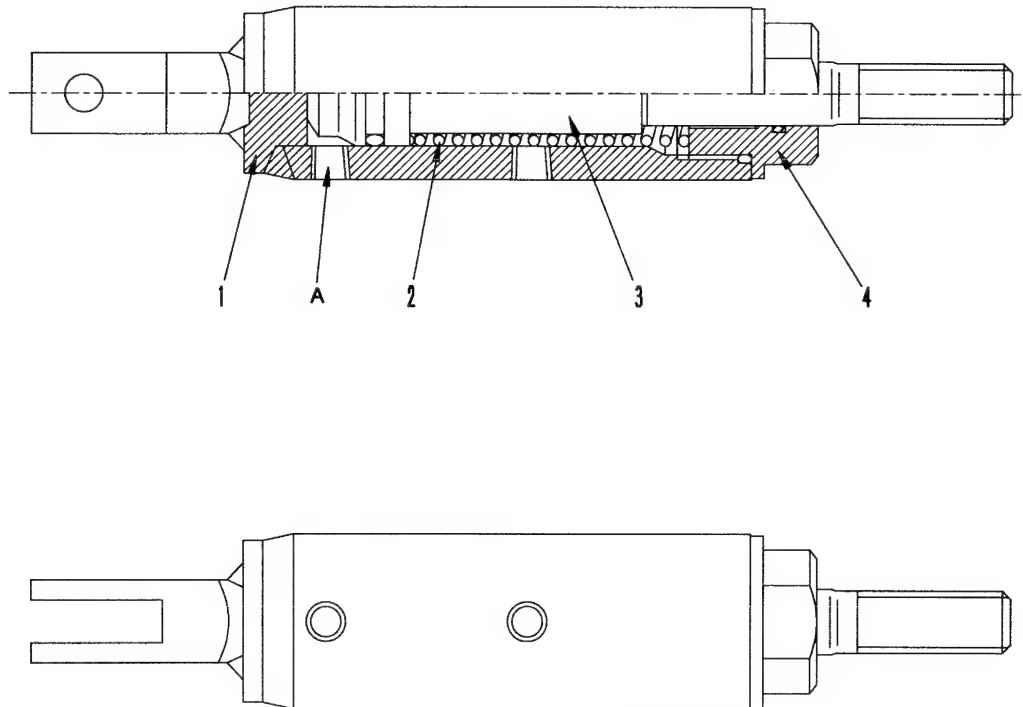
023S05

1. Front axle
2. Wheel
3. Front drive shaft
4. Retarder (option)
5. Front drive shaft
6. Rear drive shaft
7. Rear axle
8. Wheel
9. Engine (S6D125-2)
10. Damper
11. Upper drive shaft
12. Swing pump (SAR032)
13. Steering, outrigger pump (SAR040)
14. Transmission pump (SAR063)
15. Torque converter
16. Transmission
17. Winch pump (SAR090)
18. Boom pump (SAR090)
19. PPC pump (SAR016)

Outline

- The power from engine (9) passes through the engine flywheel and is transmitted to damper (10). The damper output shaft is connected to the pump of torque converter (15) through upper drive shaft (11). The torque converter turbine is connected to the input shaft of transmission (16).
- The transmission is equipped with 4 hydraulically actuated clutches, with a shifting fork used to select high and low to give 6 forward and 2 reverse speeds. Gear shifting is carried out automatically by the transmission controller.
- Switching between 2-wheel drive and 4-wheel drive is carried out by the 2/4-wheel drive selector shifting fork. Front wheel drive is used for the 2-wheel drive.
- The transmission output shaft transmits the power to front axle (1) and rear axle (7) through front drive shaft (5) and rear drive shaft (6). This power is then transmitted to wheels (2) and (8).

ENGINE SPEED SET CYLINDER



SKL00221

1. Cylinder
 2. Return spring
 3. Piston rod
 4. Cylinder head
- A. From PTO clutch selector valve

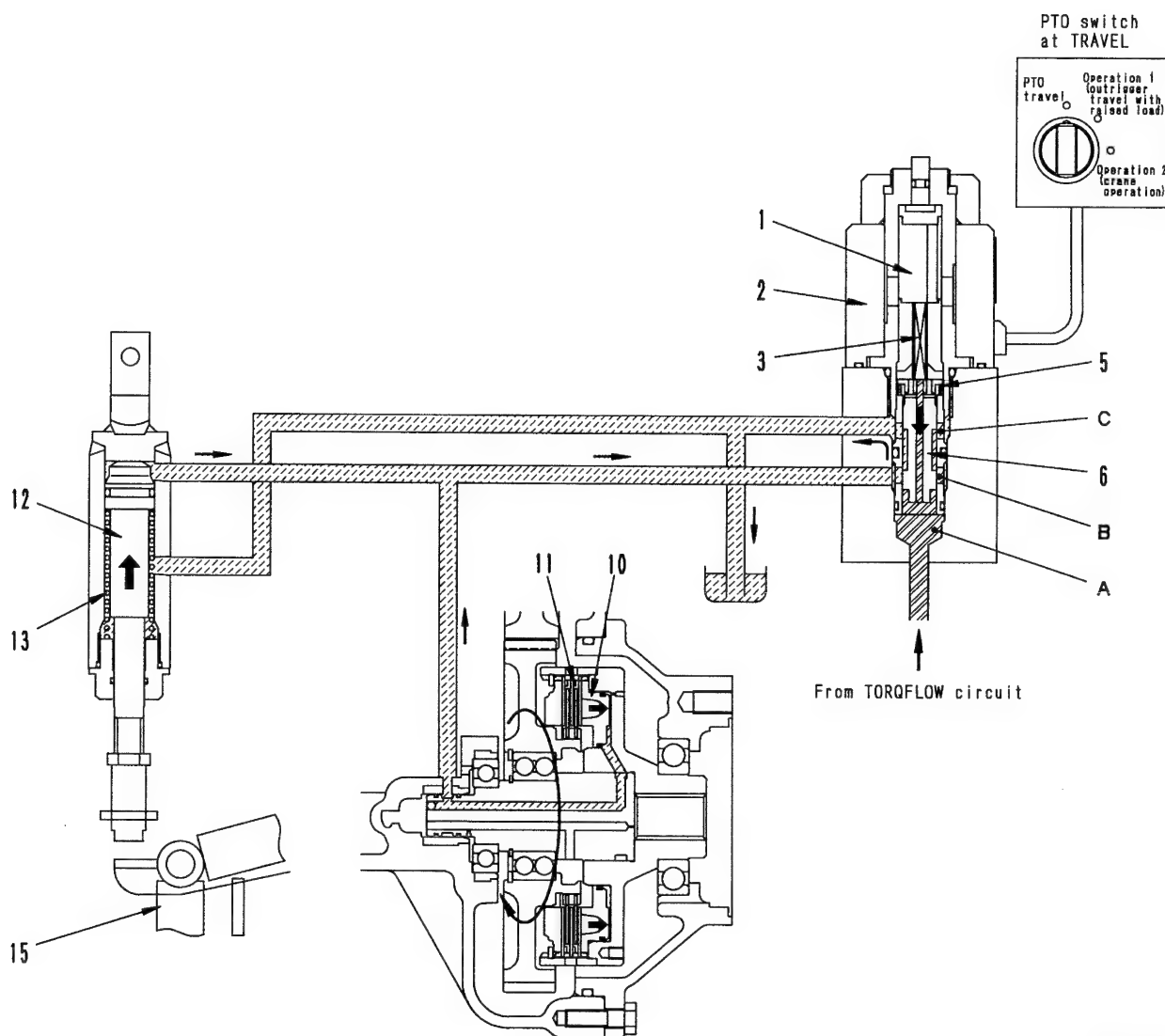
Outline

- The engine speed set cylinder is assembled in the engine control linkage. It is actuated by oil from the PTO clutch selector valve and sets the maximum engine speed to low speed (approx. 1790 rpm) during operations and high speed (approx. 2350 rpm) during general travel.

023S05

OPERATION

1. PTO switch at TRAVEL



SKL01063

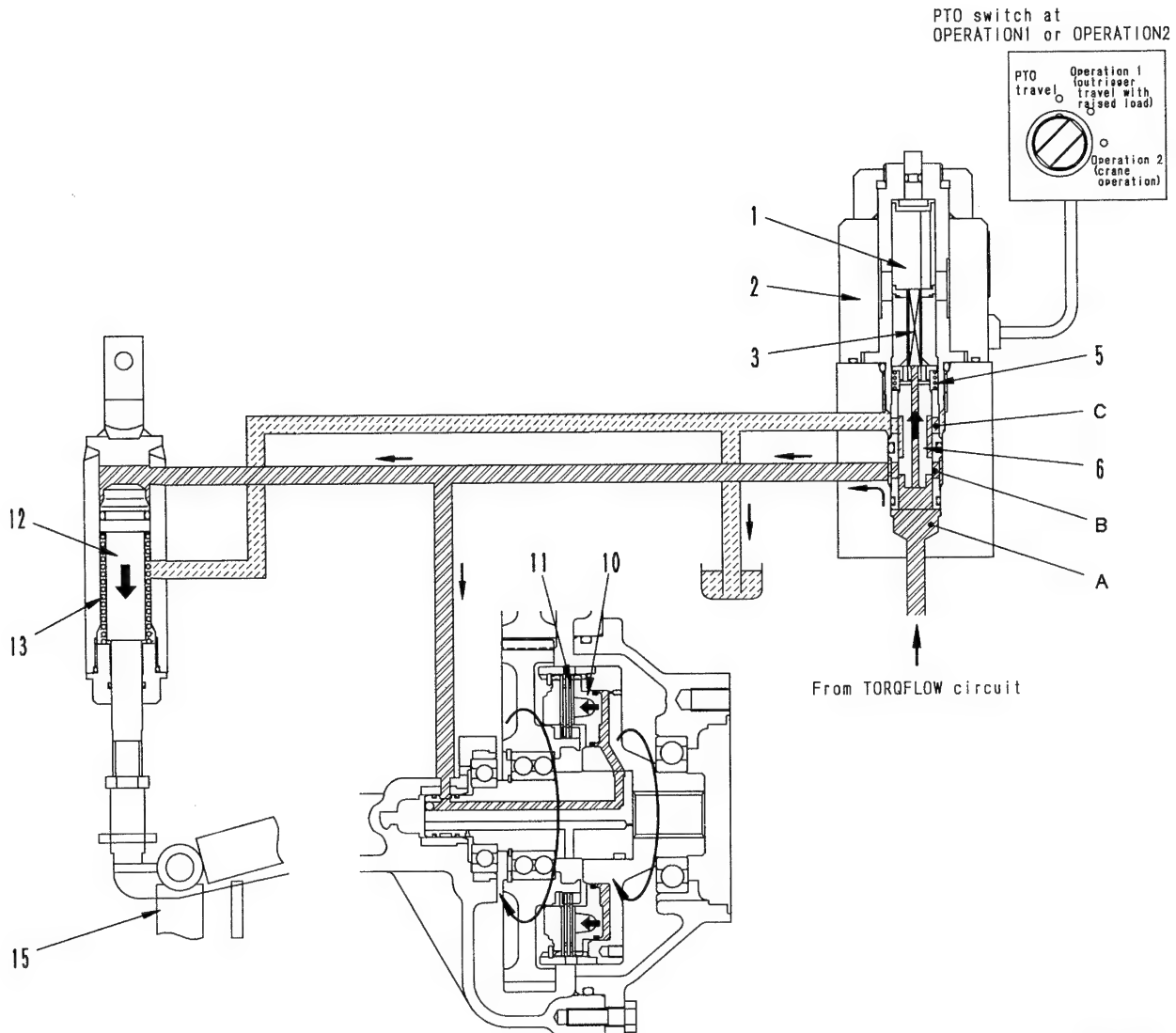
- When the PTO switch is set to the TRAVEL position, solenoid (2) is excited, and plunger (1) and push rod (3) push spool (6) in the downward direction to close the circuit between ports A and B and open the circuit between ports B and C.

When this happens, the oil from the TORQFLOW circuit enters port A and stops. The oil from port B (in other words, the oil from the back pressure port of PTO clutch piston (10) and the oil from the bottom end of the engine speed set cylinder) enters port C and is drained to the transmission case.

As a result, piston (10) is pushed back to the left by the tension of spring (11), so the PTO clutch is disengaged and the rotation of the boom and winch pumps stops.

With the engine speed set cylinder, piston rod (12) is returned in the downward direction by the tension of spring (13) and the control of the rotation range of engine control lever (15) is canceled.

2. PTO switch at OPERATION 1 or OPERATION 2

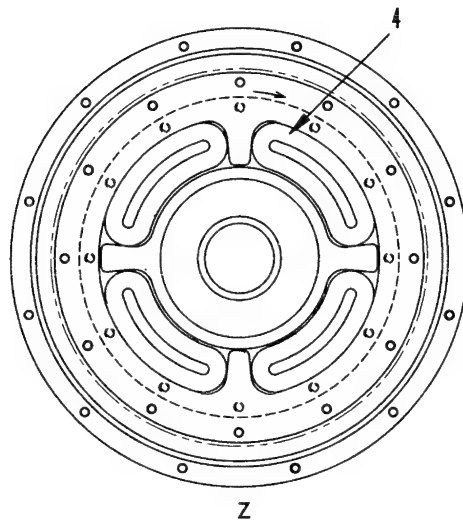
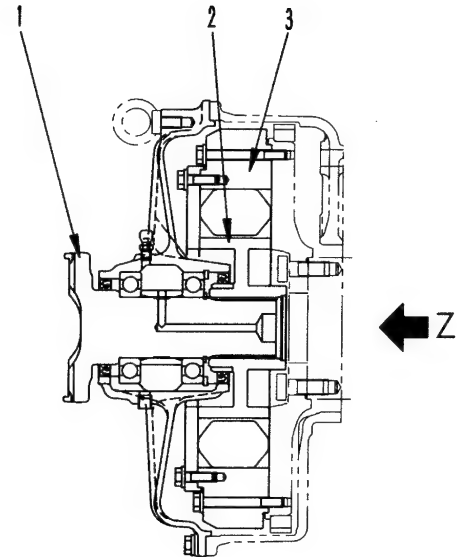
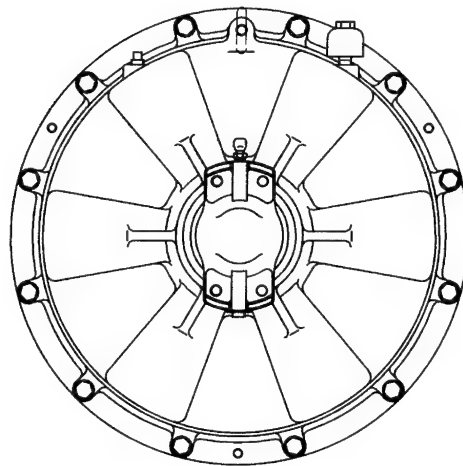


023S05

SKL01064

- If the PTO switch is set to the OPERATION 1 or OPERATION 2 position, solenoid (2) is de-energized and spool (6) is returned in the upward direction by the tension of spring (5) to close the circuit between ports **B** and **C** and open the circuit between ports **A** and **B**. When this happens, the oil from the TORQFLOW circuit enters port **B** from port **A**, and flows from port **B** to the PTO clutch and engine speed set cylinder.
- The oil flowing to the PTO clutch becomes the back pressure of piston (10), pushes the piston to the right, engages the clutch, and makes the boom and winch pumps rotate. The oil to the engine speed set cylinder enters the bottom end of the cylinder, pushes out piston rod (12), and controls the rotation range of engine control lever (15) to the "OPERATION" range (1790 rpm).

DAMPER



023S05

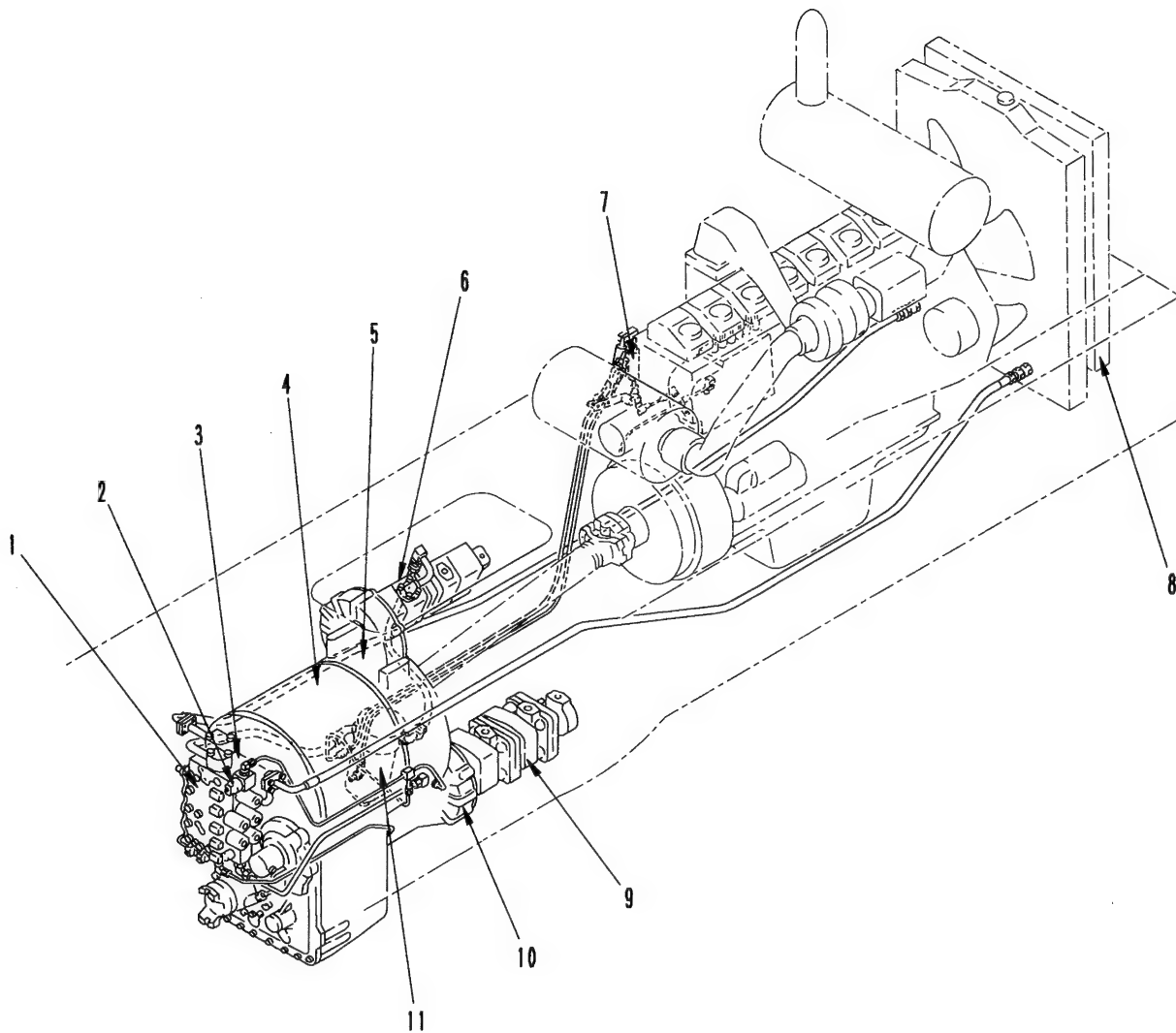
NKL00002

Outline

- The damper is installed to the engine flywheel and absorbs the torsional vibration caused by the variation in the engine torque.

1. Coupling (output shaft)
2. Inner
3. Outer
4. Rubber

TRANSMISSION HYDRAULIC PIPING DIAGRAM



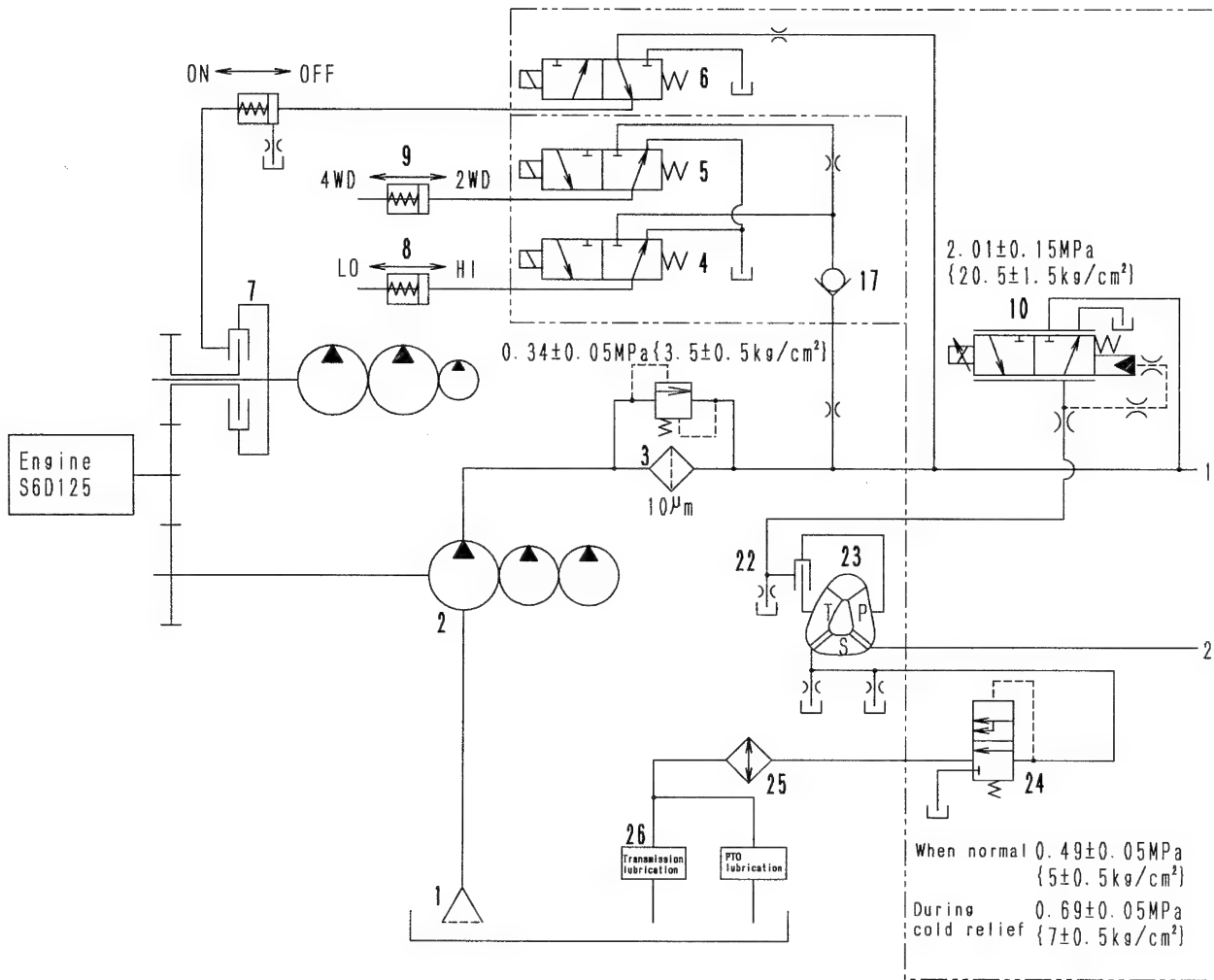
023S05

SLL00224

1. Transmission control valve
2. PTO selector valve
3. Torque converter valve
4. Transmission
5. Torque converter
6. Transmission pump (3-tandem pump)

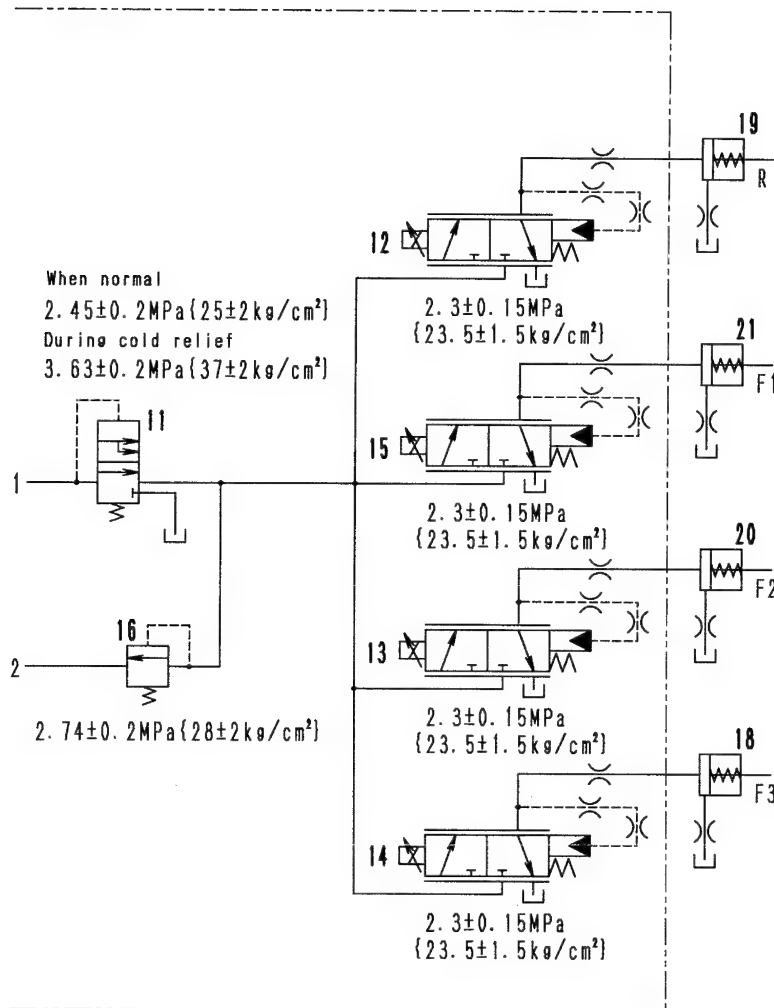
7. Engine speed set cylinder
8. Oil cooler
9. Hydraulic pump (for boom, winch)
10. PTO hydraulic clutch
11. Transmission oil filter

TORQUE CONVERTER, TRANSMISSION HYDRAULIC CIRCUIT
DIAGRAM



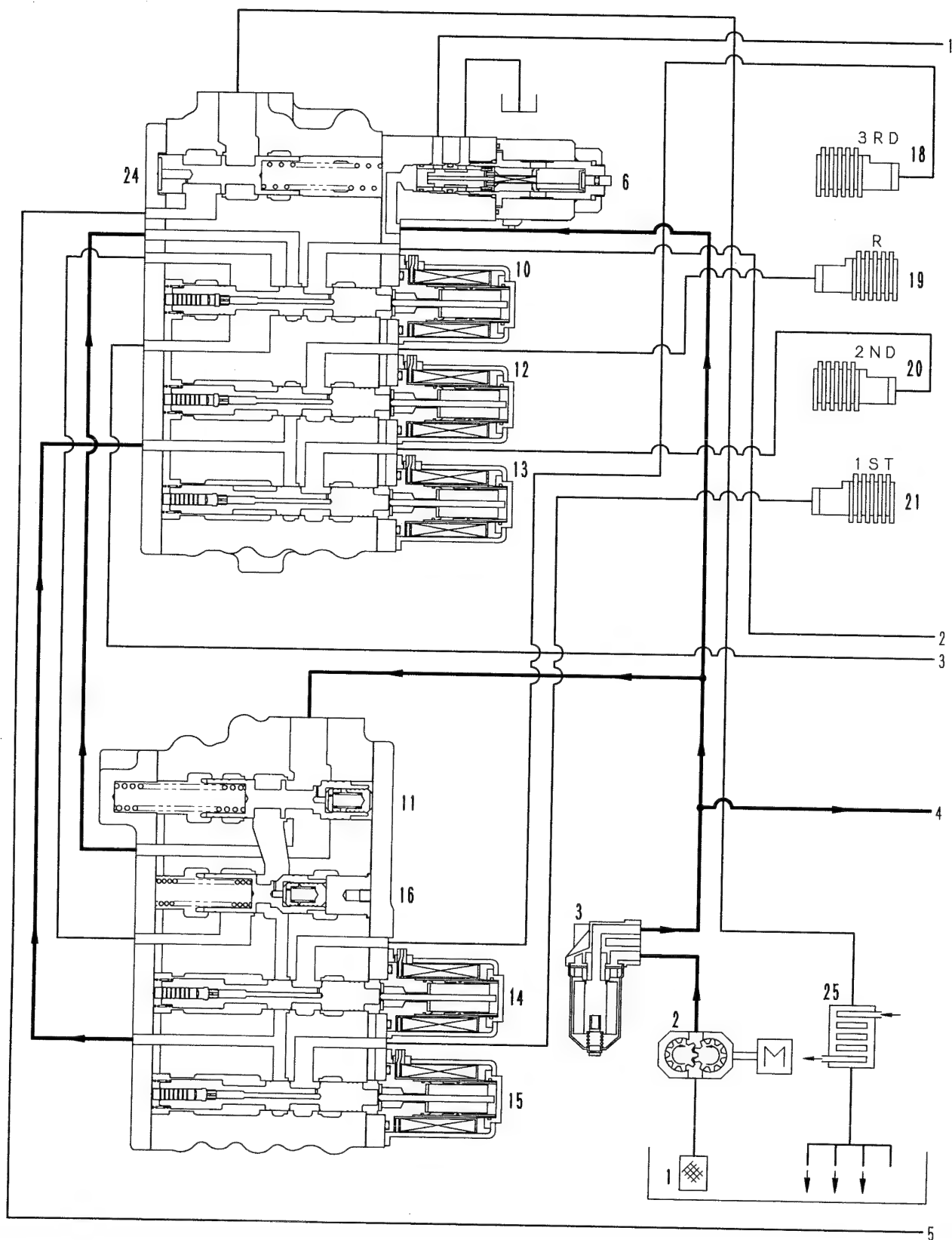
023S05

SKL01065



1. Strainer
2. Hydraulic pump
3. Oil filter
4. Hi/Lo selector solenoid valve
5. 2/4-wheel drive selector solenoid valve
6. PTO clutch solenoid valve
7. PTO clutch
8. Hi/Lo selector cylinder
9. 2/4-wheel drive selector cylinder
10. Torque converter lock-up ECMV
11. Priority valve
12. R ECMV
13. 2nd ECMV
14. 3rd ECMV
15. 1st ECMV
16. Main relief valve
17. Check valve
18. 3rd clutch
19. R clutch
20. 2nd clutch
21. 1st clutch
22. Torque converter lock-up clutch
23. Torque converter
24. Torque converter outlet port valve
25. Oil cooler
26. Transmission lubrication

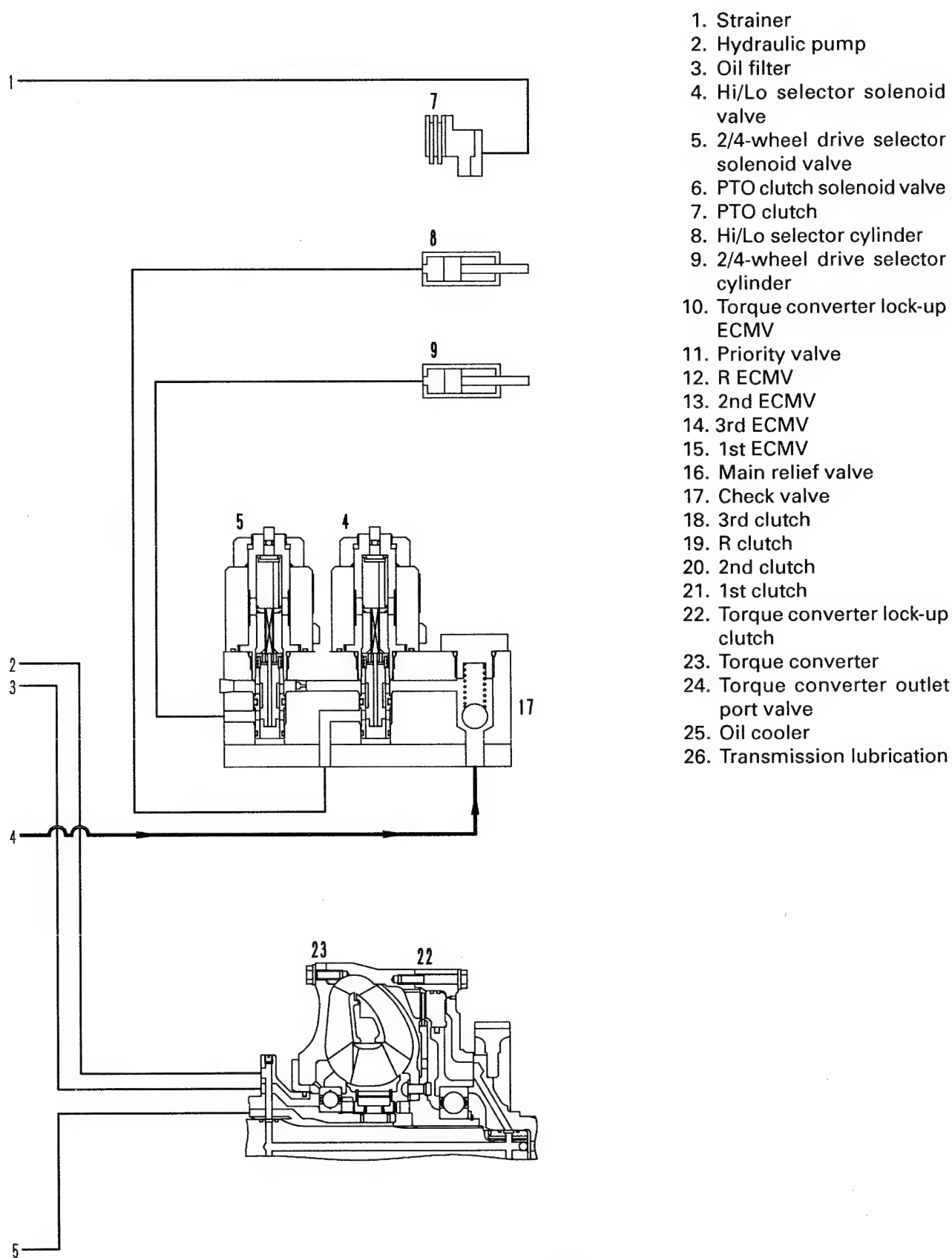
SKL01066

**TORQUE CONVERTER, TRANSMISSION HYDRAULIC SYSTEM
SCHEMATICS****(CONDITIONS : ENGINE RUNNING, GEAR SHIFT LEVER AT NEUTRAL)**

023S05

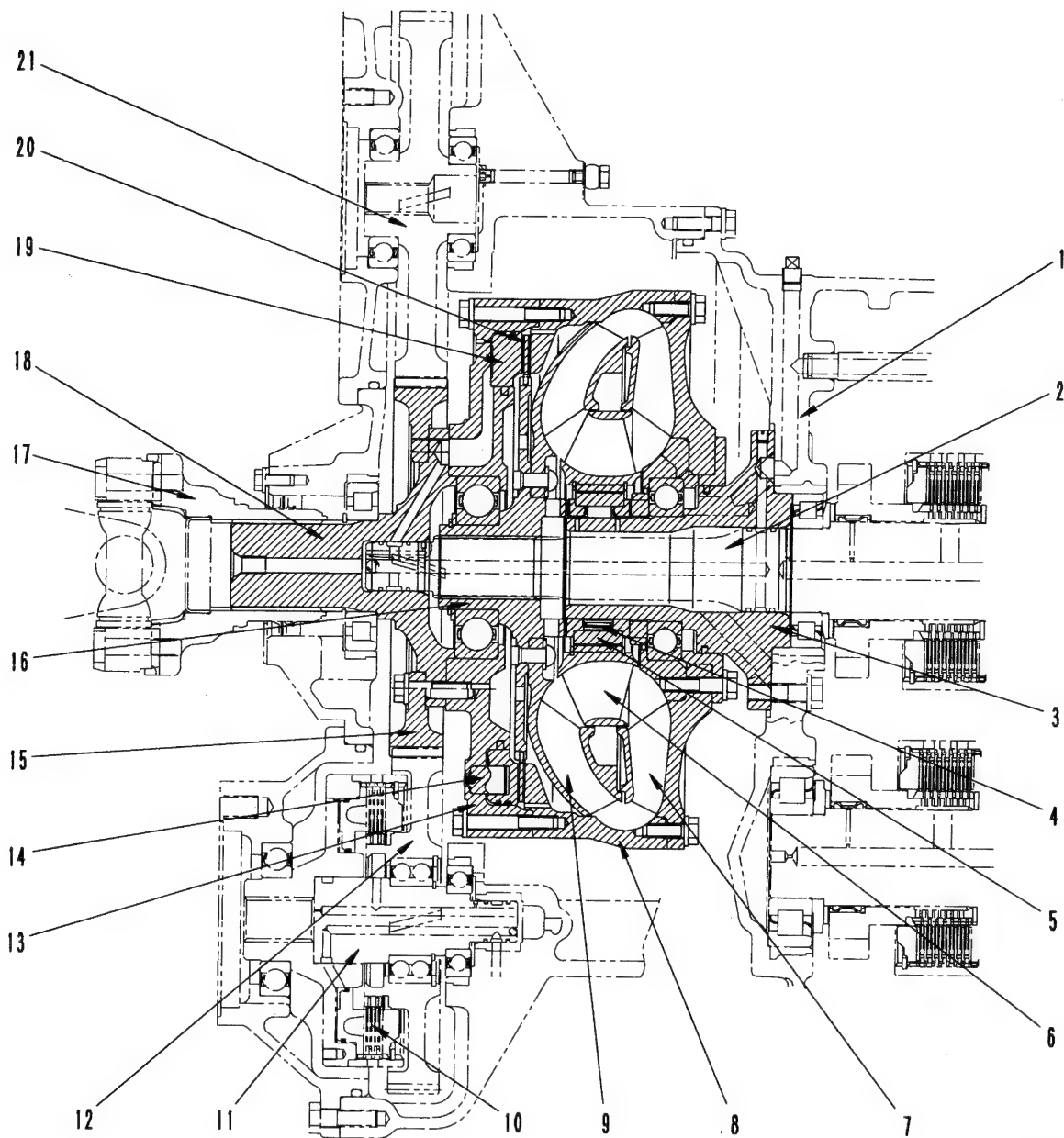
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023S05



SKL00228

TORQUE CONVERTER



SKL00229

- | | |
|--|---------------------|
| 1. Transmission rear case | 12. PTO clutch gear |
| 2. Output shaft (transmission input shaft) | 13. Clutch housing |
| 3. Stator shaft | 14. Pin |
| 4. Free wheel | 15. PTO drive gear |
| 5. Outer race | 16. Turbine boss |
| 6. Stator | 17. Input coupling |
| 7. Pump | 18. Input shaft |
| 8. Drive case | 19. Clutch piston |
| 9. Turbine | 20. Lock-up clutch |
| 10. PTO hydraulic clutch | 21. Pump drive gear |
| 11. PTO shaft | |

023S05

Outline

- The torque converter is a 3-element, 1-stage, 2-phase torque converter with free wheel (4) installed to stator (6).
The torque converter is installed to the transmission and has a torque converter lock-up mechanism using a wet type single disc clutch to transmit the power from the engine directly to the transmission.
- When traveling continuously at high speed on flat roads, it is more effective if the power from the engine is transmitted directly to the transmission input shaft.
To do this, there is a hydraulically actuated lock-up clutch installed inside the torque converter.
The lock-up clutch is controlled by the gear shift mode or is controlled automatically by the transmission controller according to the travel speed.

Structure

- Pump (7) forms one unit with drive case (8) and clutch housing (13), and is rotated by the power from the engine.
- Turbine (9) forms one unit with turbine boss (16), and the turbine boss forms one unit with output shaft (2).
In addition, the outside circumference of the turbine boss is meshed with disc (20).
- Stator (6) forms one unit with stator shaft (3) through free wheel (4).
The stator shaft is fixed to transmission rear case (12).
- The lock-up clutch consists of clutch housing (13) which forms one unit with drive case (8), and disc (20) which is meshed with the outside teeth of turbine boss (16) and piston (19). Hydraulic pressure is applied to the piston by the actuation of the torque converter lock-up ECMV. This makes the drive case and turbine boss form one unit, so the power from the engine is transmitted directly to the output shaft.
- The PTO system is provided with power by drive gear (15), which forms one unit with input shaft (18), and rotates pump drive gear (15) and PTO clutch gear (12).
The 3-tandem pump for boom, winch, and pilot is installed to PTO clutch gear (12) through PTO hydraulic clutch (10), and the 3-tandem pump for the spring, steering, and transmission charge is installed to drive gear (15).

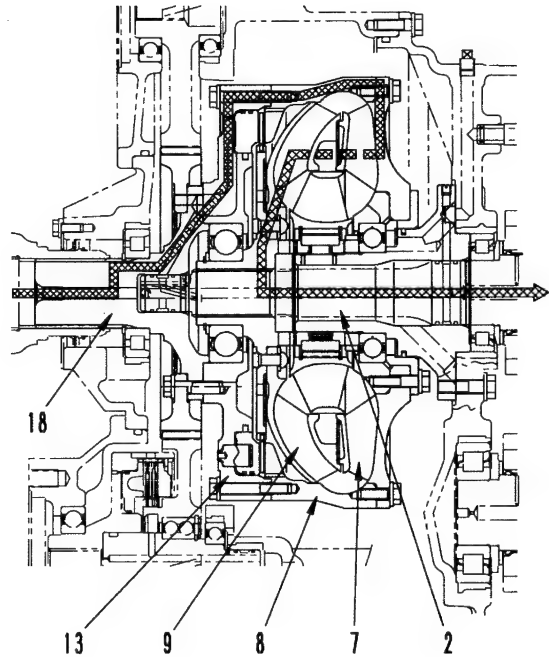
TRANSMISSION OF POWER

1. When lock-up clutch is disengaged

When the lock-up clutch is disengaged, drive case (8) and turbine (9) are disconnected, and the torque converter carries out the normal torque converter function.

The power generated by the engine is transmitted from the damper through the drive shafts to input shaft (18) and clutch housing (13), and drive case (8) and pump (7) are rotated as one unit.

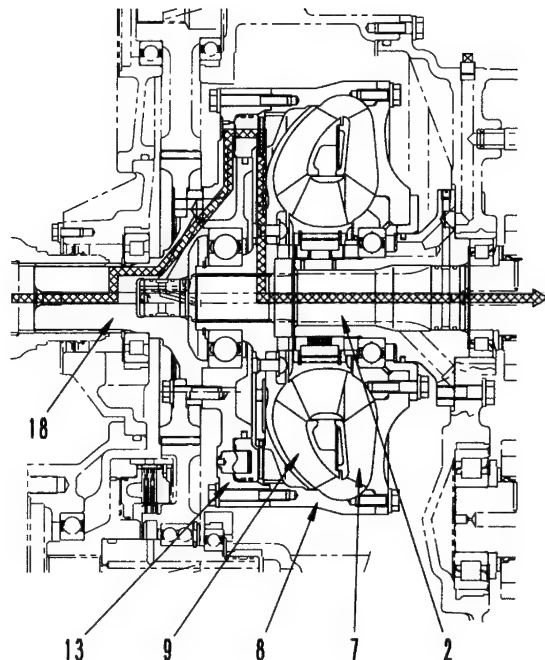
The power from the pump uses oil to rotate turbine (9), and is transmitted to output shaft (2), which forms one unit with the turbine.



SKL00230

2. When lock-up clutch is engaged

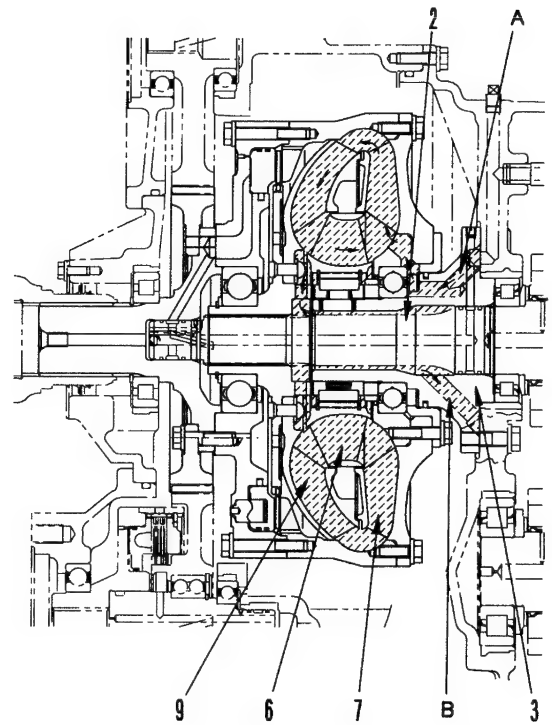
When the lock-up clutch is engaged, drive case (8) and turbine (9) are connected to form one unit. The power generated by the engine is transmitted from the damper through the drive shafts to input shaft (18) and clutch housing (13), and drive case (8) and pump (7) are rotated as one unit. The drive case and turbine (9) are connected by the clutch, so the power is transmitted directly to the output shaft (2) and the turbine without using oil.



SKL00231

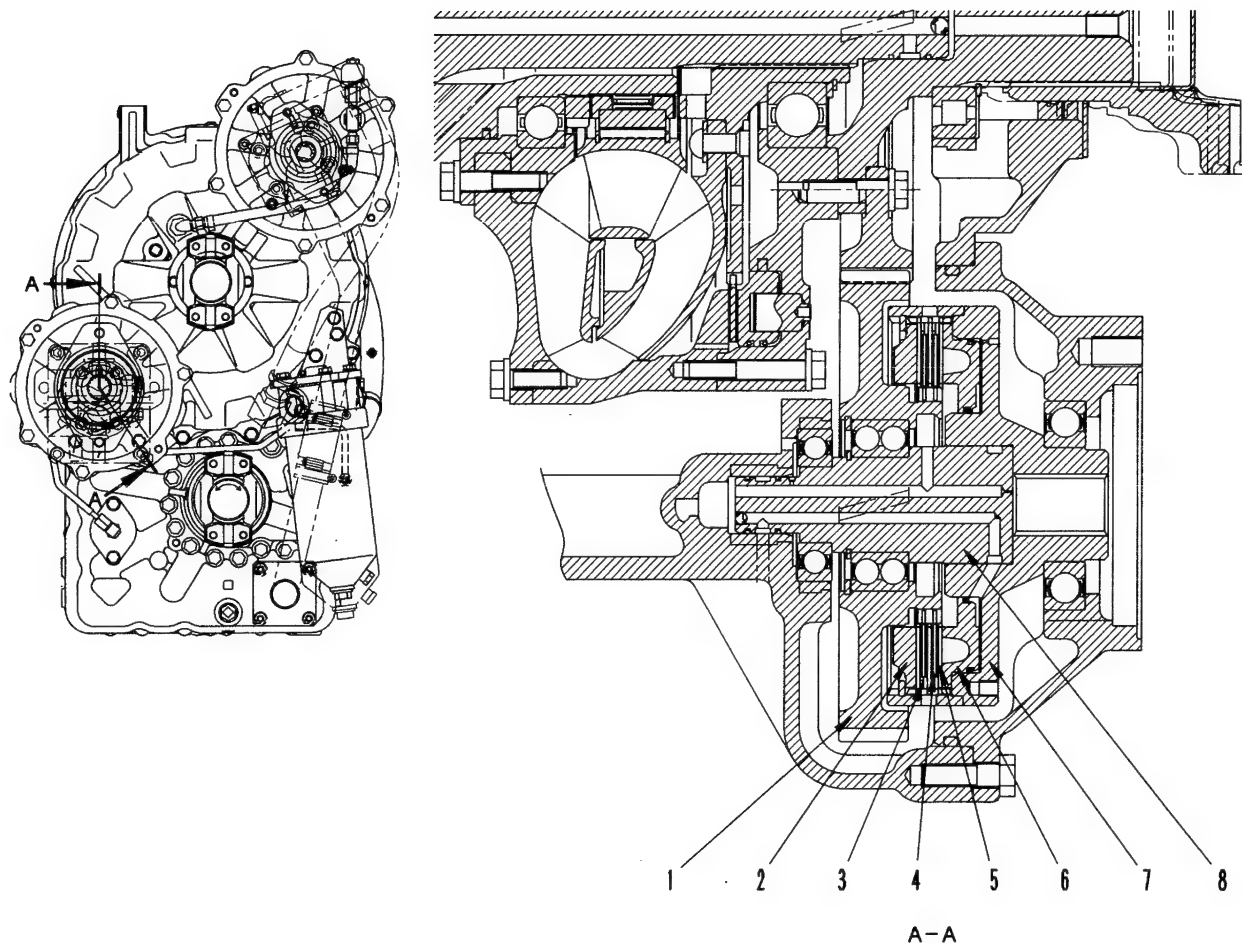
FLOW OF OIL

- The oil flows from port **A** through the oil hole inside stator shaft (3), and enters pump (7), which is always being rotated by the power from the engine.
- The oil entering the pump is given centrifugal force, enters turbine (9), and the turbine is rotated by the centrifugal force of the oil. The turbine forms one unit with output shaft (2), so the power received by the turbine is transmitted to the transmission.
- The oil leaving the turbine is sent to stator (6) and enters the pump again, but some of the oil passes from the stator through port **B** and is sent to the oil cooler.



SKL00232

PTO CLUTCH



1. PTO clutch gear
2. End plate
3. Clutch spring
4. Clutch disc
5. Clutch plate
6. Clutch piston
7. Clutch housing
8. PTO shaft

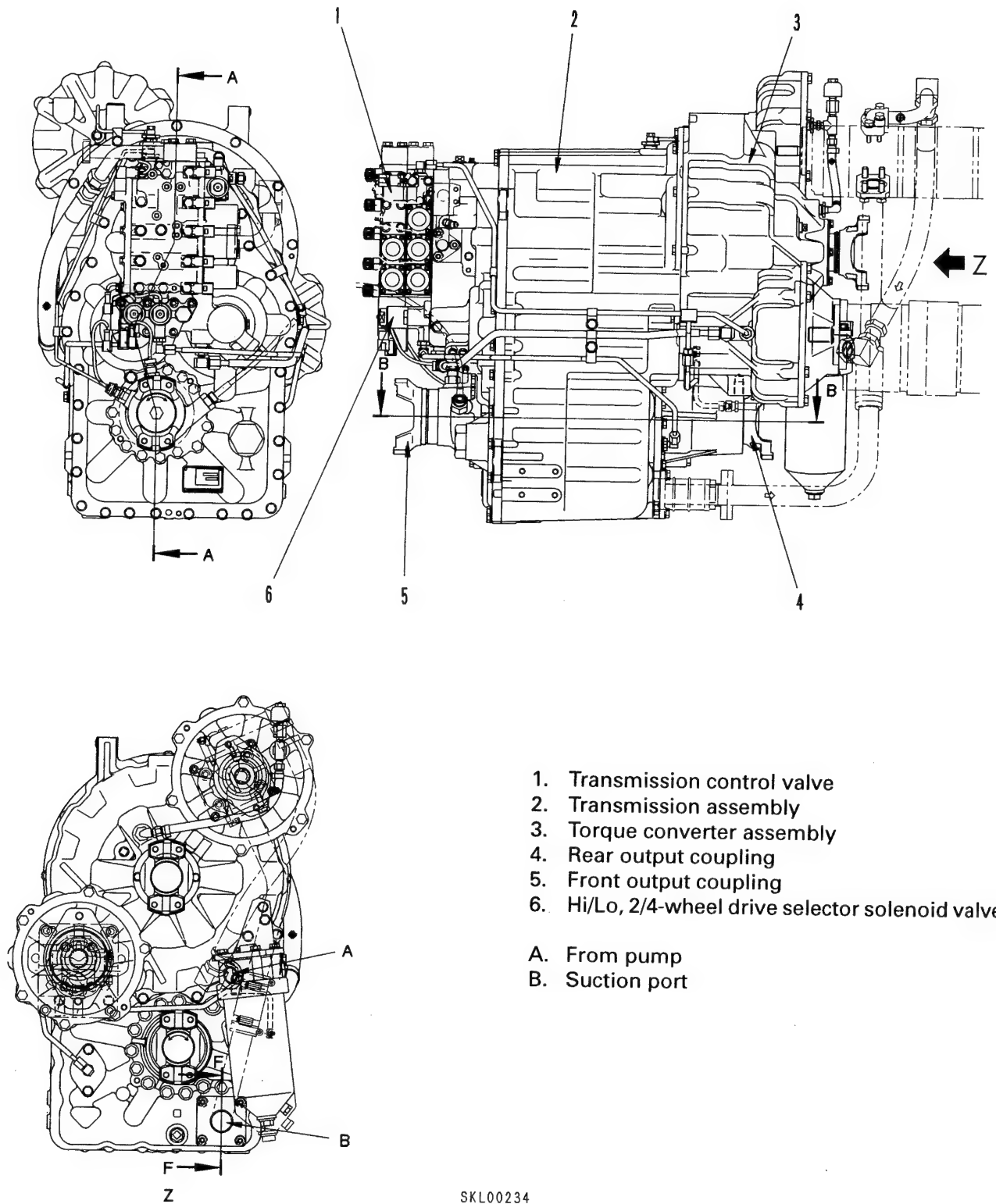
Outline

- The PTO clutch is a wet type multiple disc clutch, and acts to switch the transmission of power of the PTO clutch gear and the boom pump, winch (outrigger) pump, and pilot pump.
The PTO clutch is assembled inside the transmission rear case, and the hydraulic pump is installed to the hub of clutch housing (7).
- The PTO clutch is operated by the PTO switch in the operator's compartment. The solenoid valve is actuated and the hydraulic circuit is switched, so the oil in the TORQFLOW hydraulic circuit pushes clutch piston (6).
- When the PTO switch is at any position other than TRAVEL, the clutch is engaged and the three pumps rotate to supply oil to each circuit.

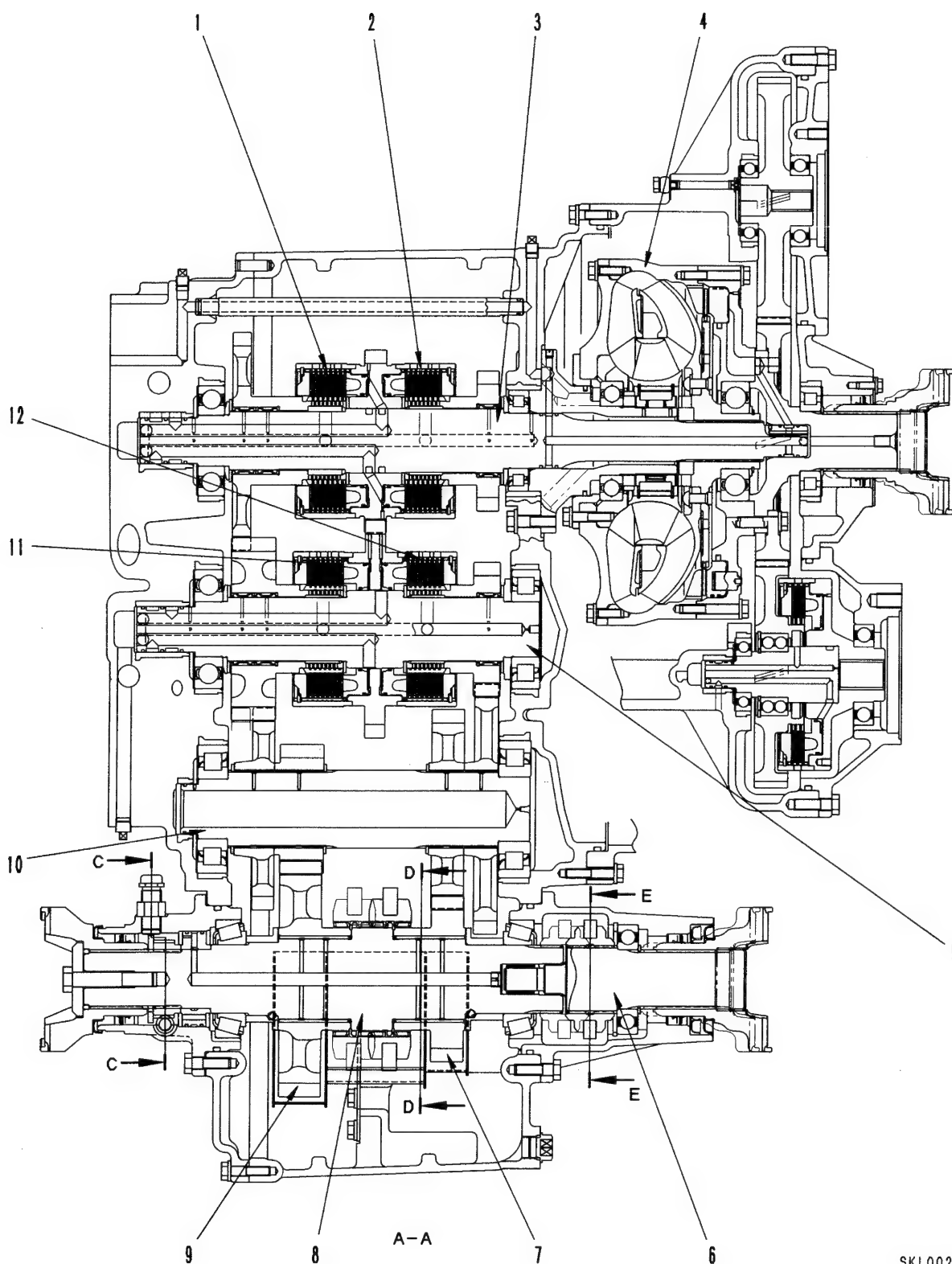
023S05

SKL00233

TRANSMISSION

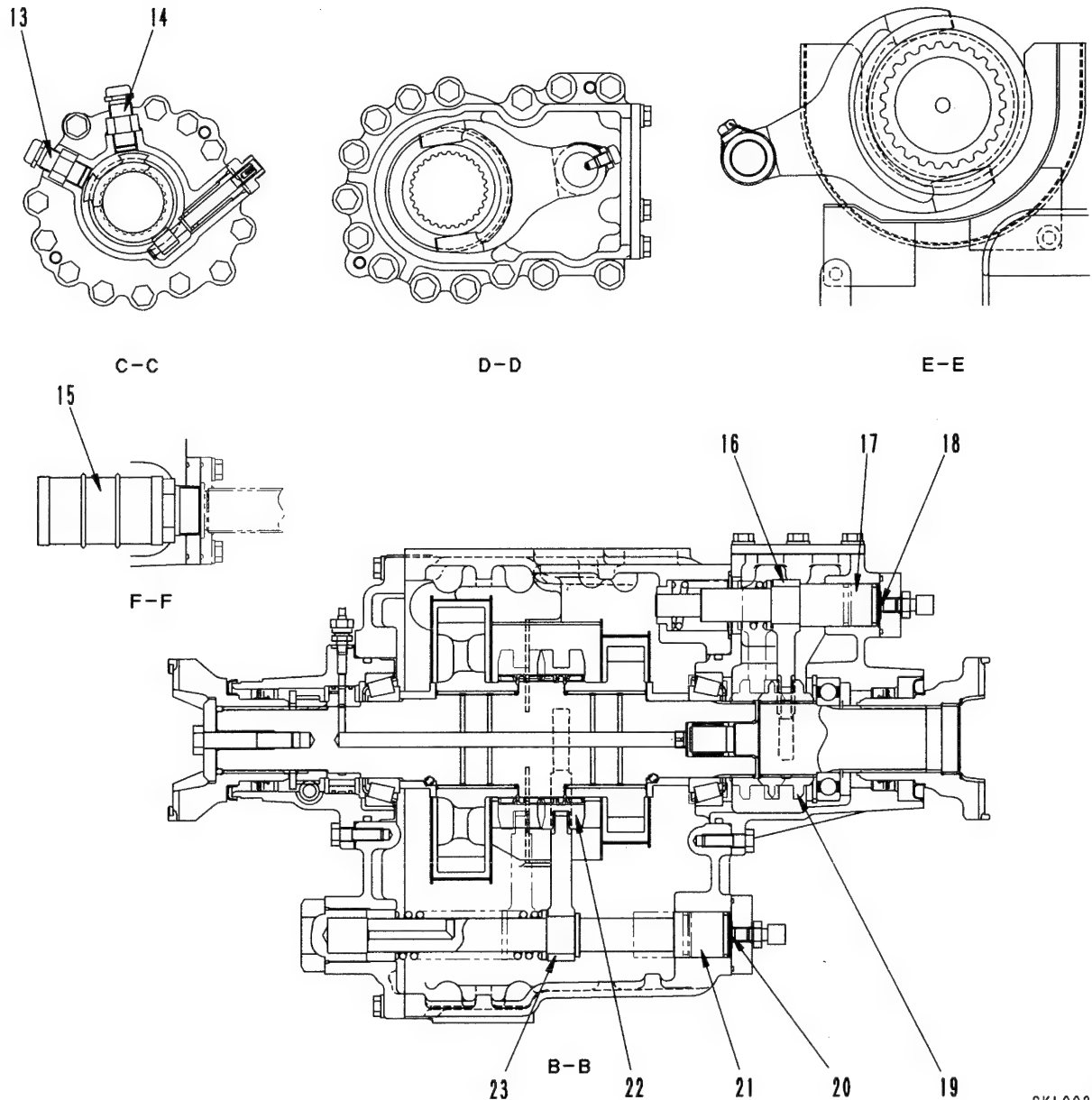


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023S05

SKL00235



023S05

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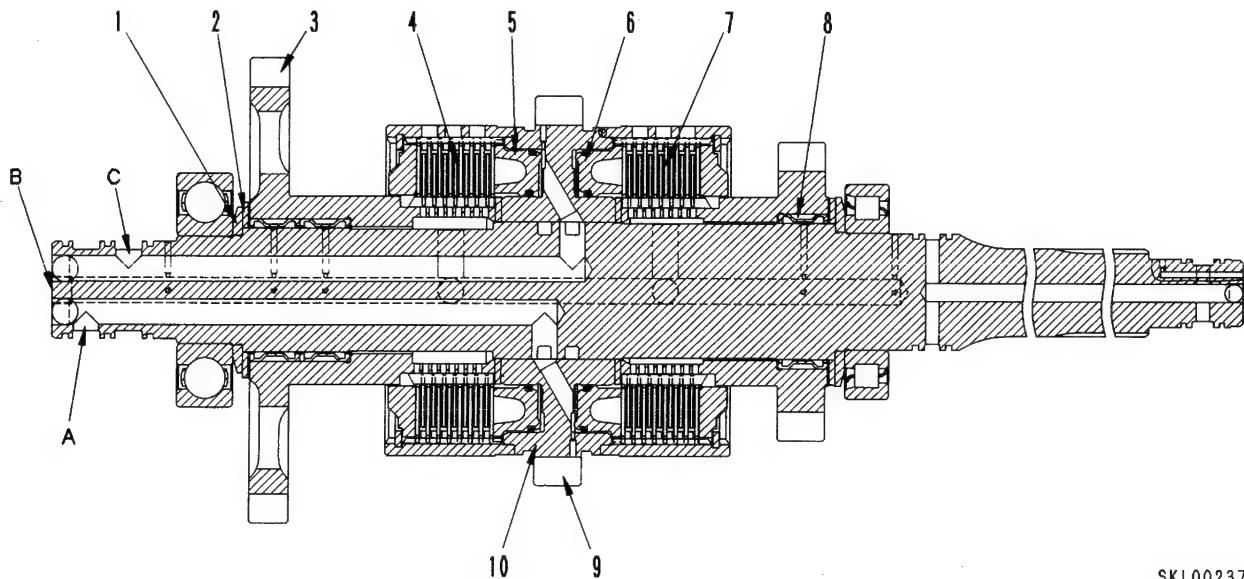
- | | |
|-------------------------------------|--|
| 1. 3rd clutch | 13. Speed sensor |
| 2. R clutch | 14. Speed sensor |
| 3. R, 3rd shaft | 15. Strainer |
| 4. Torque converter | 16. 2/4-wheel drive selector shifting fork |
| 5. 1st, 2nd shaft | 17. 2/4-wheel drive selector piston |
| 6. Rear output shaft | 18. 2/4-wheel drive selector cylinder |
| 7. Hi drive gear (No. of teeth: 28) | 19. 2/4-wheel drive selector coupling |
| 8. Front output shaft | 20. Hi/Lo selector cylinder |
| 9. Lo drive gear (No. of teeth: 41) | 21. Hi/Lo selector piston |
| 10. Hi/Lo shaft | 22. Hi/Lo selector coupling |
| 11. 2nd clutch | 23. Hi/Lo selector shifting fork |
| 12. 1st clutch | |

OUTLINE

- The transmission is installed to the rear of the torque converter, and the power from the torque converter passes through the torque converter output shaft and enters the transmission.
- The transmission consists of the reverse clutch, 1st clutch, 2nd clutch, and 3rd clutch to provide 3 forward speeds and 1 reverse speed, and this is transmitted to the output shaft.
- Switching between 2-wheel drive and 4-wheel drive is carried out by the 2/4-wheel drive selector shifting fork. Front wheel drive is used for the 2-wheel drive.
- Switching between Hi and Lo speed is carried out by the Hi/Lo selector shifting fork.
- The transmission is shifted automatically by the transmission controller.

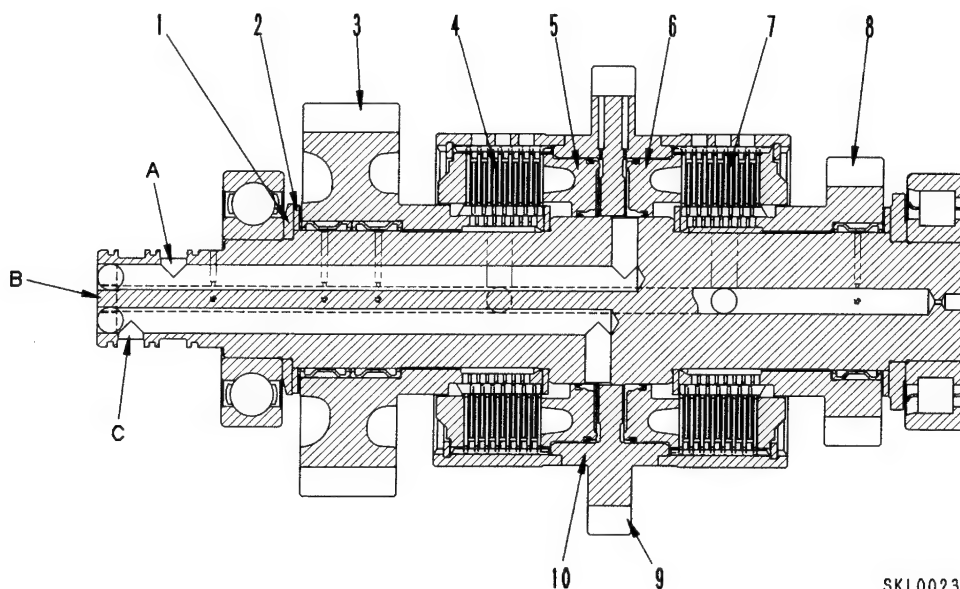
Reduction ratio

Hi/Lo	Speed range	Reduction ratio
Hi	F1	1.973
Hi	F2	1.107
Hi	F3	0.737
Lo	F1	4.678
Lo	F2	2.625
Lo	F3	1.747
Hi	R	1.540
Lo	R	3.650

R, 3RD CLUTCH

SKL00237

- | | | |
|--------------------------------|-----------------------------------|-------------------------|
| 1. Thrust washer | 6. R clutch piston | A. R clutch port |
| 2. Thrust bearing | 7. R clutch | B. Lubricating oil port |
| 3. 3rd gear (No. of teeth: 38) | 8. R gear (No. of teeth: 23) | C. 3rd clutch port |
| 4. 3rd clutch | 9. R, 3rd gear (No. of teeth: 31) | |
| 5. 3rd clutch piston | 10. R, 3rd cylinder | |

1ST, 2ND CLUTCH

SKL00238

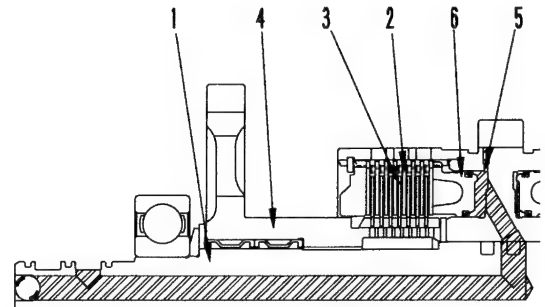
- | | | |
|--------------------------------|-------------------------------------|-------------------------|
| 1. Thrust washer | 6. 1st clutch piston | A. 1st clutch port |
| 2. Thrust bearing | 7. 1st clutch | B. Lubricating oil port |
| 3. 2nd gear (No. of teeth: 31) | 8. 1st gear (No. of teeth: 22) | C. 2nd clutch port |
| 4. 2nd clutch | 9. 1st, 2nd gear (No. of teeth: 38) | |
| 5. 2nd clutch piston | 10. 1st, 2nd cylinder | |

023S05

OPERATION OF CLUTCH

When actuated

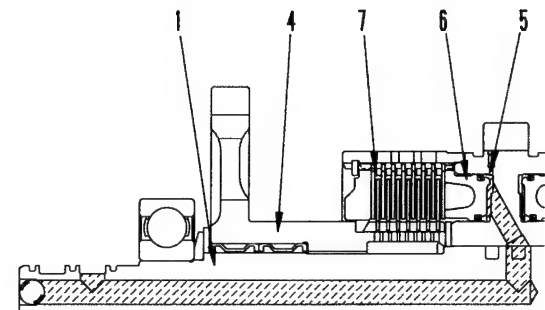
- The oil sent from the transmission control valve passes through the oil passage inside shaft (1), reaches the back surface of piston (6), and actuates the piston.
- When piston (6) is actuated, separator plate (2) and clutch disc (3) are brought into close contact, so shaft (1) and clutch gear (4) form one unit and transmit the power.
When this happens, the oil from oil drain hole (5) is drained, but the amount drained is less than the amount of oil supplied, so there is no effect on the actuation of the clutch.



SKL00239

When not actuated

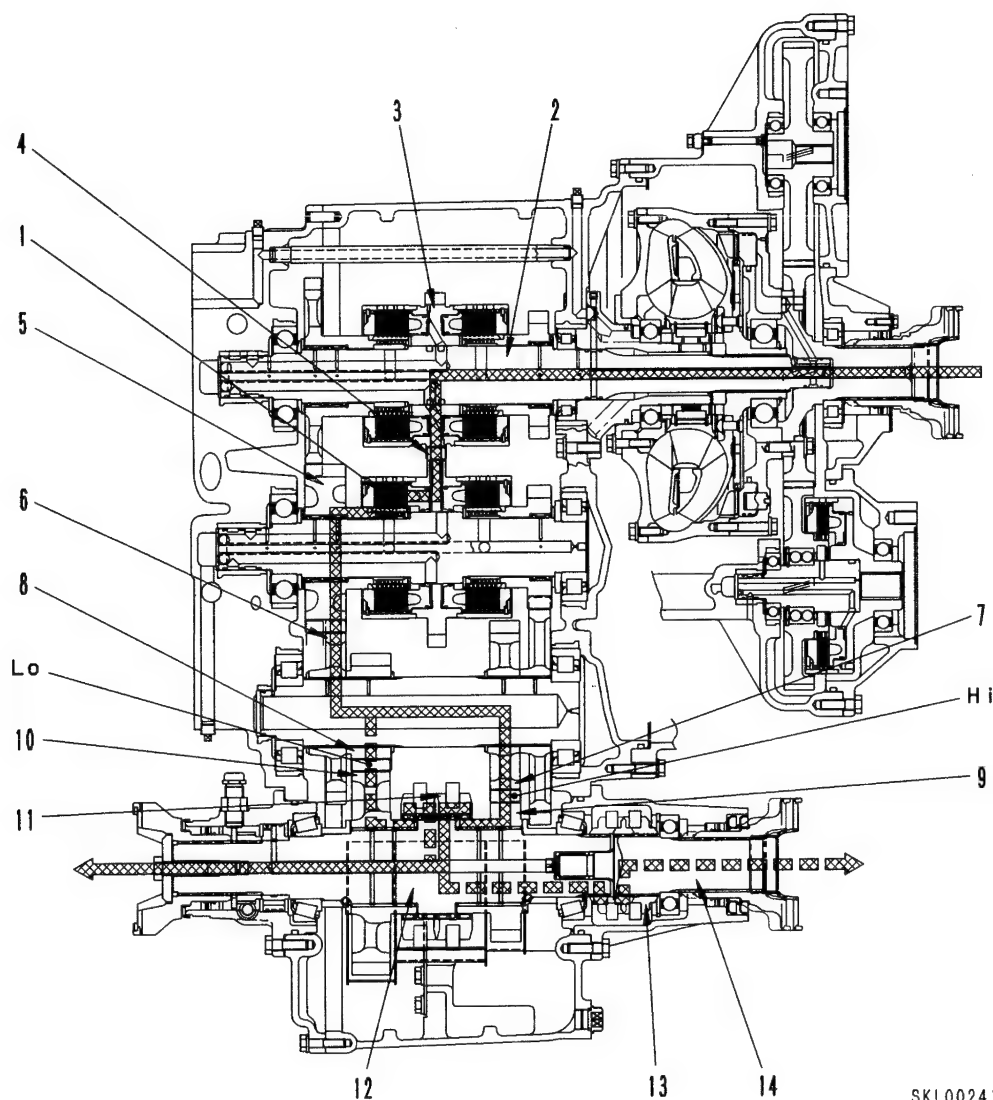
- The oil sent from the transmission control valve is shut off, so the pressure of the oil acting on the back surface of piston (6) drops.
- Oil drain hole (5) drains the oil at the back face of the piston by centrifugal force when the clutch is disengaged. This prevents the clutch from remaining partially engaged.



SKL00240

TRANSMISSION OF POWER

Forward 2nd



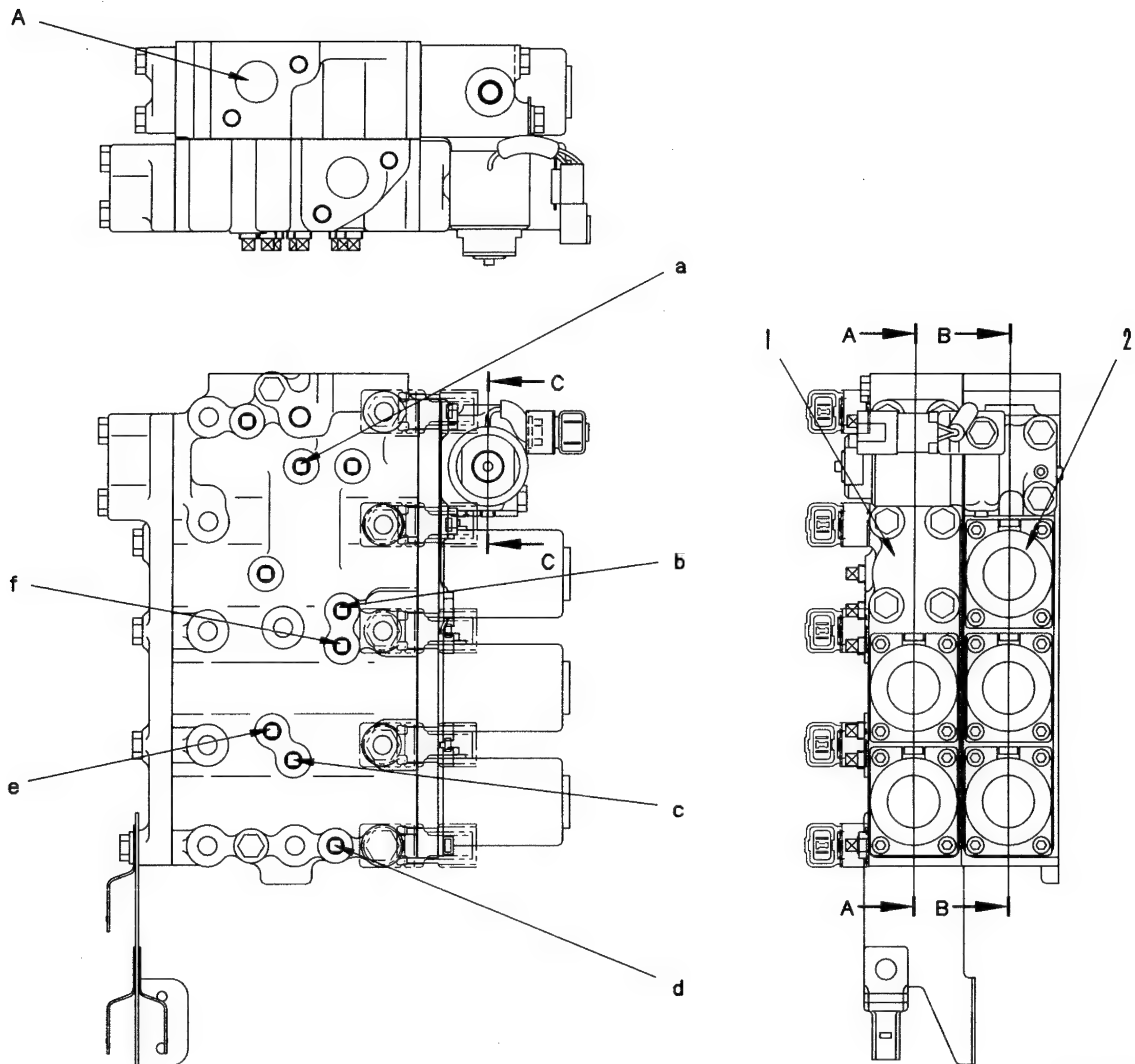
SKL00241

023S05

Operation

- In FORWARD 2nd, 2nd clutch (1) is connected by the oil pressure from the transmission valve.
- The power from the torque converter is transmitted from input shaft (2) to R, 3rd gear (3), and rotates 1st, 2nd gear (4).
- 2nd clutch (1) is connected, so the rotation of 1st, 2nd gear (4) passes through the 2nd clutch and rotates 2nd gear (5).
- 2nd gear (5) rotates 2nd drive gear (6) and Hi drive gear (7) and Lo drive gear (8). Hi driven gear (9) and Lo driven gear (10), which are meshed with these, also rotate.
- When Hi/Lo selector coupling (11) shifts, the rotation of either Hi driven gear (9) or Lo driven gear (10) passes through the selector coupling and is transmitted to front output shaft (12).
- In the case of 4-wheel drive, when 2/4-wheel drive selector coupling (13) is shifted, the rotation of front output shaft (12) is transmitted to rear output shaft (14).

TRANSMISSION CONTROL VALVE



SKL00242

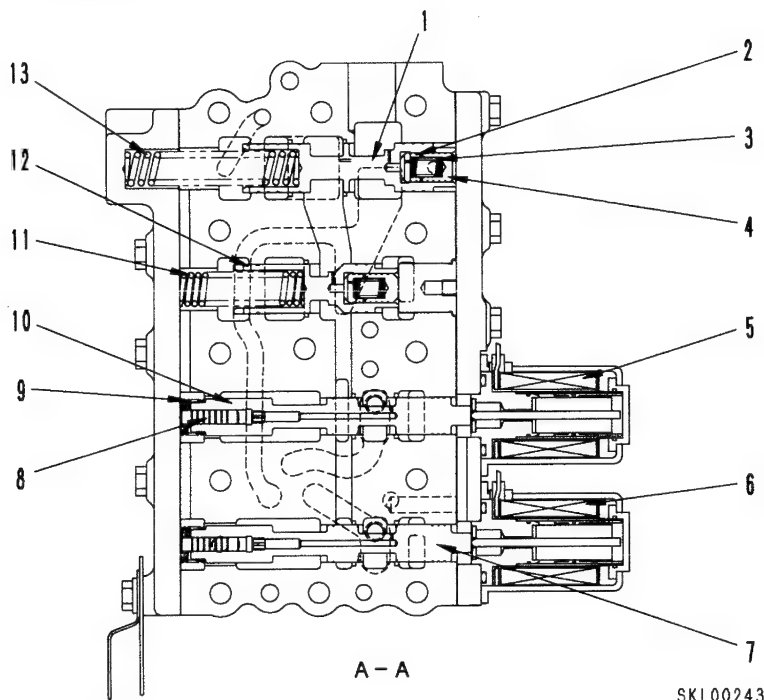
- 1. Upper valve
- 2. Lower valve

- A. To oil cooler
- a. Main oil pressure pickup port
- b. Torque converter lock-up clutch oil pressure pickup port
- c. 1st clutch oil pressure pickup port
- d. 2nd clutch oil pressure pickup port
- e. 3rd clutch oil pressure pickup port
- f. R clutch oil pressure pickup port

Outline

- The transmission control valve automatically controls the torque converter lock-up clutch and the shifting of the transmission according to the command from the transmission controller.
- An electronic clutch modulation valve is used for control (modulation) of the clutch oil pressure. This provides the most suitable characteristics for build-up of the clutch pressure according to the speed range and conditions, and reduces the transmission shock.

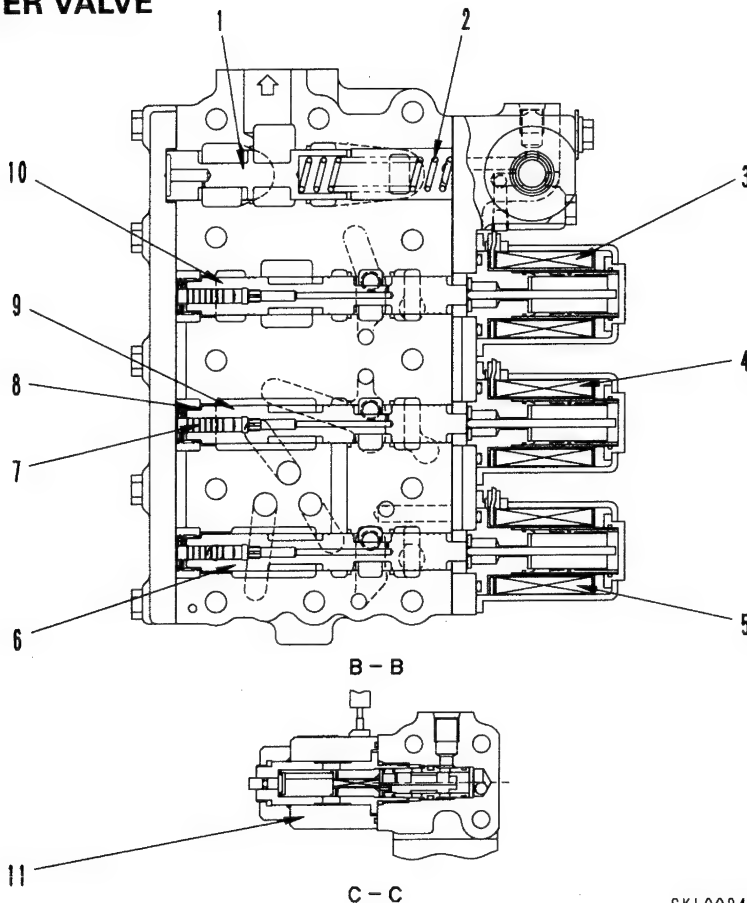
UPPER VALVE



SKL00243

1. Priority valve
2. Piston (small)
3. Spring
4. Piston (large)
5. 3rd proportional solenoid
6. 1st proportional solenoid valve
7. 1st ECMV spool
8. Piston
9. Spring
10. 3rd ECMV spool
11. Spring
12. Main relief valve
13. Spring

LOWER VALVE

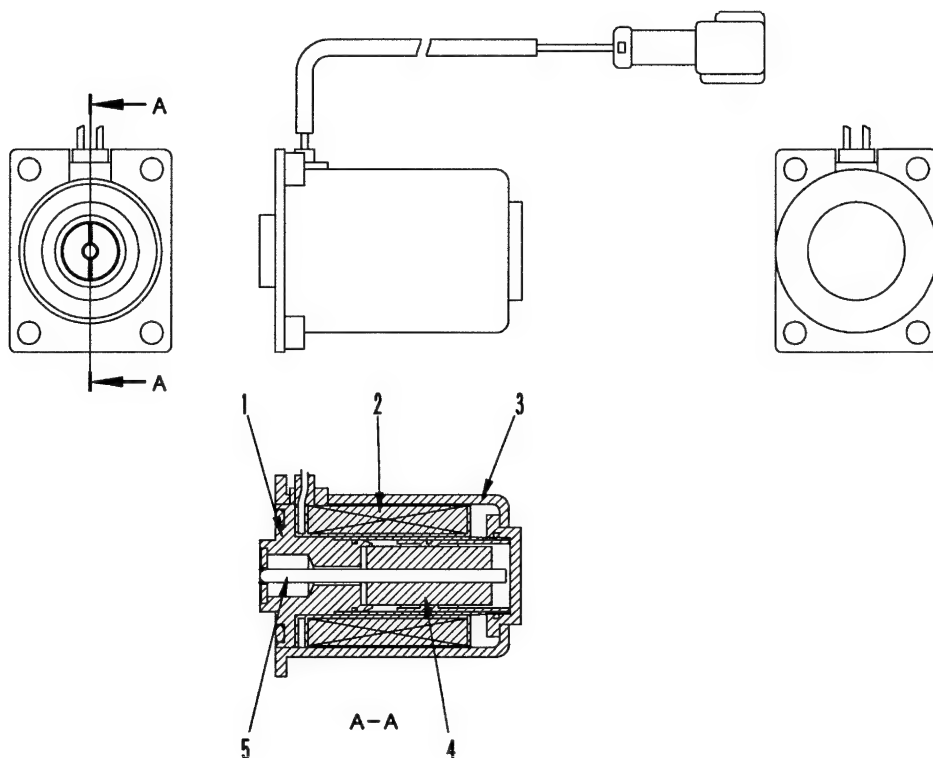


SKL00244

1. Torque converter outlet port valve
2. Spring
3. Torque converter lock-up clutch proportional solenoid
4. R clutch proportional solenoid
5. 2nd clutch proportional solenoid
6. 2nd clutch ECMV spool
7. Piston
8. Spring
9. R clutch ECMV spool
10. Torque converter lock-up clutch ECMV spool
11. PTO clutch solenoid valve

023S05

PROPORTIONAL SOLENOID VALVE



SKL00245

1. Body
2. Coil assembly
3. Case
4. Plunger
5. Shaft

023S05

ELECTRONIC CONTROL MODULATION VALVE (ECMV)

Structure of ECMV

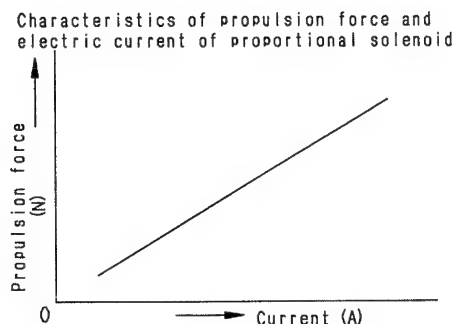
- The ECMV (Electronic Control Modulation Valve) consists of a proportional solenoid valve and the ECMV spool.

Proportional solenoid valve and ECMV

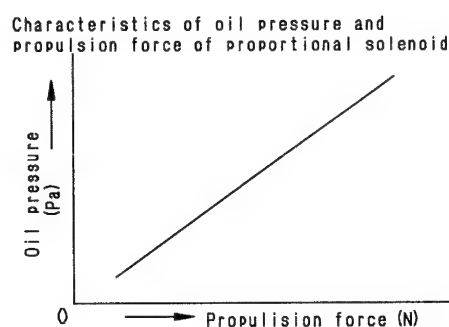
A propulsion force as shown in the diagram on the right is generated by the command current from the transmission controller.

The propulsion force generated by the proportional solenoid acts on the pressure control spool and generates the oil pressure shown in the diagram on the right.

Therefore, by controlling the command current, it is possible to change the propulsion force, actuate the pressure control valve, and control the oil flow and oil pressure.



SKL01067

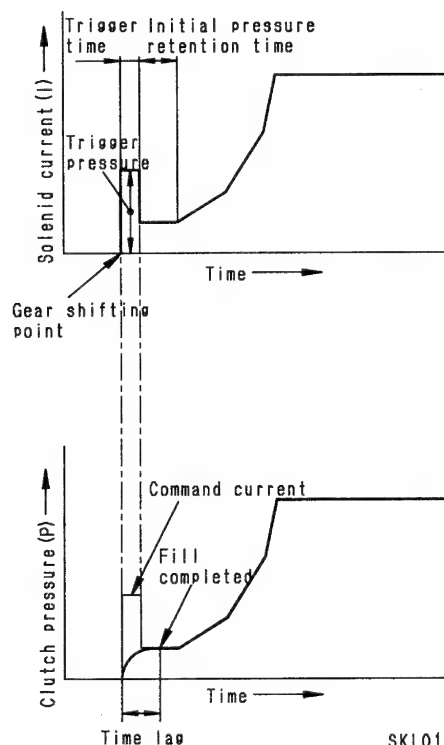


SKL01068

Operation of ECMV

The ECMV is controlled by the command current sent from the transmission controller to the proportional solenoid. The relationship between the clutch pressure and the command current for the proportional solenoid in the ECMV is as shown in the diagram on the right.

- ★ Clutch retention pressure: 2.3 MPa
{23.5 kg/cm²}

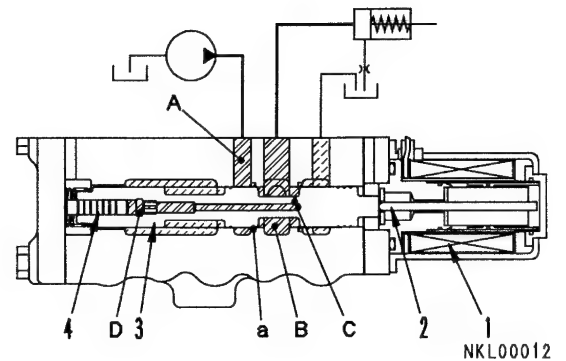


SKL01069

OPERATION

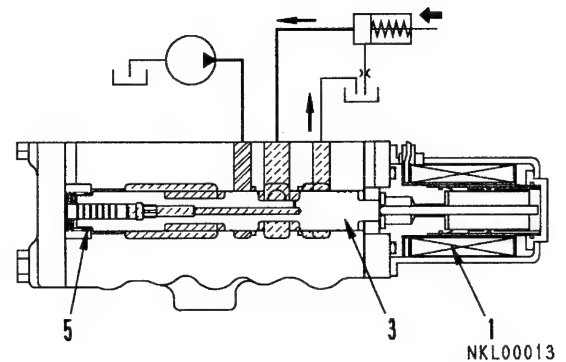
1. Mechanism of pressure adjustment

The oil from the priority valve enters chamber **A**, passes through throttle **a** and flows to chamber **B**. Some of the oil in chamber **B** passes through port **C** and enters chamber **D**. The oil in chamber **D** pushes out piston (4), and the reaction to this moves spool (3) to the right to try to close throttle **a**. Propulsion force is generated on shaft (2) of proportional solenoid (1) to match the command current from the transmission controller. The hydraulic pressure is maintained at the point where this propulsion force and the reaction (hydraulic pressure) of spool (3) are in balance.



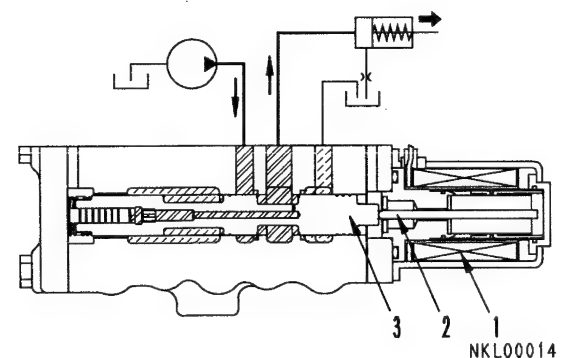
2. Before shifting gear

The command current does not flow from the transmission controller, so proportional solenoid valve (1) does not allow propulsion force to be generated. ECMV spool (3) is being pushed to the right by spring (5), so the oil from the priority valve is shut off by the ECMV spool and does not flow to the clutch. At the same time, the clutch oil is drained.



3. When shifting gear (immediately after shifting gear)

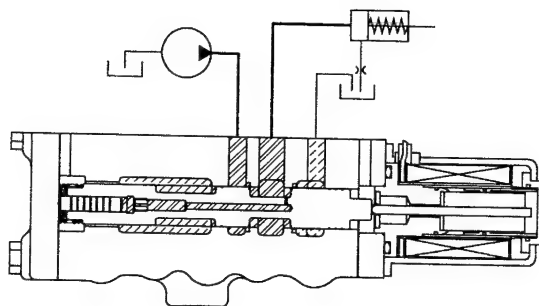
The command current to proportional solenoid (1) becomes the trigger current and generates propulsion force on shaft (2). Spool (3) is pushed to the left, and oil from the priority valve starts to fill the clutch chamber.



023S05

4. Setting initial pressure

Immediately after oil fills the clutch chamber, the command current to the solenoid is dropped to the set value for the initial pressure. Therefore, the propulsion force of shaft (2) of the proportional solenoid becomes smaller, and the clutch pressure becomes the set value for the initial pressure.

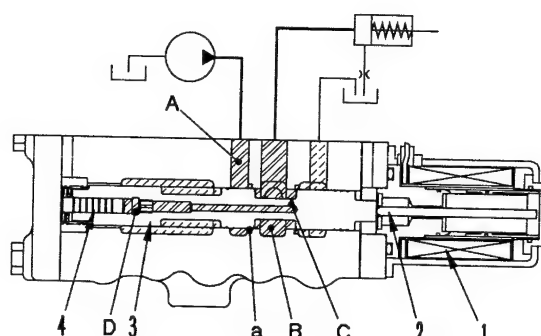


NKL00015

5. Adjusting pressure

When the electric current flows to proportional solenoid (1), a propulsion force proportional to the current is generated. This propulsion force of shaft (2) of solenoid (1) is adjusted by the oil pressure at the clutch port applied to spool (3) so that it is in balance with the reaction force.

In other words, the clutch pressure is controlled by controlling the command current sent to solenoid (1).

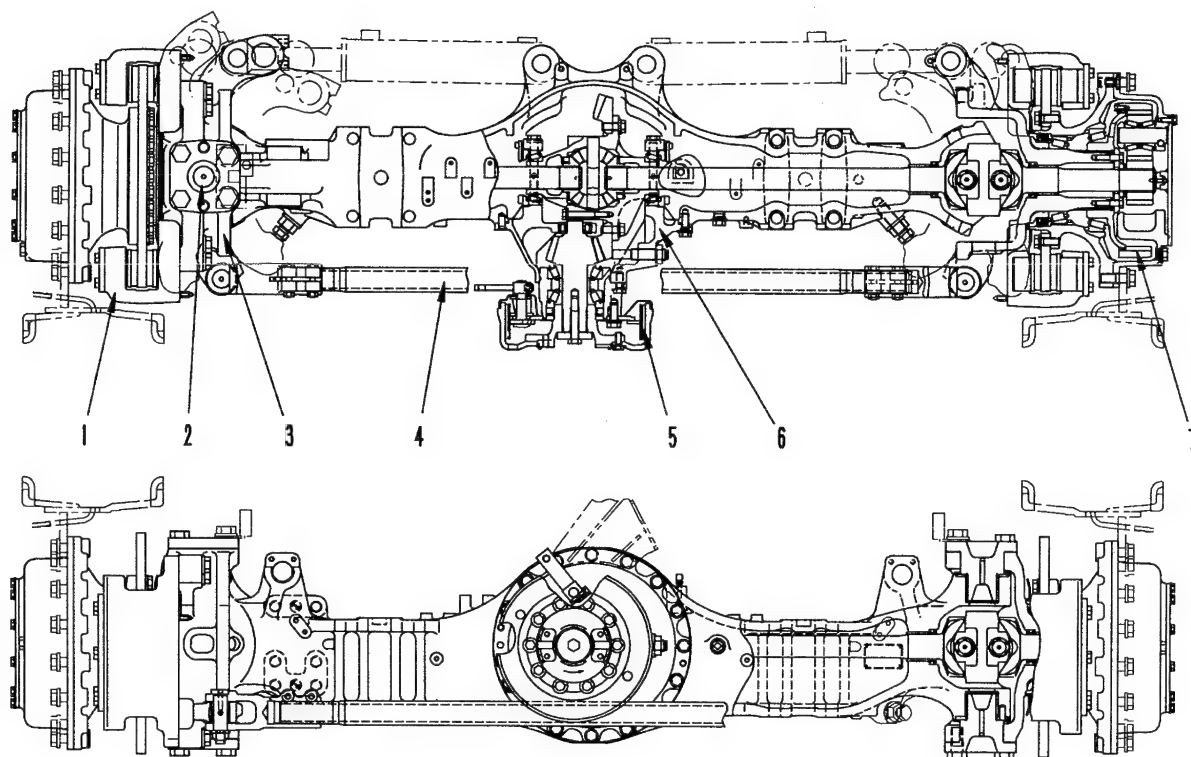


NKL00012

023S05

AXLE

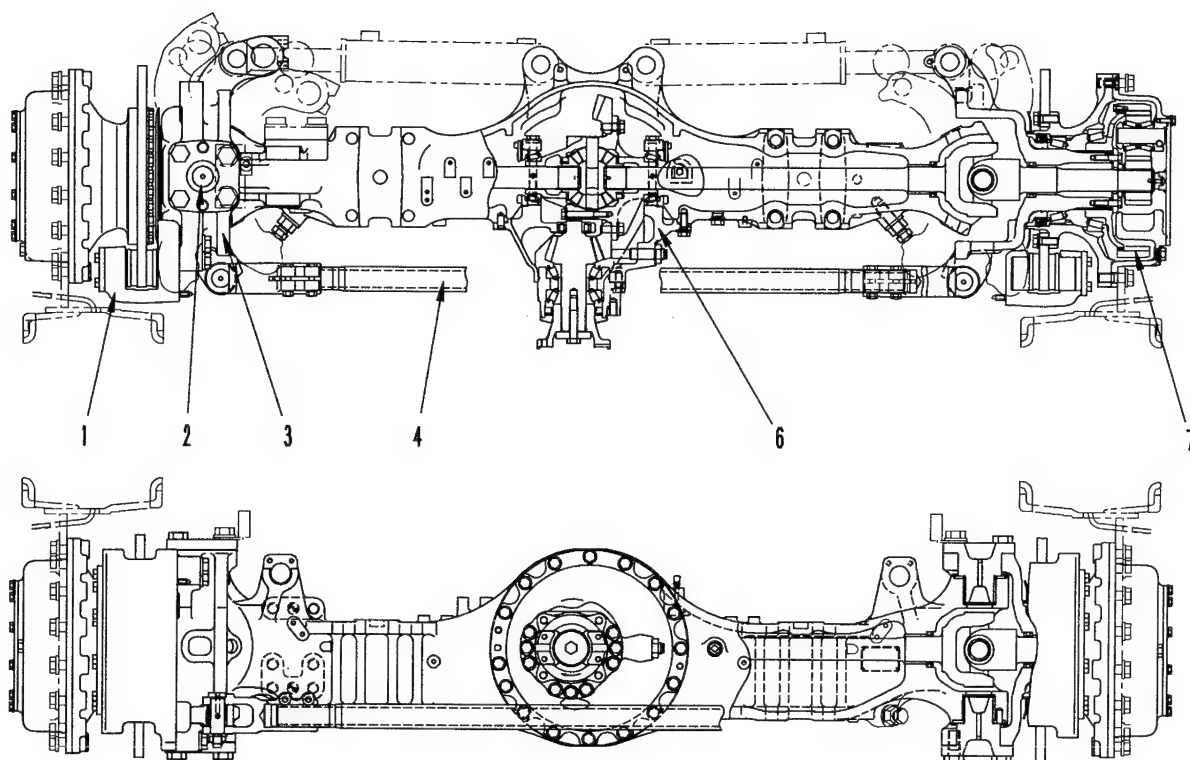
FRONT AXLE



SKL00246

023S05

REAR AXLE



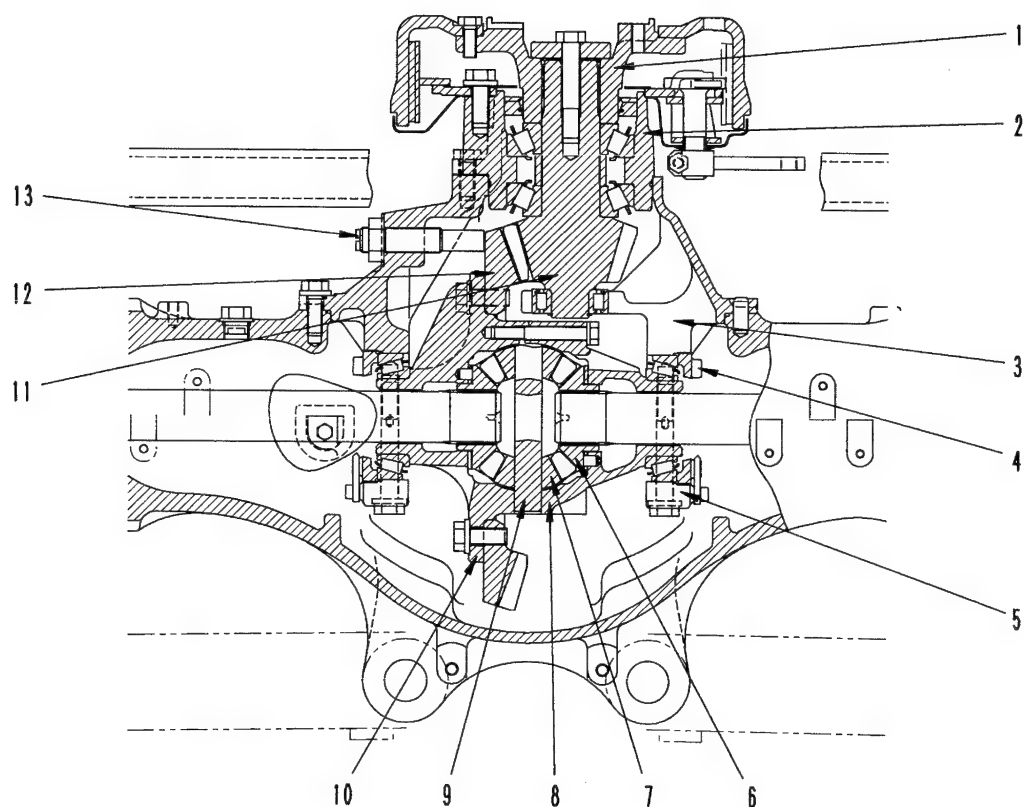
SKL00247

Outline

- The axle consists of the axle housing which supports the weight of the machine, the differential which is built into the axle housing, and the final drives and brakes at the left and right ends of the axle.
- In order to allow the machine to change the direction of travel, the axles are a trunnion type equipped with king pins at the final drive ends, and the left and right knuckle arms are connected with tie rods.

1. Brake caliper assembly
2. King pin
3. Knuckle arm
4. Tie rod
5. Parking brake (front only)
6. Differential
7. Final drive

DIFFERENTIAL



SKL00248

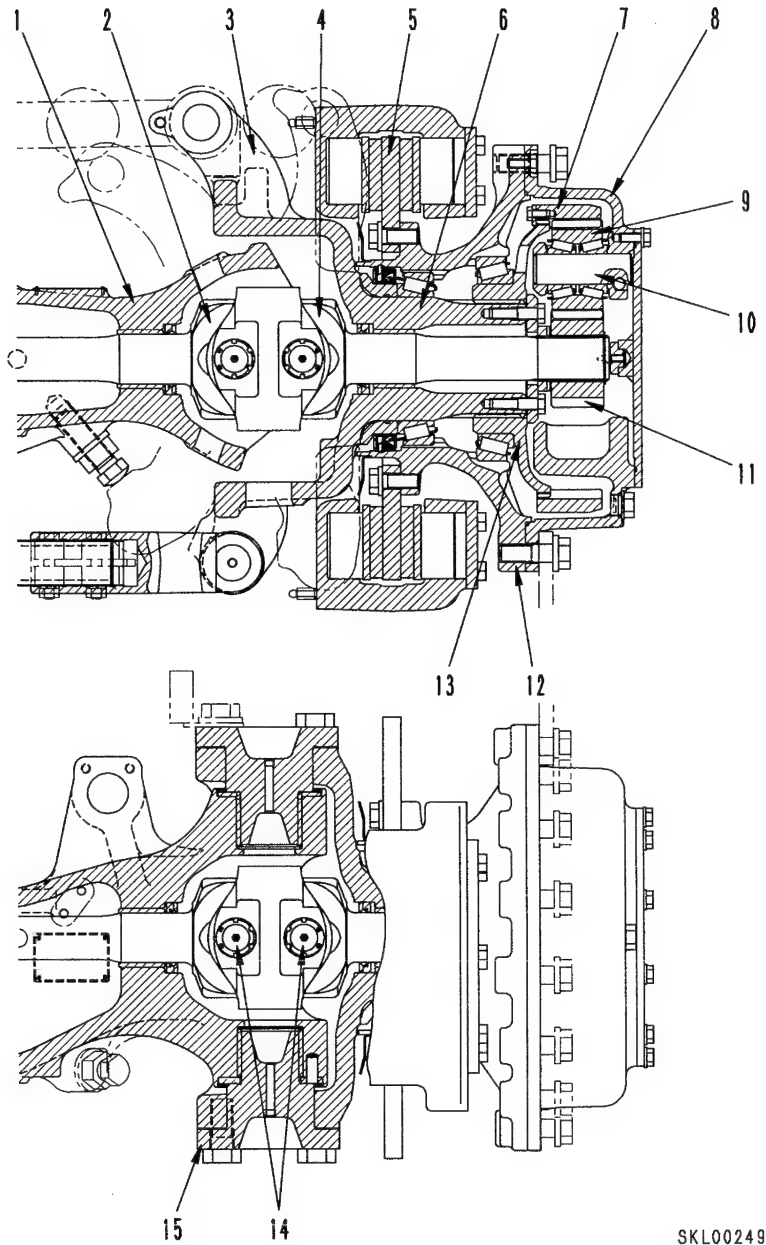
1. Input coupling
2. Bearing cage
3. Differential carrier
4. Adjustment ring
5. Support cap
6. Differential side gear
7. Differential pinion
8. Differential case
9. Cross shaft
10. Differential case
11. Bevel pinion
12. Bevel gear
13. Adjustment screw

Outline

- The differential is installed at the center of the axle housing and fulfills the following roles.
 - 1) It uses bevel pinion (11) and bevel gear (12) to reduce the speed of the power transmitted from the transmission output shaft through the drive shafts, converts it to power sent at right angles to the left and right.
 - 2) When the machine changes its direction of travel (for example, when it turns to the left), the machine cannot turn smoothly unless the wheel on the outside (right side) turn faster than the wheel on the inside (left side). The differential acts to automatically change the speed of rotation on the left and right to match the difference in the resistance from the road surface received by the tires. This makes it possible to turn smoothly.

023S05

FINAL DRIVE



- | | |
|-----------------------|--------------------------|
| 1. Axle housing | 9. Planetary pinion |
| 2. Double joint shaft | 10. Pinion shaft |
| 3. Knuckle arm | 11. Sun gear |
| 4. Double joint shaft | 12. Wheel hub |
| 5. Brake disc | 13. Hub |
| 6. Spindle | 14. Cross shaft assembly |
| 7. Ring gear | 15. King pin |
| 8. Carrier | |

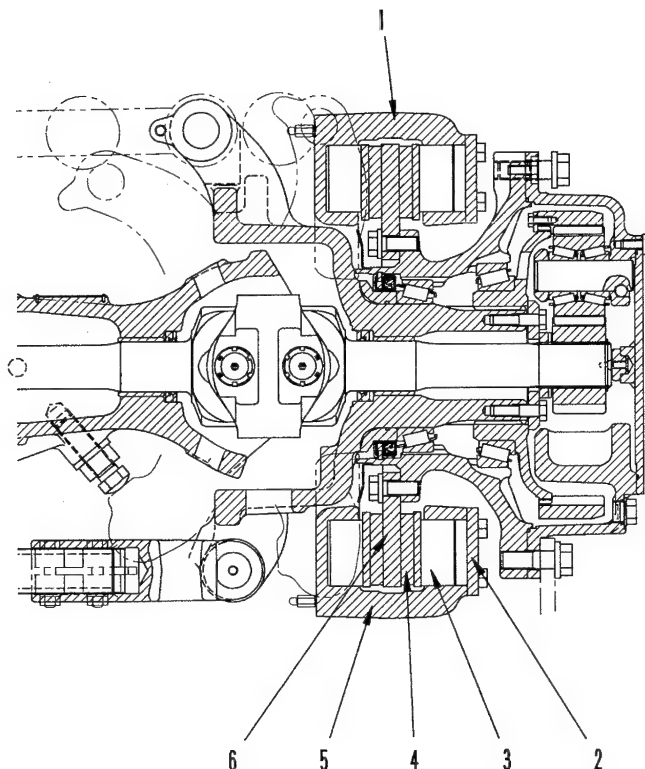
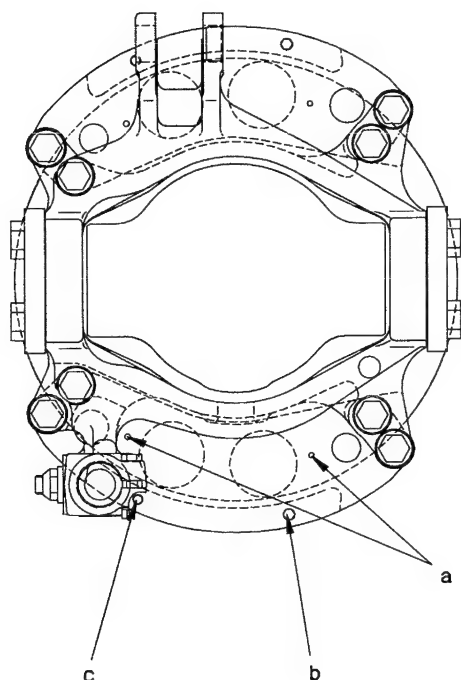
Outline

- The final drive is a planetary gear type, and is built into planetary carrier (8). Compared with a series type final drive using a gear train, the planetary type final drive has small mechanical dimensions, but provides a big reduction ratio despite its size. Another feature is that it provides good power transmission efficiency.

SKL00249

023S05

BRAKE



SKL00250

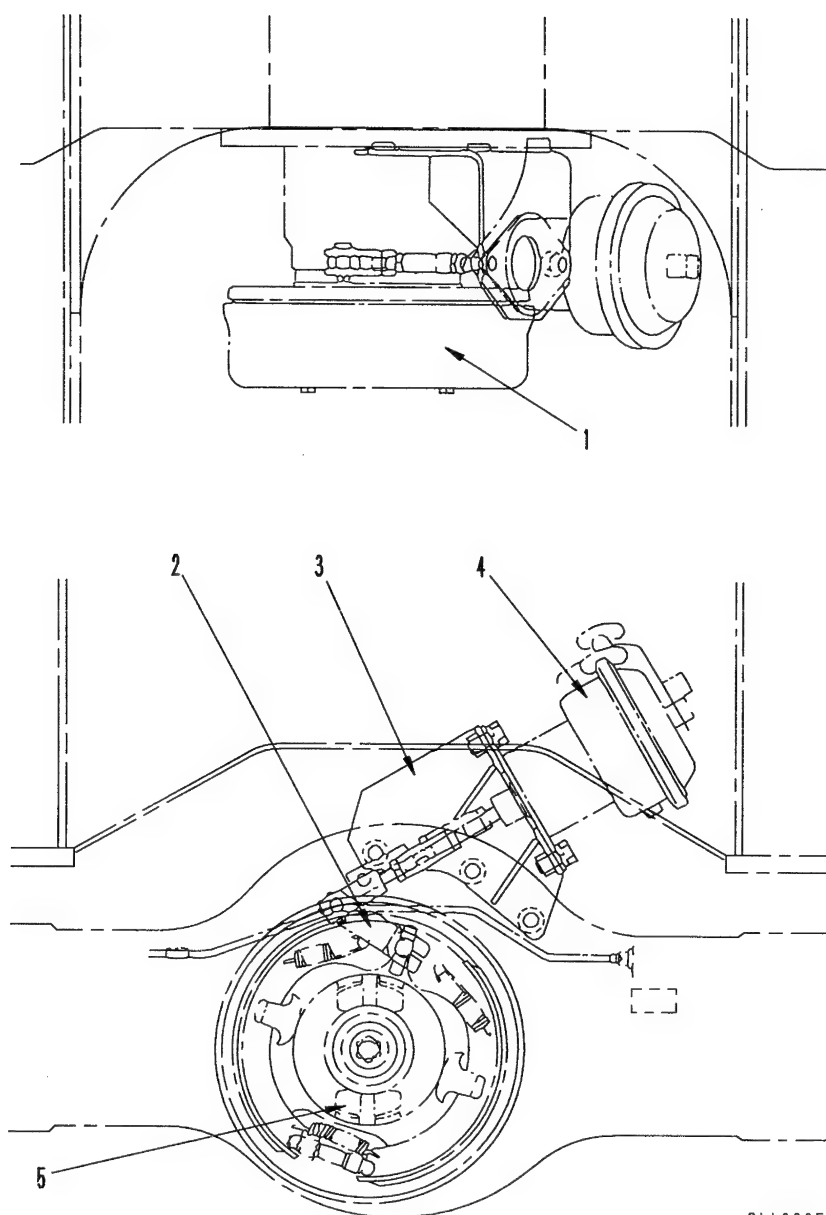
- | | |
|---------------------|------------------------|
| 1. Caliper assembly | a. Pad inspection hole |
| 2. Cover | b. Bleeder |
| 3. Piston | c. Oil supply port |
| 4. Pad | |
| 5. Cylinder | |
| 6. Disc | |

Outline

- The wheel brake is an air-over-hydraulic, dry, disc type, which applies braking force to all wheels. It has two independent circuits for the front and rear.
- Brake disc (6) is tightened with bolts to the wheel hub, and caliper assembly (1) is tightened with bolts to the knuckle arm. The rear wheel caliper assembly consists of one set each on the left and right; the front wheel caliper assembly consists of two sets each on the left and right.
- To actuate the brake, the brake pedal is depressed to send compressed air from the dry tank to the air-over-hydraulic booster. This raises the pressure of the brake oil inside the booster to actuate the brake piston (3) and push brake pad (4) against disc (6).

023S05

PARKING BRAKE

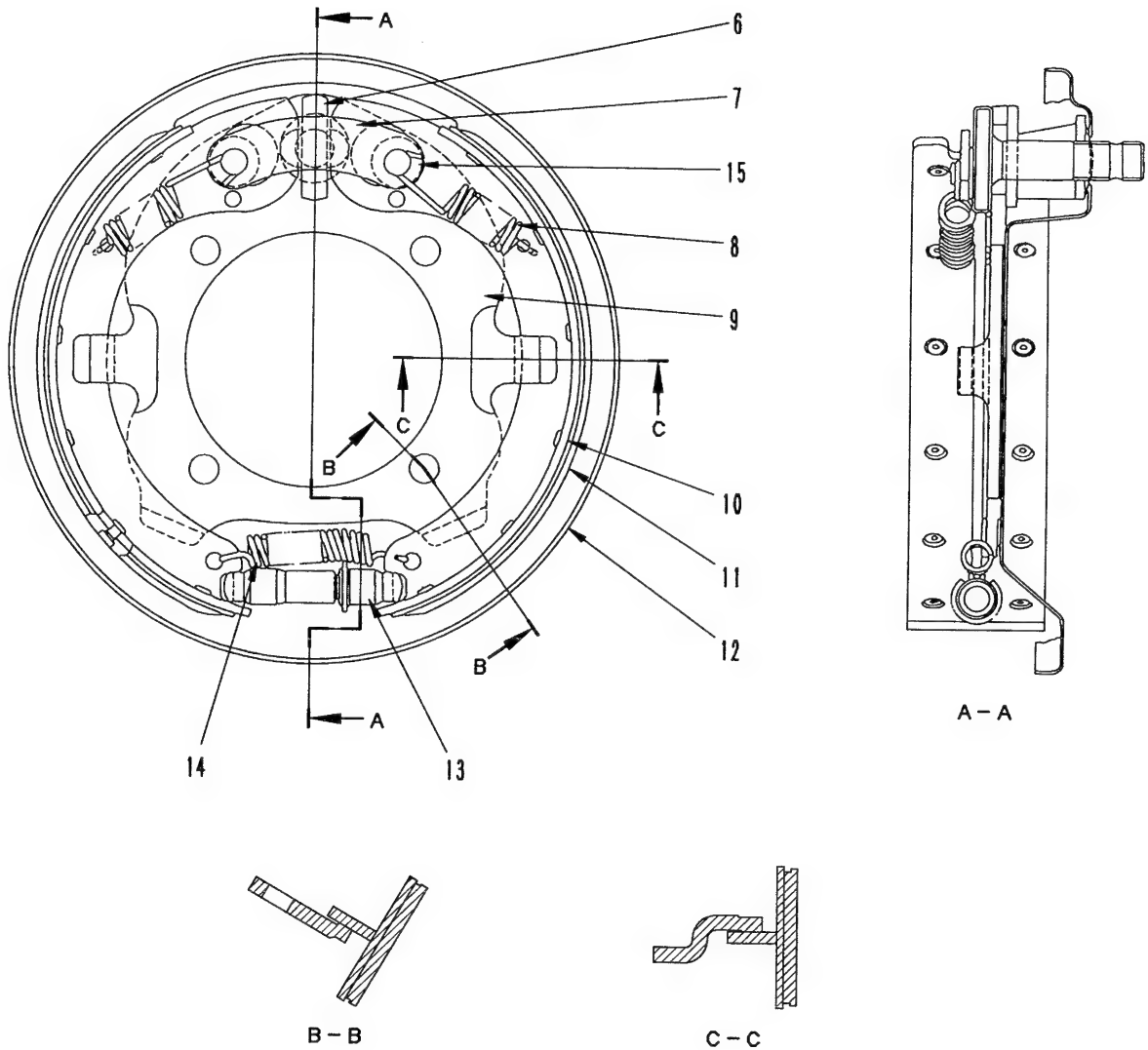


SLL00251

- | | |
|--------------------------------------|----------------------|
| 1. Brake drum | 9. Support plate |
| 2. Lever | 10. Brake shoe |
| 3. Bracket | 11. Brake lining |
| 4. Brake chamber | 12. Dust cover |
| 5. Front differential input coupling | 13. Adjustment screw |
| 6. Camshaft | 14. Spring |
| 7. Brace | 15. Anchor pin |
| 8. Brake shoe return spring | |

023S05

023S05



SLL00252

Outline

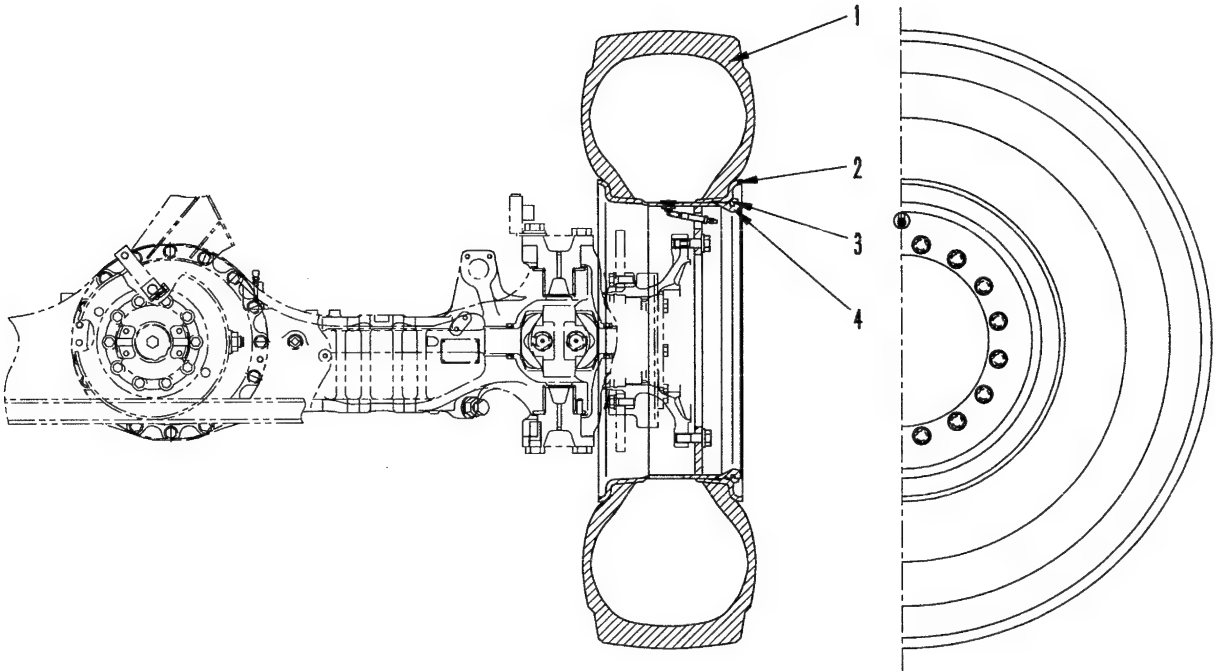
- The parking brake is an internal expanding type using camshaft (6), and applies braking force between the transfer output shaft and the front axle.
- Brake drum (1) is tightened with bolts to the input coupling of the front axle differential. Support plate (9) is tightened with bolts to the front axle differential case, and supports the brake shoe and adjustment screw (13).
- The brake is applied by setting the parking brake switch in the operator's compartment to the PARKING BRAKE or AUXILIARY BRAKE position. This de-energizes the parking brake

valve, so the air from the dry tank does not flow to brake chamber (4).

When this happens, lever (2) is operated by the tension of the spring inside the chamber, and brake shoe (10) is pushed against brake drum (1) by camshaft (6), which is connected to the lever.

When the parking brake switch is set to the OFF position, the parking brake valve is excited, and air from the dry tank flows to brake chamber (4). This compresses the spring inside the brake chamber and separates brake shoe (10) from brake drum (1).

TIRES



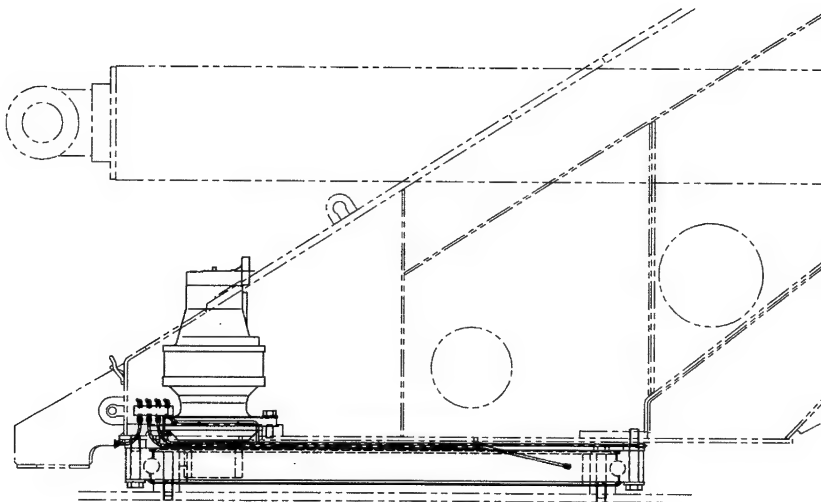
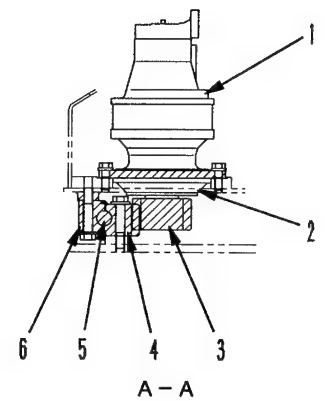
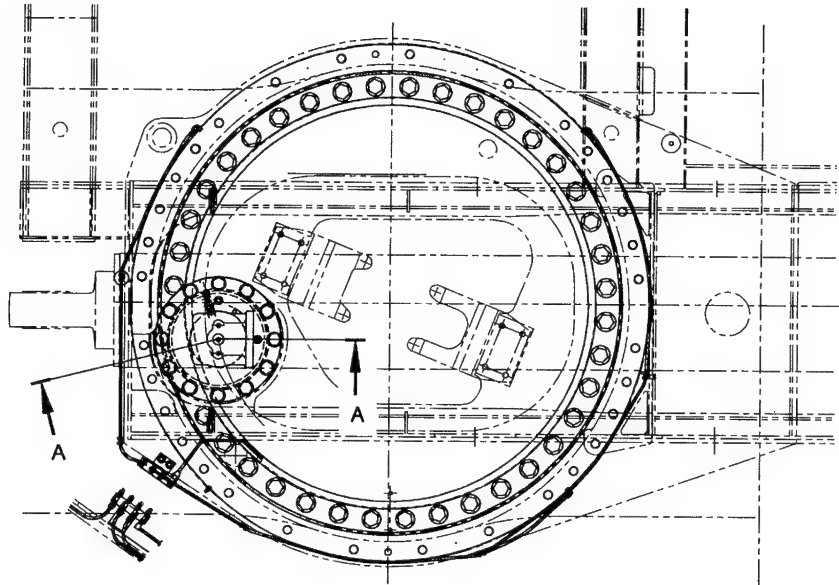
SKL00253

- 1. Tire
- 2. Side ring
- 3. Lock ring
- 4. Rim

Tire size	385/95 R25
Inflation pressure	0.9 MPa{9.0kg/cm ² }

023S05

SWING CIRCLE



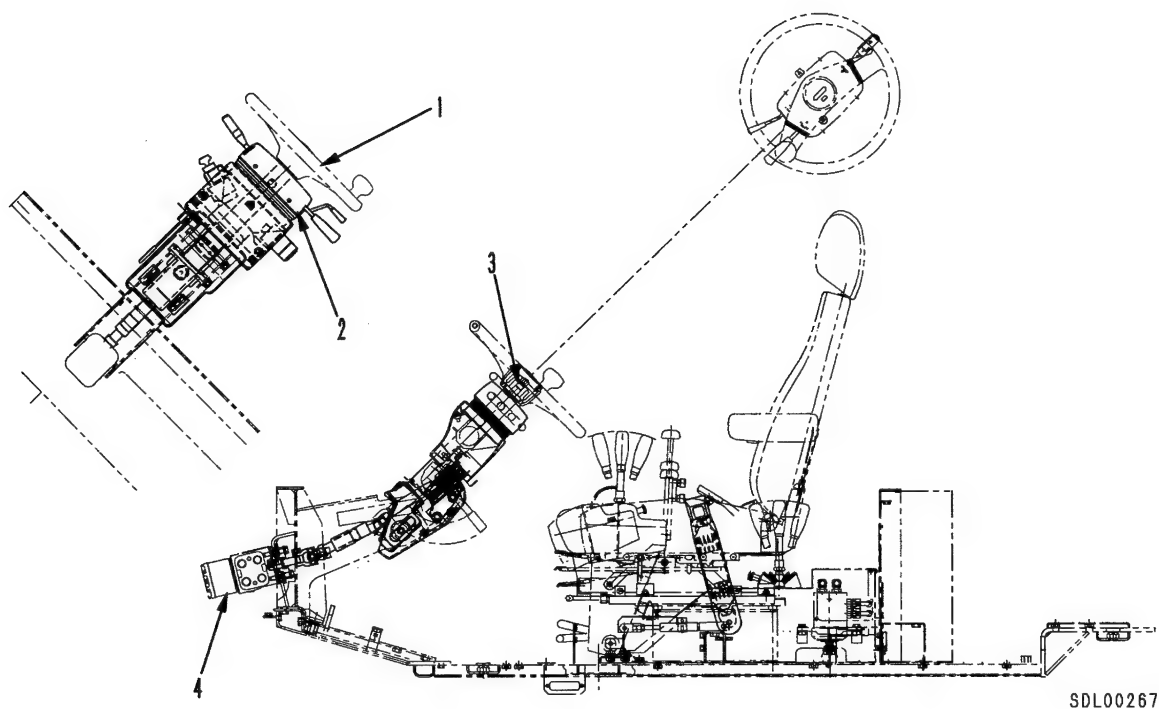
SDL00266

1. Swing motor
2. Swing machinery
3. Swing pinion
4. Inner race
5. Ball bearing
6. Outer race

Outline

- The swing circle consists of outer race (6) which forms one unit with the upper structure, inner race (4) which forms one unit with the undercarriage, and ball bearing (5). Inner race (4) has teeth on the inside, and these are always meshed with swing pinion (3).

STEERING WHEEL



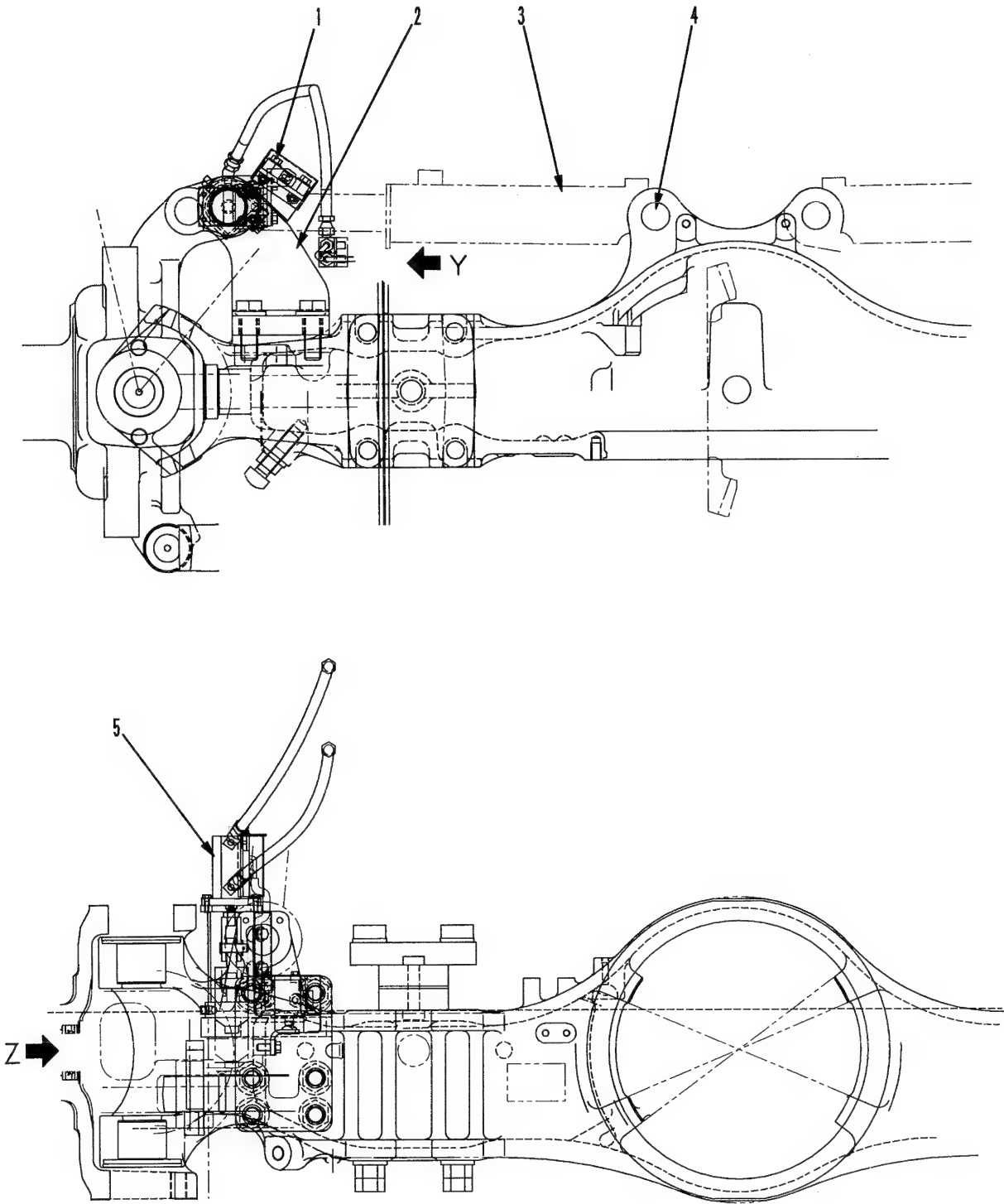
1. Steering wheel
2. Combination switch assembly
3. Steering shaft
4. Steering valve

Outline

- The steering wheel system consists of steering wheel (1), steering shaft (3) which is connected to steering valve (4), and combination switch assembly (2). It is possible to change the direction of travel of the machine by operating steering wheel (1).

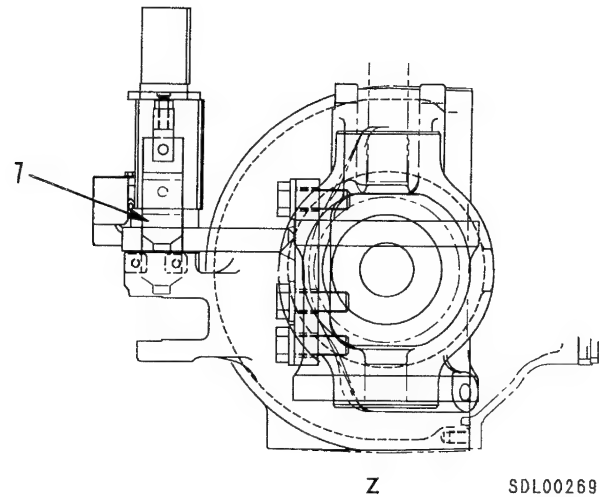
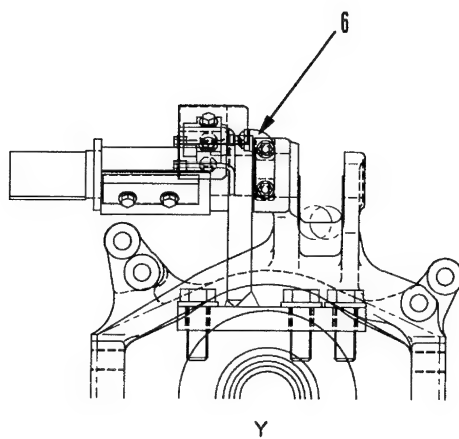
023S05

REAR STEERING LOCK SYSTEM



023S05

SDL00268



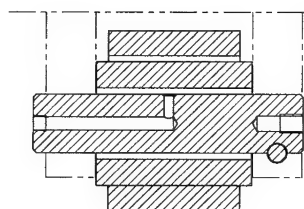
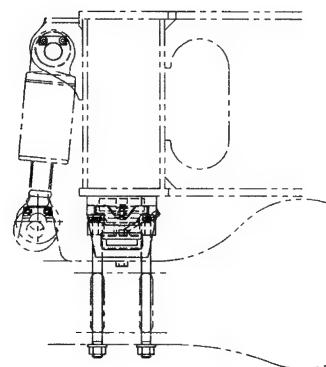
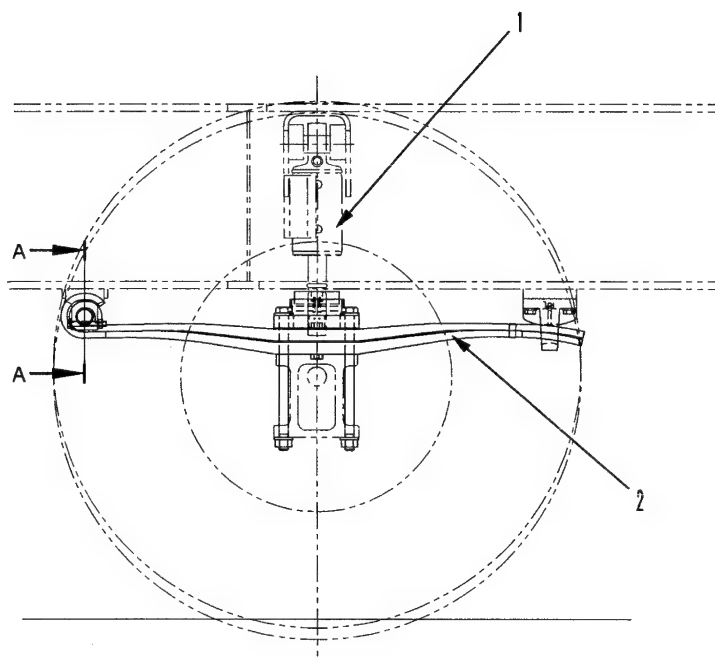
SDL00269

1. Center position detection switch
2. Axle housing bracket
3. Steering cylinder
4. Steering cylinder mounting pin
5. Steering lock cylinder
6. Detection switch operation plate
7. Lock pin

Outline

- The steering lock system consists of bracket (2) which is mounted to the axle housing, steering lock cylinder (5) which is mounted to bracket (2), and lock pin (7).
 - Cylinder (5) forms one unit with lock pin (7), and it extends when the steering lock is applied. It forms one unit with bracket (2), which is fixed to the axle housing, and prevents the steering from being operated.
- When the rear steering switch is operated, the air valve is switched, and high pressure air from the air tank extends or retracts cylinder (5).
- For details of the operation, see AIR SYSTEM.

SUSPENSION SYSTEM



A - A

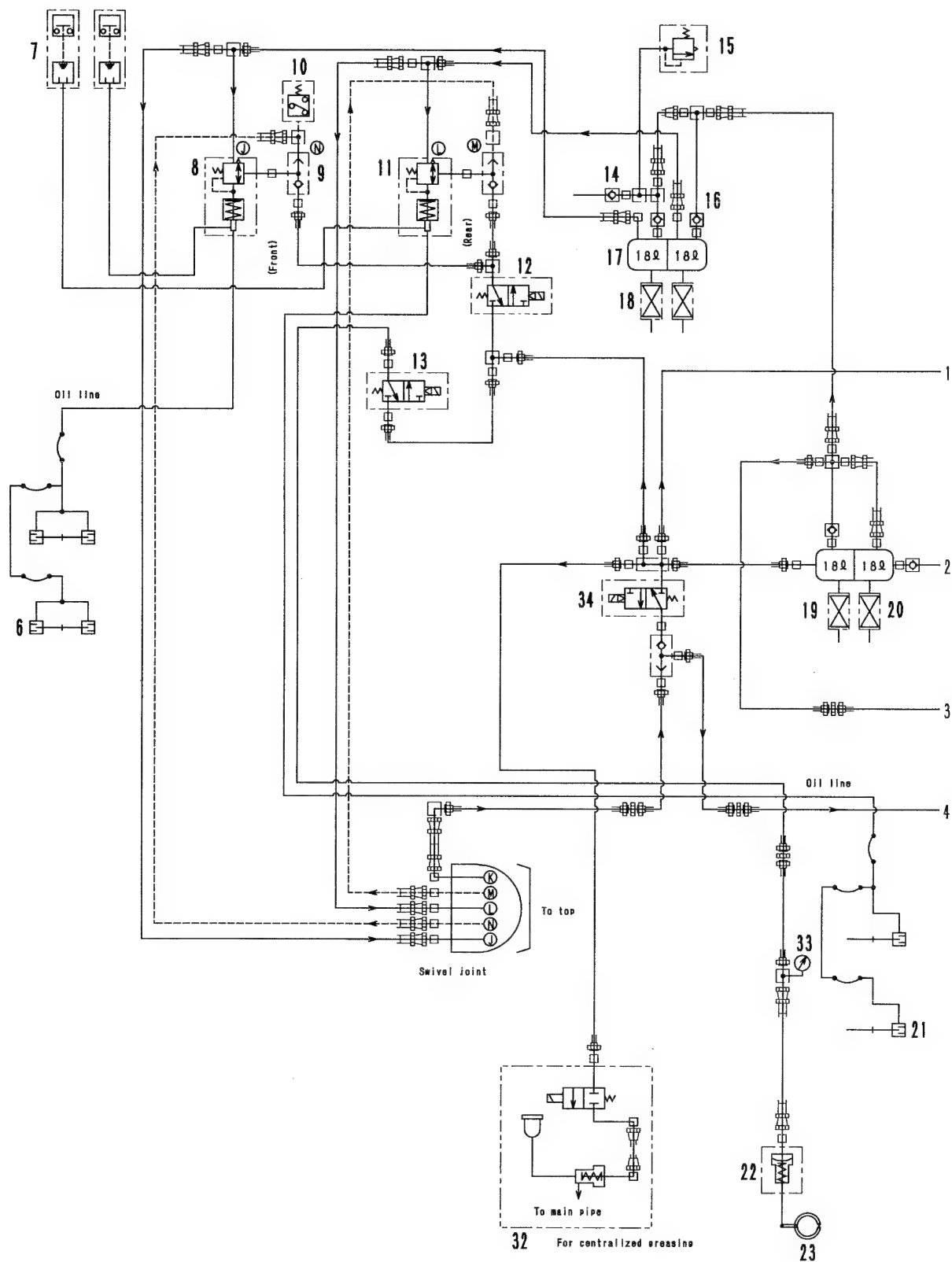
SDL00270

Outline

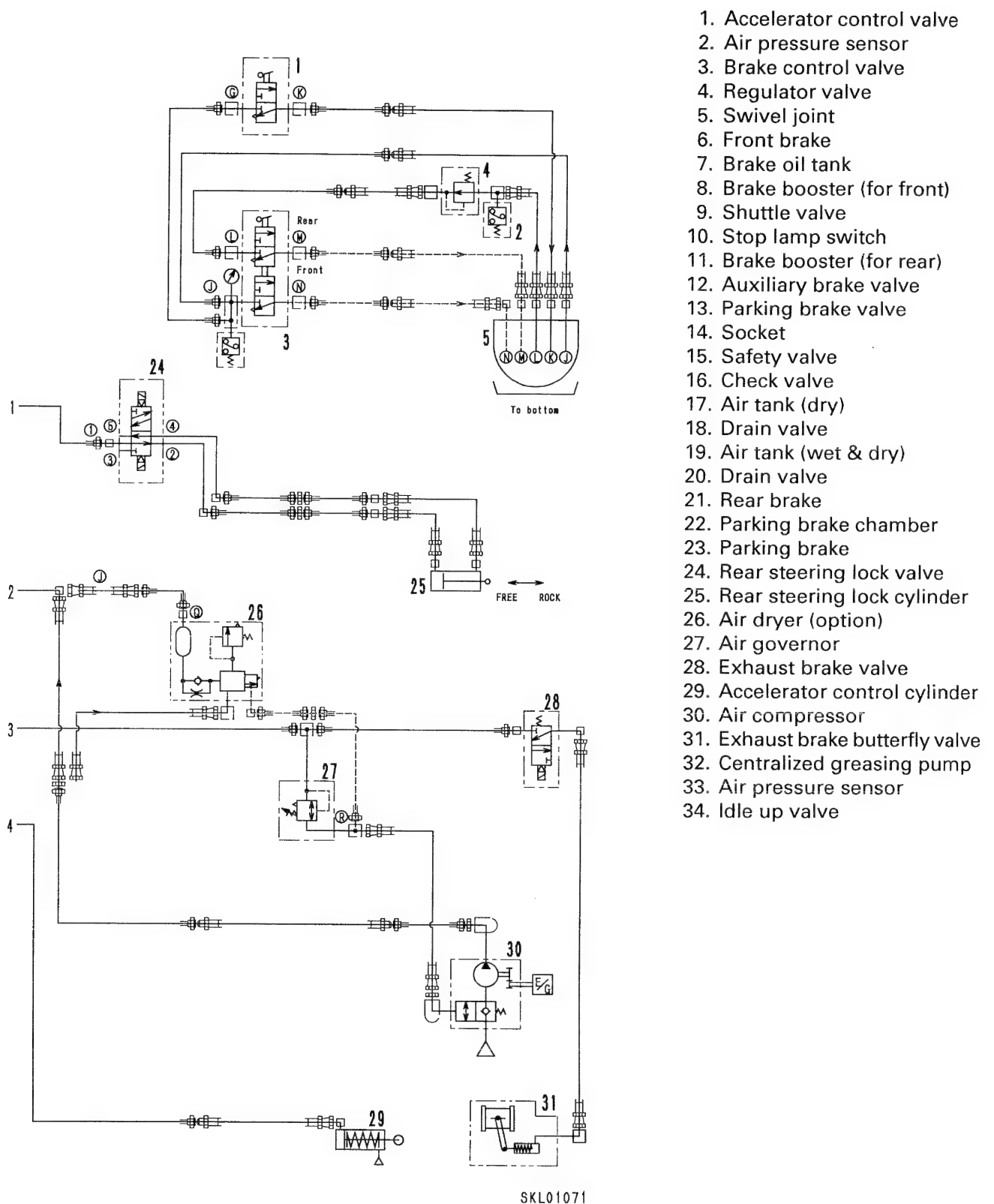
- The suspension system consists of suspension lock cylinder (1) and leaf spring (2). The system has three functions: the suspension function which functions during normal travel operations, the suspension lock function which acts to ensure the stability of the machine during on-tire operations (when the outriggers are not extended), and a third function which prevents the machine from nosediving when the brakes are applied.

1. Suspension lock cylinder
2. Leaf spring

AIR CIRCUIT DIAGRAM



023S05

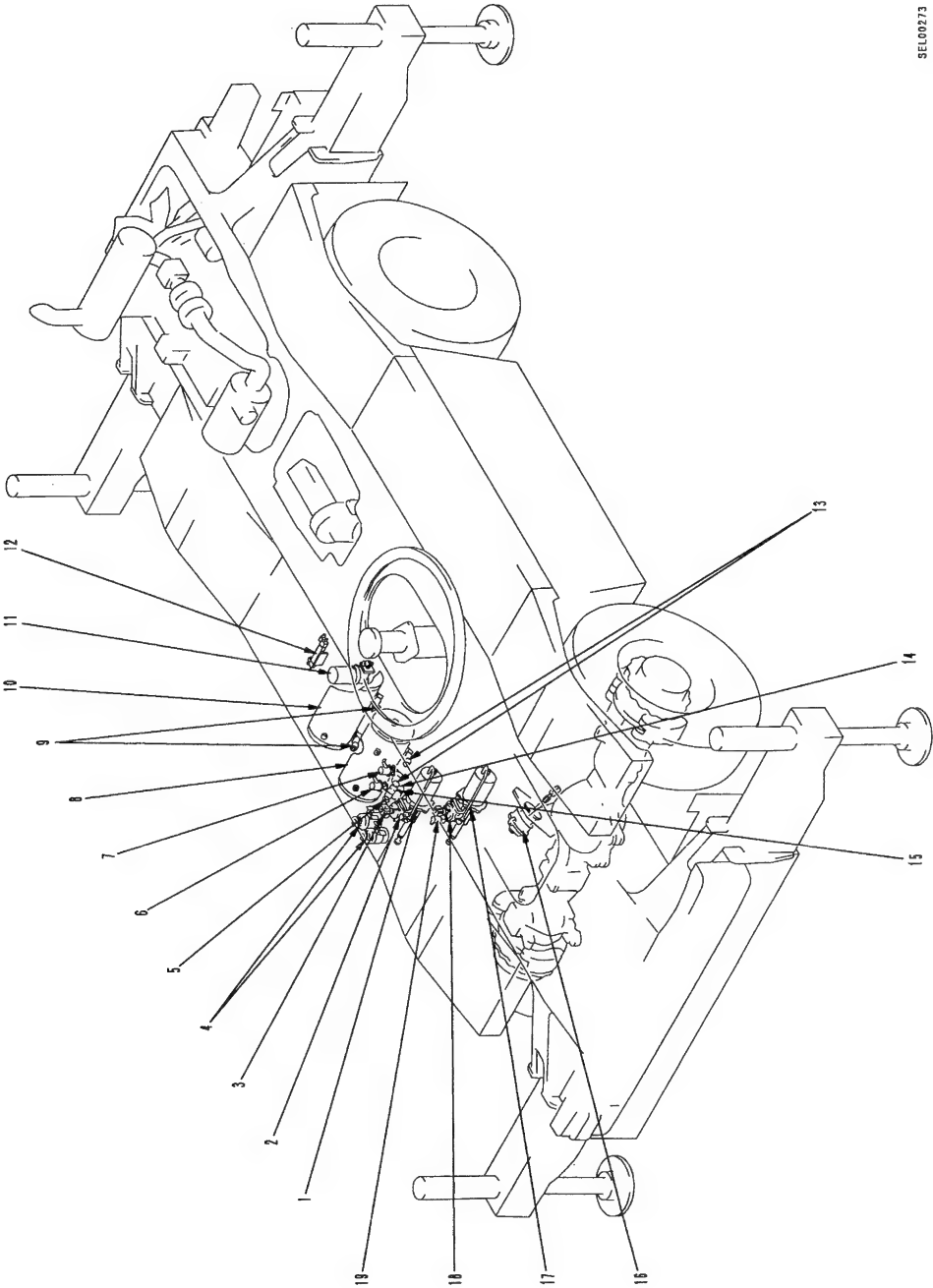


AIR EQUIPMENT PIPING DRAWING (1/2)

UNDERCARRIAGE

★ For details of this page, see page 90-3.

- 1. Brake booster (for rear brake)
- 2. Relay valve (for rear brake)
- 3. Shuttle valve (for rear brake)
- 4. Brake oil reservoir
- 5. Safety valve
- 6. Auxiliary brake valve
- 7. Parking brake valve
- 8. Dry tank
- 9. Check valve
- 10. Wet tank, dry tank for auxiliary equipment
- 11. Centralized greasing pump
- 12. Rear steering lock valve
- 13. Check valve
- 14. Cap
- 15. Socket
- 16. Parking brake chamber
- 17. Brake booster (for front brake)
- 18. Relay valve (for front brake)
- 19. Shuttle valve (for front brake)



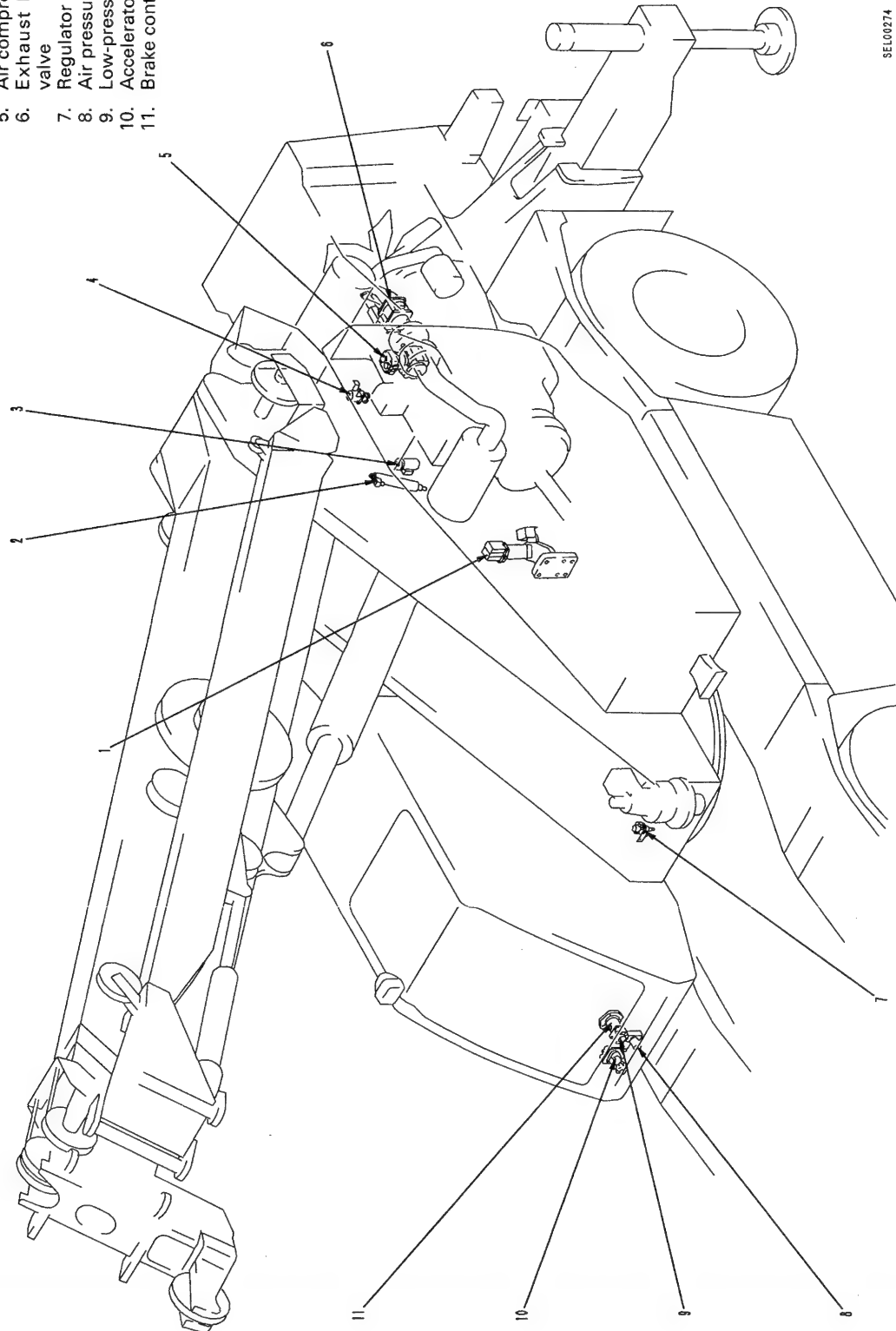
023S05

AIR EQUIPMENT PIPING DRAWING (2/2)

UPPER STRUCTURE

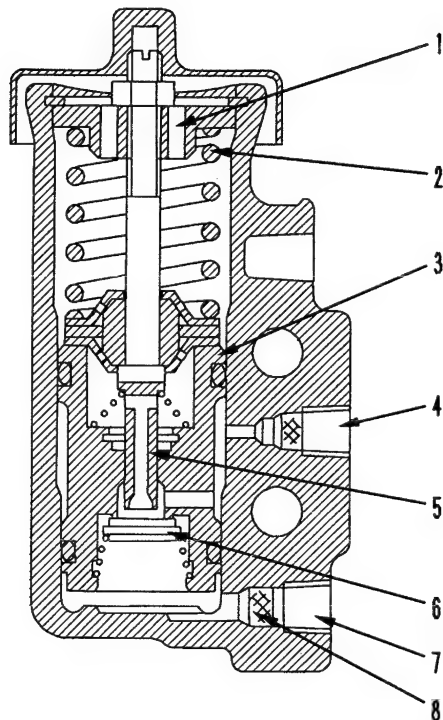
★ For details of this page, see page 90-5.

1. Rear steering lock cylinder
2. Accelerator control cylinder
3. Air governor
4. Exhaust brake valve
5. Air compressor
6. Exhaust brake butterfly valve
7. Regulator
8. Air pressure sensor
9. Low-pressure sensor
10. Accelerator control valve
11. Brake control valve



SEL00274

AIR GOVERNOR



SEL00276

1. Exhaust port
2. Spring
3. Piston
4. Unloader port
5. Exhaust stem
6. Inlet valve
7. Tank port
8. Filter

Specifications

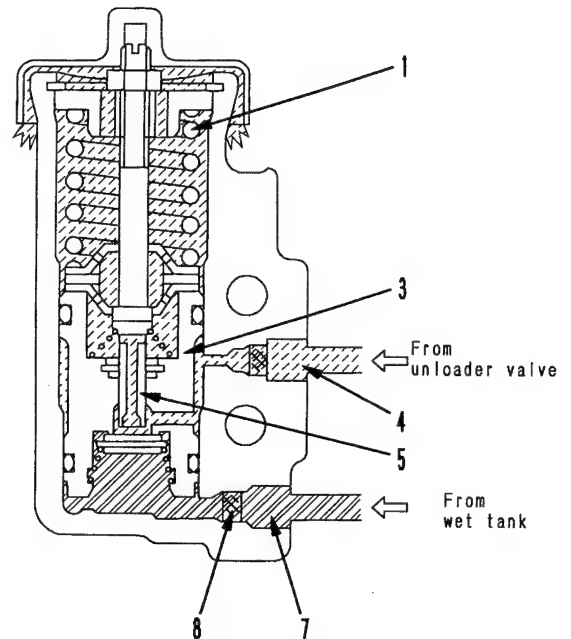
- Cut-out pressure: $0.86^{+0.01}_{-0.05}$ MPa{ $8.8^{+0.1}_{-0.5}$ kg/cm²}
- Cut-in pressure: $0.75^{+0.01}_{-0.05}$ MPa{ $7.6^{+0.1}_{-0.5}$ kg/cm²}

Outline

- The air governor is in the circuit between the wet tank and the compressor unloader valve. It acts to adjust the pressure inside the wet tank automatically to keep it within a range of 0.75 - 0.86 MPa {7.6 - 8.8 kg/cm²}.
- The compressor is connected directly to the engine timing gear, and it sends compressed air to the tank continuously while the engine is running.
However, if the pressure inside the tank exceeds the set pressure (cut-out pressure) of 0.86 MPa {8.8 kg/cm²}, the governor is set to decompression, and stops the action of the compressor to prevent the pressure from becoming any higher.
If the pressure inside the tank goes below the set pressure (cut-in pressure) of 0.75 MPa {7.6 kg/cm²}, the compressor is actuated again to send compressed air to the tank.

OPERATION**1. When compressor is compressing**

- The pressurized air in the wet tank passes from tank port (7) through filter (8) and acts on the bottom of piston (3).
- If the air pressure inside the wet tank is below the set pressure (cut-out pressure), piston (3) is pushed down by spring (1).
- When this happens, the air at unloader port (4) passes through exhaust stem (5) and is released to the atmosphere, so the compressor is actuated.



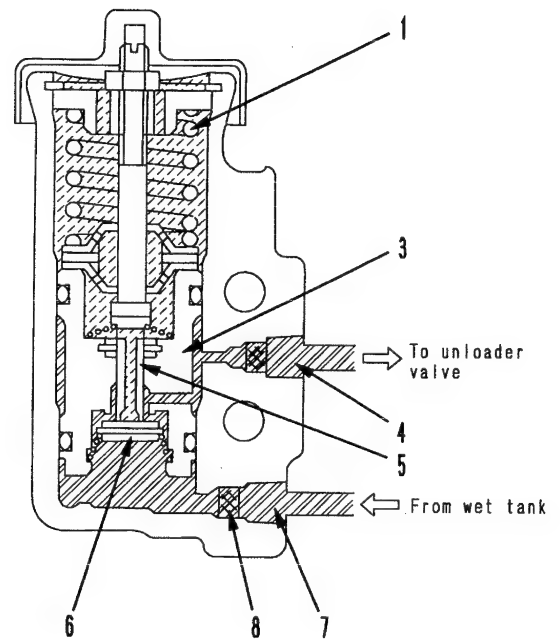
SLL01072

2. When compressor stops compressing

- When the pressure inside the wet tank rises and reaches the set pressure (cut-out pressure), piston (3) overcomes the force of spring (1) and is pushed up.
- When piston (3) is pushed up, exhaust stem (5) is closed and inlet valve (6) opens.
- The pressure air from the tank passes through inlet valve (6) and unloader port (4), acts on the unloader valve of the compressor, and sets the compressor to "no load".

When the air pressure inside the tank goes down, piston (3) is pushed down by spring (1).

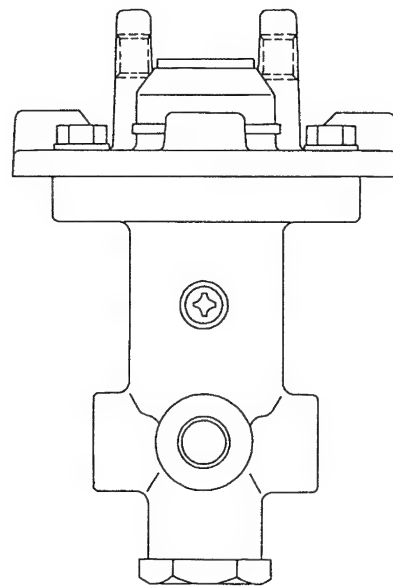
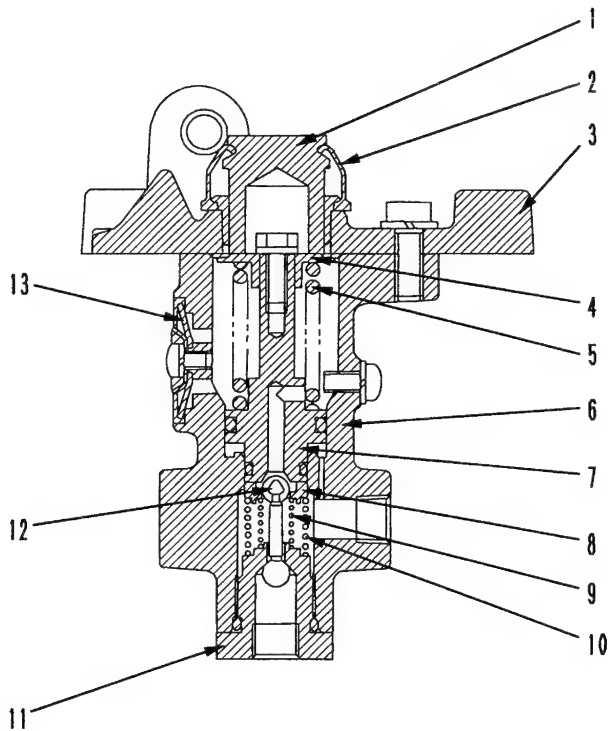
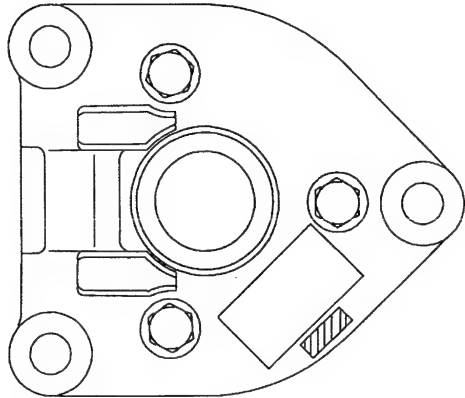
- When the pressure goes below the set pressure (cut-in pressure), inlet valve (6) is closed and exhaust stem (5) opens, so the pressure at unloader port (4) passes through exhaust stem (5) and is released to the atmosphere, so the compressor is actuated again.



SLL01073

023S05

ACCELERATOR CONTROL VALVE



SEL00279

- | | |
|----------------|-----------------------|
| 1. Plunger | 8. Spring seat |
| 2. Seal | 9. Spring |
| 3. Bracket | 10. Spring |
| 4. Spring seat | 11. Plug |
| 5. Spring | 12. Valve |
| 6. Valve body | 13. Exhaust diaphragm |
| 7. Seat | |

Outline

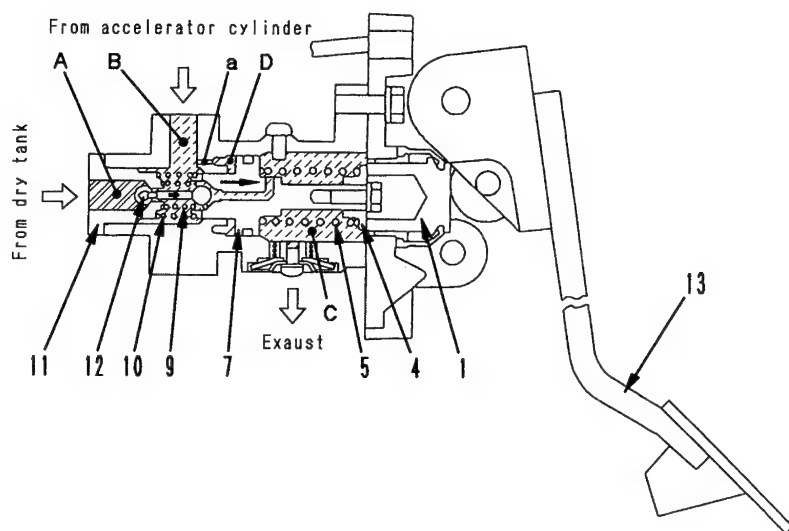
- The accelerator control valve is in the circuit between the dry tank and the accelerator control cylinder. When the accelerator pedal in the operator's compartment is depressed, air is sent from the dry tank to the cylinder to actuate the engine throttle lever.

023S05

Operation**1. When accelerator pedal is not being depressed**

The air accumulated in the dry tank always enters port **A**.

When accelerator pedal (13) is not being depressed, valve (12) is pushed against plug (11) by the tension of spring (9), and closes the circuit between ports **A** and **B**. Seat (7) is in a position where the tension of spring (10) is balanced with the tension of spring (5), which is pushing plunger (1) up to the right. It separates the sealing of the ball portion of valve (12), so the air from the cylinder is returned to port **C** from port **D**, and is released to the atmosphere.



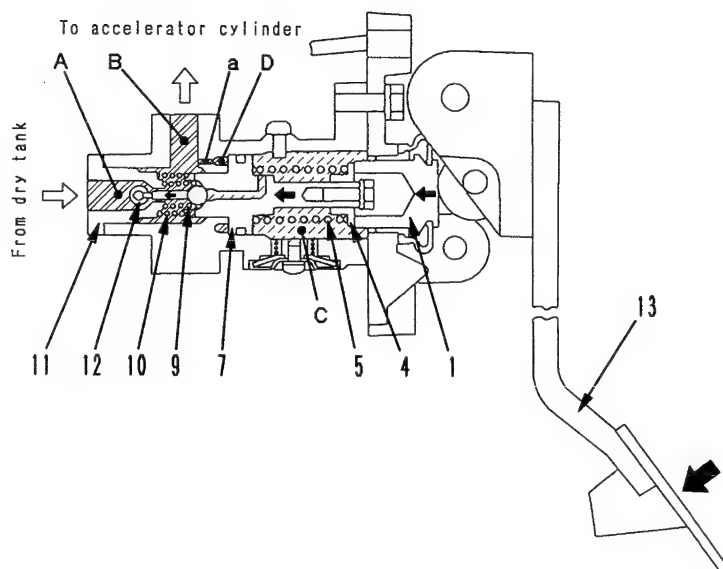
SLL01074

2. When accelerator pedal is depressed

When accelerator pedal (13) is depressed, plunger (1) compresses spring (5) and moves it to the left. Spring (5) pushes seat (7) to the left and compresses spring (10), so seat (7) and the ball portion of valve (12) are sealed and close the circuit between ports **B** and **C**.

If the pedal is depressed further, valve (12) compresses spring (9), moves it to the left, and opens the circuit between ports **A** and **B**.

When this happens, the air in the dry tank enters port **B** from port **A**, and flows from port **B** to the accelerator cylinder.



SLL01075

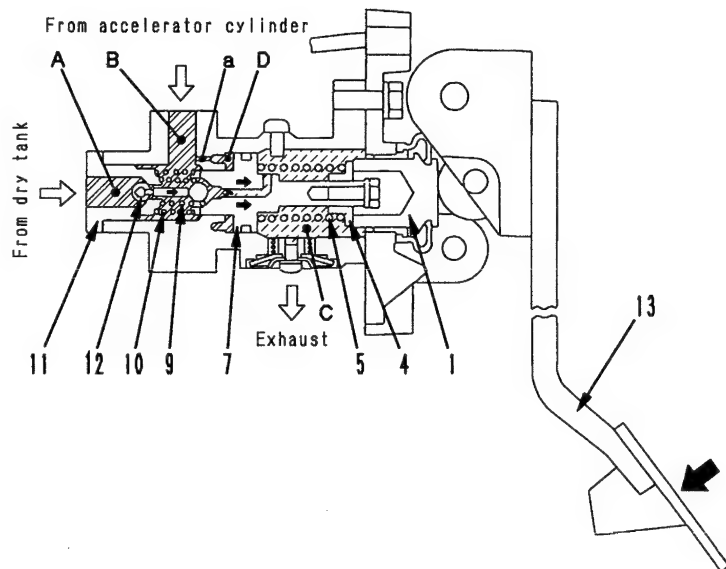
3. When accelerator pedal is depressed and held in position

In the condition in Item 2, if the pressure beyond port **B** becomes higher, the air pressure passing through orifice **a** and entering port **D** also becomes higher. It moves seat (7) to the right to a position where the pressure balances with the tension of spring (5).

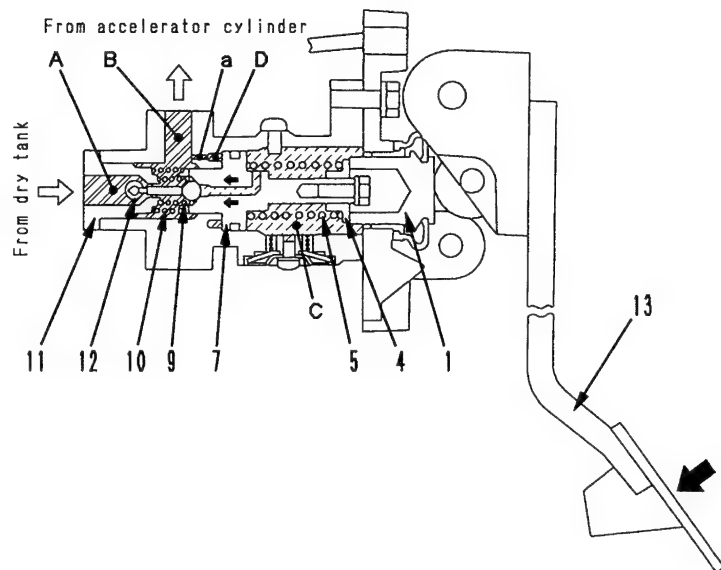
When this happens, the sealing between seat (7) and the ball portion of valve (12) separates, the circuit between ports **B** and **C** opens, and the air pressure beyond port **B** is relieved to prevent it from becoming any higher. This is done in order to maintain the accelerator cylinder actuating pressure constant to match the amount the pedal is depressed.

In other words, in order to maintain the engine speed constant, when the pedal is depressed and kept at a fixed position, if the air pressure beyond port **B** becomes too high, the air pressure in port **D** compresses spring (5), pushes seat (7) to the right, opens the circuit between ports **B** and **C**, and releases the air pressure from port **B** to the atmosphere to reduce the pressure.

On the other hand, if the air pressure beyond port **B** becomes too low, spring (5) pushes seat (7) to the left, closes the circuit between ports **B** and **C**, opens the circuit between ports **A** and **B**, and fills with pressure air from the dry tank. By repeating this process, even when the brake pedal is depressed and kept at a fixed position, any change in the pressure caused by small amounts of air leakage from the brake valve or changes in the temperature are automatically compensated for, and the engine can be kept at a constant speed.



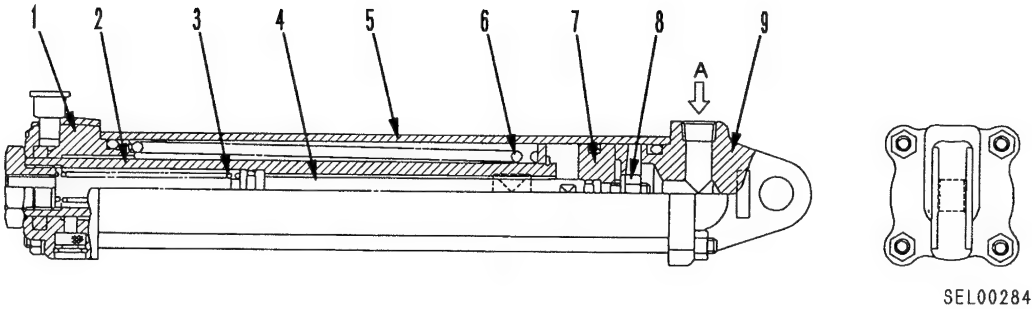
SLL01076



SLL01077

023S05

ACCELERATOR CONTROL CYLINDER



- 1. Cylinder head
- 2. Push rod
- 3. Return spring
- 4. Piston rod
- 5. Cylinder
- 6. Return spring
- 7. Piston
- 8. Piston nut
- 9. Cylinder bottom
- A. From accelerator control valve

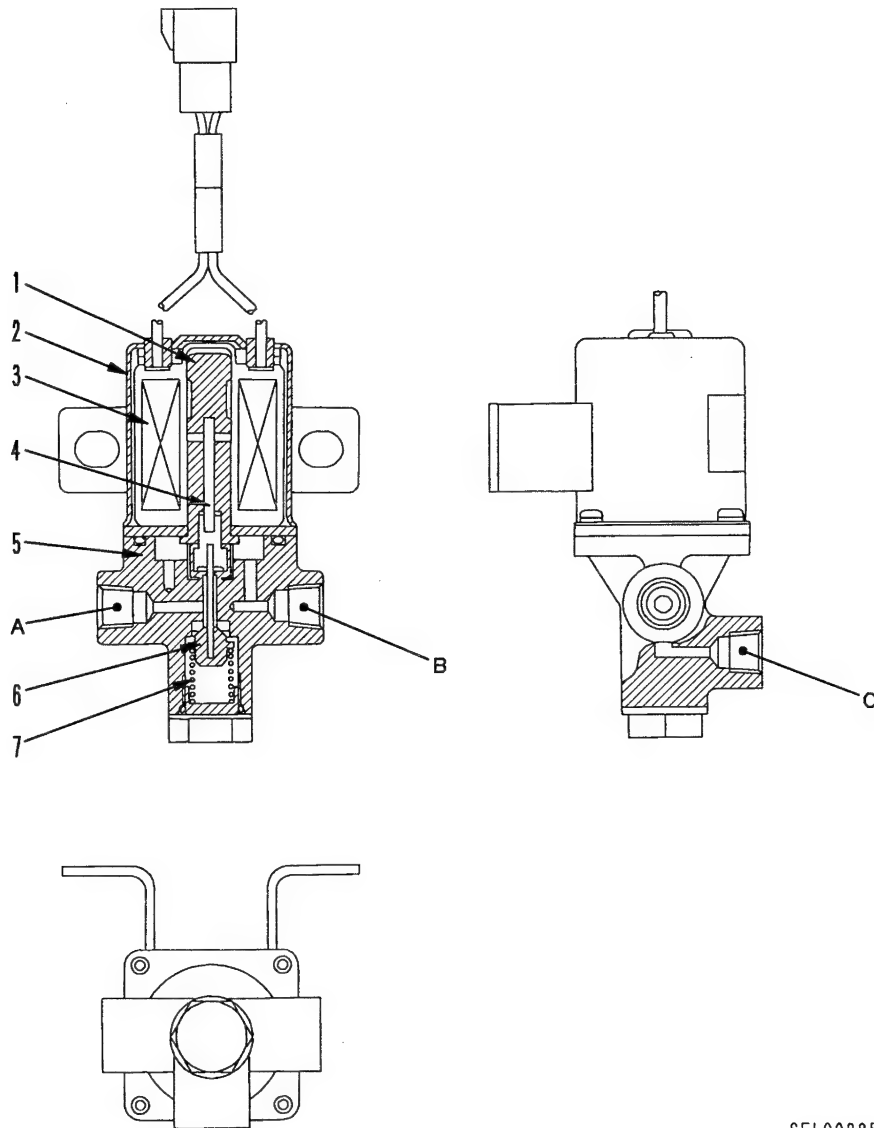
Outline

- The accelerator cylinder is a single-acting piston type (with return spring). It is connected with the throttle lever of the engine fuel injection pump. The dimensions and stroke are as shown in the table below.
Air enters only the bottom end of the cylinder; a return spring is used at the head end.

Unit: mm	
Item	Standard value
Outside diameter of piston rod	18
Inside diameter of cylinder	40
Stroke	45

023S05

EXHAUST BRAKE SELECTOR VALVE



1. Plunger
2. Cover
3. Coil
4. Core
5. Valve body
6. Valve
7. Spring

- A. To butterfly valve
- B. Exhaust
- C. From dry tank

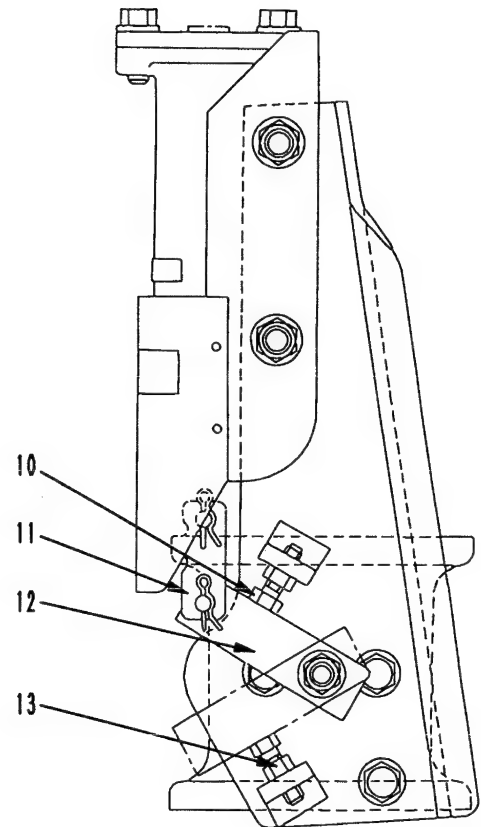
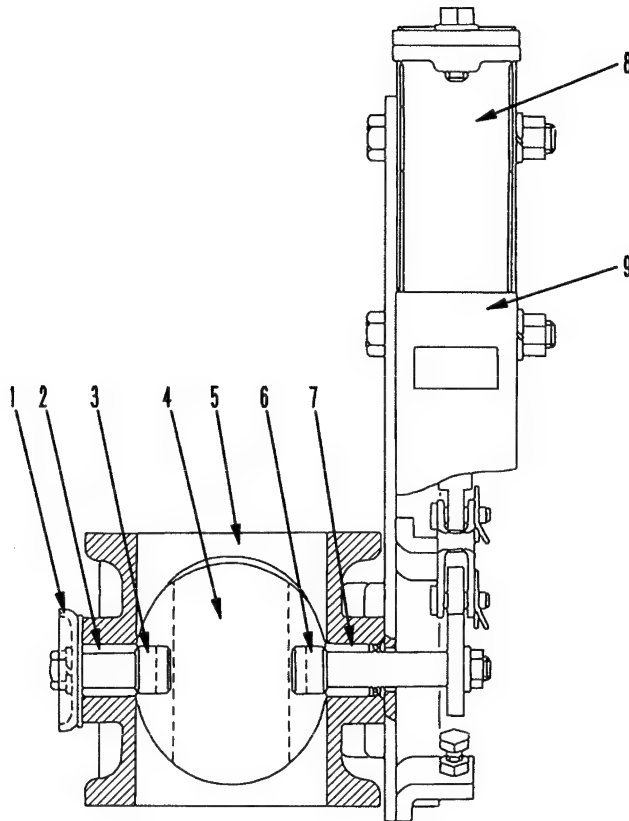
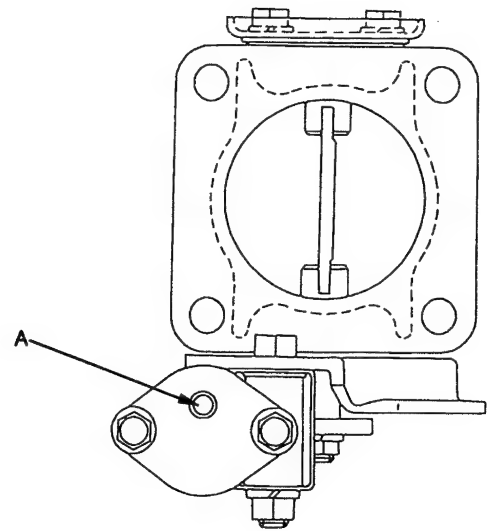
Outline

- The exhaust brake selector valve is in the circuit between the wet tank and the butterfly valve. When the exhaust brake switch in the operator's compartment is operated, air from the wet tank is switched to actuate the butterfly valve and actuates the exhaust brake.

023S05

SEL00285

EXHAUST BRAKE BUTTERFLY VALVE



SEL00286

- | | |
|-----------------|-------------------------|
| 1. Plate | 10. Stopper |
| 2. Bushing | (fully open position) |
| 3. Spindle | 11. Yoke |
| 4. Valve | 12. Lever |
| 5. Valve body | 13. Stopper |
| 6. Spindle | (fully closed position) |
| 7. Bushing | A. From exhaust brake |
| 8. Air cylinder | valve |
| 9. Insulator | |

Outline

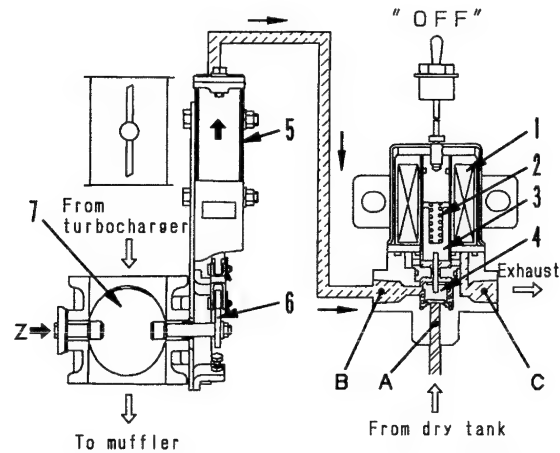
- The butterfly valve is installed between the engine turbocharger and muffler. It is actuated by air pressure from the exhaust brake valve and throttles the exhaust passage from the turbocharger to the muffler to reduce the engine speed. The butterfly valve consists of a valve mechanism and an air cylinder which operates the valve.

OPERATION

1. When exhaust brake switch is OFF

When the switch is set to the **OFF** position, solenoid (1) of the exhaust brake valve is de-energized.

In this condition, the passage between ports **A** and **B** of the exhaust brake valve is closed, and the circuit between ports **B** and **C** is open. Therefore, the air entering cylinder (5) of the butterfly valve returns from port **B** to port **C** and is released to the atmosphere. Butterfly valve (7) sets the passage from the turbocharger to the muffler to the "FULLY OPEN" position.



SLL01078

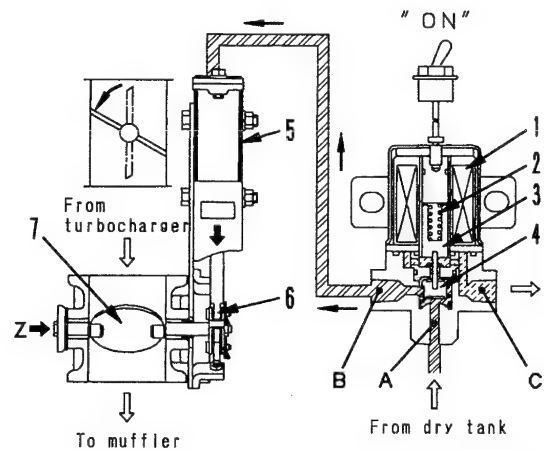
2. When exhaust brake switch is ON

When the switch is set to the **ON** position, solenoid (1) of the exhaust brake valve is excited, and plunger (3) and valve (4) move up. This closes the passage between ports **B** and **C** and opens the passage between ports **A** and **B**, so the air from the wet tank enters port **B** and flows to cylinder (5) of the butterfly valve.

When this happens, the cylinder extends, moves lever (6) down, and butterfly valve (7) sets the passage from the turbocharger to the muffler to the "FULLY CLOSED" position.

As a result, the engine speed drops, and the machine travel speed is limited when the machine is traveling downhill.

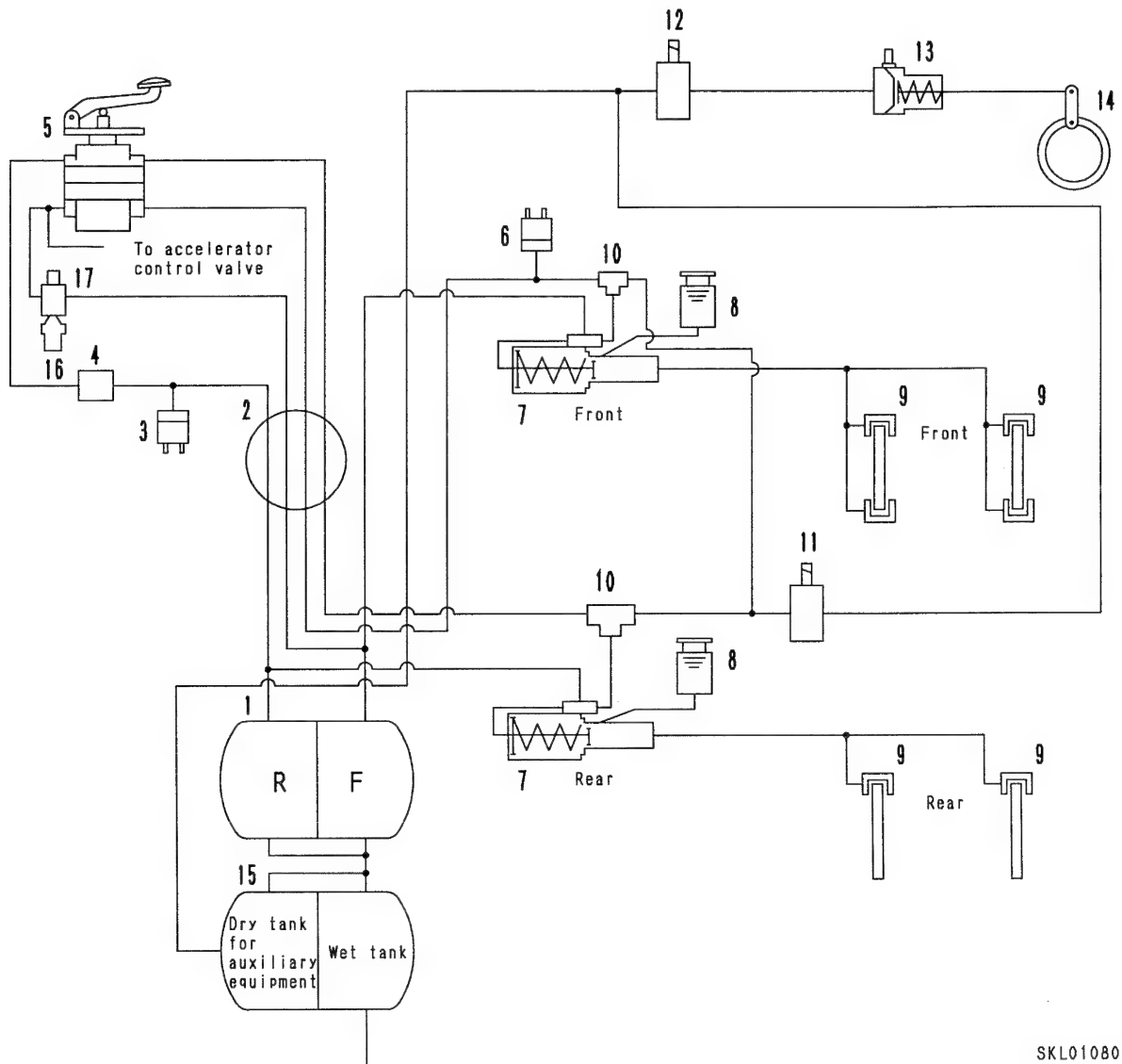
Note that even when the switch is at the **ON** position, if the accelerator pedal is depressed, the exhaust brake limit switch acts to prevent the engine from acting as a brake.



SLL01079

023S05

BRAKE AIR SYSTEM



SKL01080

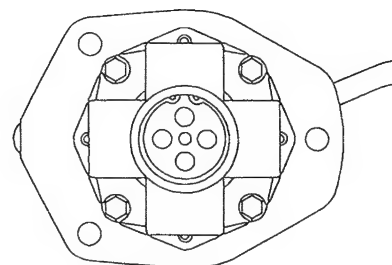
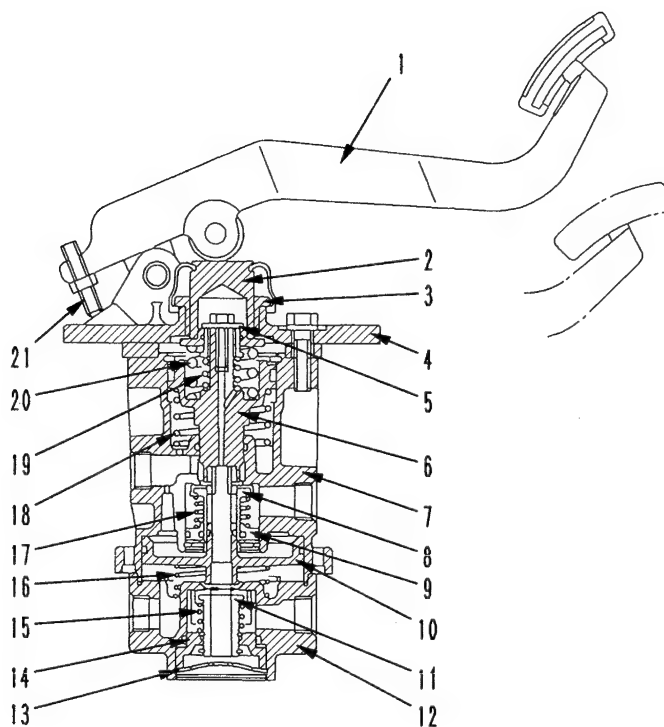
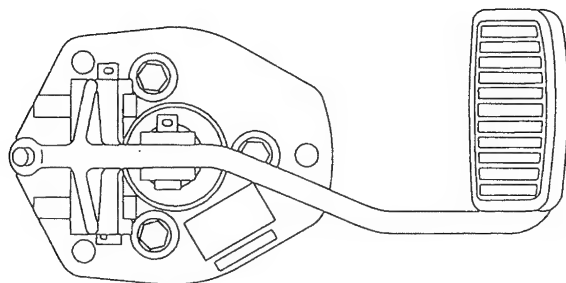
- | | |
|------------------------|--|
| 1. Dry tank | 10. Shuttle valve |
| 2. Swivel joint | 11. Auxiliary brake valve |
| 3. Low-pressure switch | 12. Parking brake valve |
| 4. Regulator | 13. Parking brake chamber |
| 5. Brake control valve | 14. Parking brake |
| 6. Stop lamp switch | 15. Wet tank, dry tank for auxiliary equipment |
| 7. Brake booster | 16. Air pressure sensor |
| 8. Brake oil reservoir | 17. Low-pressure switch |
| 9. Wheel brake | |

023S05

Outline

- The brake air system consists of brake control valve (5) which is actuated by the brake pedal, and brake (9) which is actuated by hydraulic pressure and by brake booster (7) and the valves which are actuated by the air pressure.
- The air compressed in the air compressor passes through wet tank (15) and is stored in dry tank (1). It enters brake control valve (5), which is actuated by the brake pedal. When the brake is depressed, the air in brake control valve (5) enters brake booster (7), sends the oil from brake oil reservoir (8) to wheel brake (9) to apply the brakes. Regulator (4), which is in the rear brake circuit, is installed in order to balance the braking effect of the front and rear brakes.
- The parking brake air system consists of auxiliary brake valve (11), parking brake valve (12) which are actuated by the parking brake switch, and parking brake chamber (13) which is actuated by the air pressure.
- The air compressed in the air compressor is stored in the dry tank and enters the two parking brake valves (11) and (12). When the parking brake switch is set to AUXILIARY BRAKE, parking brake valve (12) is de-energized and cuts off the flow of air to brake chamber (13). The air in brake chamber (13) is released from the valve to apply the parking brake. At the same time, auxiliary brake valve (11) is excited and sends the air in the dry tank to the rear brake booster to apply the rear brake. If the parking brake switch is set to the PARKING BRAKE position, parking brake (12) remains de-energized and the parking brake is applied. At the same time, auxiliary brake valve (11) is also de-energized, so the flow of air to the rear brake booster is cut off and the rear brake is released. Shuttle valve (10) acts to switch the air circuit from brake valve (5) and auxiliary brake valve (11).

BRAKE CONTROL VALVE



SEL00290

- | | | |
|----------------|------------------------|--------------------------------|
| 1. Brake pedal | 8. Upper valve | 15. Lower valve spring |
| 2. Plunger | 9. Upper ring retainer | 16. Relay piston return spring |
| 3. Bushing | 10. Outer relay piston | 17. Upper valve spring |
| 4. Cover | 11. Lower valve | 18. Piston return spring |
| 5. Spring seat | 12. Cover | 19. Control spring (small) |
| 6. Piston | 13. Check valve | 20. Control spring (large) |
| 7. Valve body | 14. Lower valve guide | 21. Stopper bolt |

023S05

OUTLINE

- The brake control valve is in the circuit between the dry tank and the brake booster, and consists of 2 valves (the upper and lower valves).

The upper valve actuates the rear brake, and the lower valve actuates the front valve.

- The brake control valve is operated by depressing the brake pedal in the operator's compartment and controls the brake booster pressure.

In the normal pressure range, the brake pedal travel and operating effort increase, but if the discharge pressure goes above approx. 0.4 MPa {4 kg/cm²}, the pressure is controlled by increasing only the operating effort.

OPERATION

1. Brake pedal released

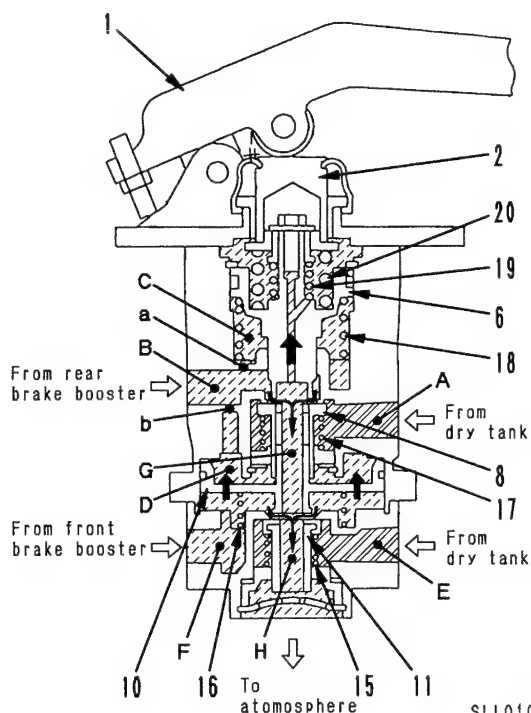
The air from the dry tank is divided into two lines and enters ports **A** and **E**.

When brake pedal (1) is not being depressed, piston (6) and (10) are pushed up by the tension of springs (18) and (16). Valves (8) and (11) are also pushed up by the tension of springs (15) and (17), so the circuit between ports **A** and **B** is closed

and the circuit between ports **B** and **G** is open.

At the same time, the circuit between ports **E** and **B**, **F** is closed and the circuit between ports **F** and **H** is opened.

Therefore, the air from the dry tank enters ports **A** and **E**, and stops, so the pressure rises. The air pressure from the brake booster goes from ports **B** and **F** into ports **G** and **H**, is released to the atmosphere, and the brake is released.



SLL01081

023S05

2. Brake pedal depressed

When brake pedal (1) is depressed, plunger (2) is pushed out in a downward direction and springs (19) and (20) are compressed.

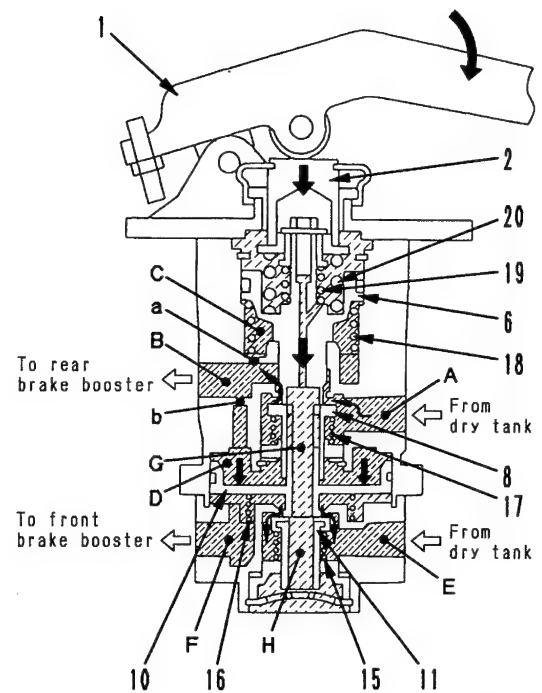
The tension of springs (19) and (20) pushes piston (6) down, and piston (6) then pushes upper valve (8) to open the circuit between ports **A** and **B**.

When this happens, the air from the dry tank goes from port **A** into port **B**, flows to the rear brake booster, and actuates the rear brake.

The air passing through orifice **b** and entering port **D** pushes relay piston (10) down and pushes lower valve (11) to open the circuit between ports **E** and **F**.

When this happens, the air from the dry tank goes from port **E** into port **F**, flows to the front brake booster and actuates the front brake.

In the above explanation, first, upper valve (8) opens and the rear brake is actuated, then lower valve (11) opens and the front brake is actuated. However, in actual fact, even slight pressure at port **D** is enough to actuate piston (10), so there is almost no time lag between the actuation of upper valve (8) and lower valve (11).



SLL01082

3. When brake pedal is depressed and held in position

In the condition in Item 2, when the pressure at port **B** becomes higher, the pressure of the air passing through orifice **a** and entering port **C** also becomes higher, so piston (6) is pushed up and springs (19) and (20) are compressed to a point where the tension balances the air pressure.

When this happens, valve (8) also follows because of the tension of spring (17), and is pushed up to a position where it closes the circuit between ports **A** and **B** as the pressure rises at port **C**. As a result, the air pressure at port **A** does not enter port **B**.

If the pressure at port **F** becomes higher, piston (10) is pushed up to a position where the pressure matches the pressure at port **D**.

When this happens, valve (11) also follows because of the tension of spring (15), and is pushed up to a position where it closes the circuit between ports **E** and **F** as the pressure rises at port **F**. As a result, the air pressure at port **E** does not enter port **F**.

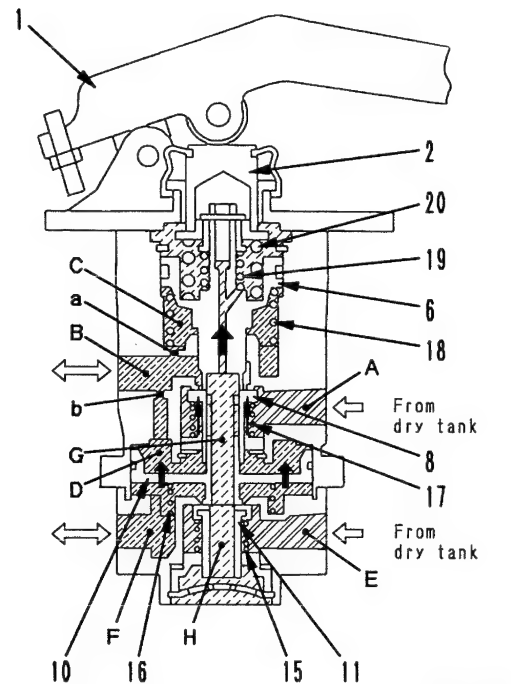
This is done in order to maintain a constant actuating pressure in the brake booster to match the amount the pedal is depressed.

In other words, when the pedal is depressed and kept at a fixed position, the air pressure at ports **B** and **F** is prevented from rising too high.

On the other hand, if the air pressure at ports **B** and **F** becomes too low, piston (6) is returned in the downward direction by the tension of springs (19) and (20), and the circuit between ports **A** and **B** opens again to supply pressure. When the

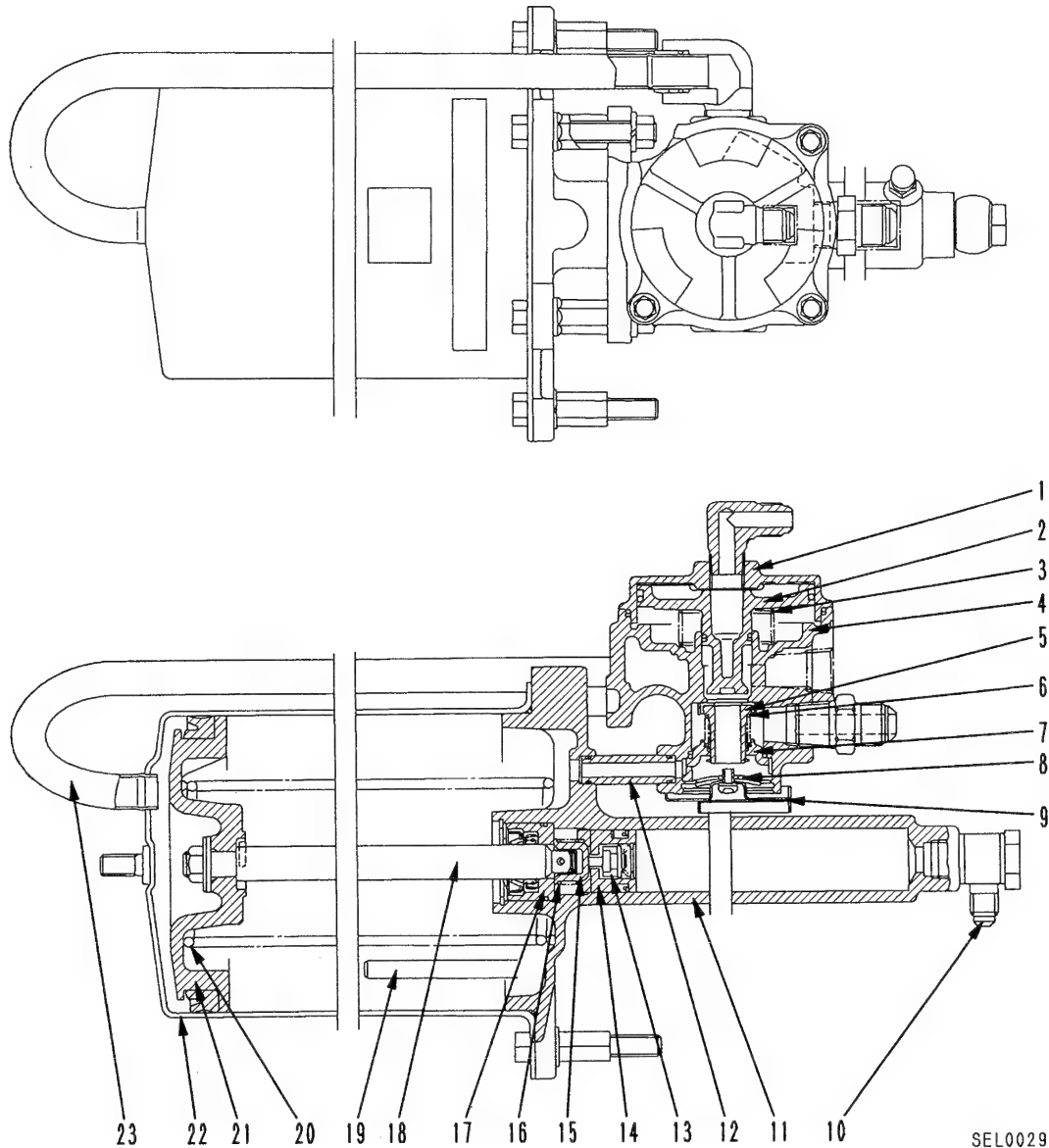
pressure at port **B** rises again, piston (10) is also returned in the downward direction to open the circuit between ports **E** and **F** and to supply pressure.

By repeating this process, even when the brake pedal is depressed and kept at a fixed position, any change in the pressure caused by small amounts of air leakage from the brake valve or changes in the temperature are automatically compensated for.



SLL01083

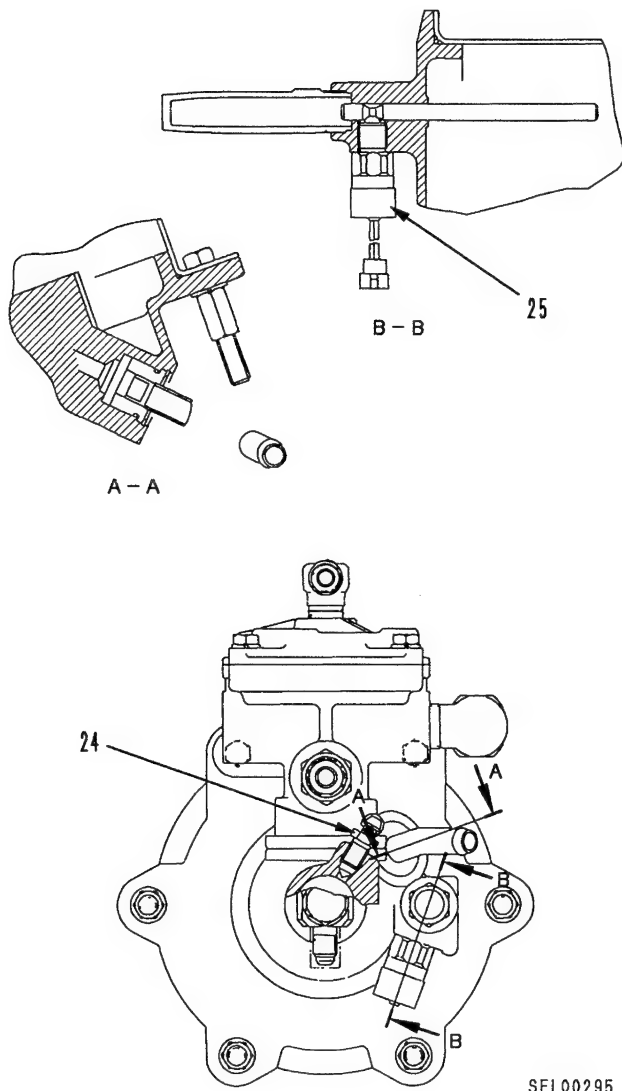
023S05

BRAKE BOOSTER (AIR-OVER-HYDRAULIC BOOSTER)

023S05

SEL00294

- | | | |
|------------------------|------------------|-----------------------------|
| 1. Cover | 10. Connector | 19. Stroke detection rod |
| 2. Relay piston | 11. Oil cylinder | 20. Return spring |
| 3. Piston spring | 12. Sleeve | 21. Air piston |
| 4. Relay valve body | 13. Valve | 22. Air cylinder |
| 5. Inlet valve | 14. Oil piston | 23. Tube |
| 6. Valve spring | 15. Yoke | 24. Bleeder |
| 7. Valve guide | 16. Valve spring | 25. Stroke detection switch |
| 8. Exhaust check valve | 17. Retainer | |
| 9. Cover | 18. Push rod | |



OUTLINE

- The brake booster is an air-over-hydraulic booster (AOH booster: converting air pressure to fluid pressure), and the brake booster and relay valve form a unified structure.
- The brake booster detects the air pressure sent from the brake valve at the service pressure portion of the relay valves (No. 1-9), and controls the pressure supplied from the dry tank to the air cylinder portions (No. 18-24) of the booster.

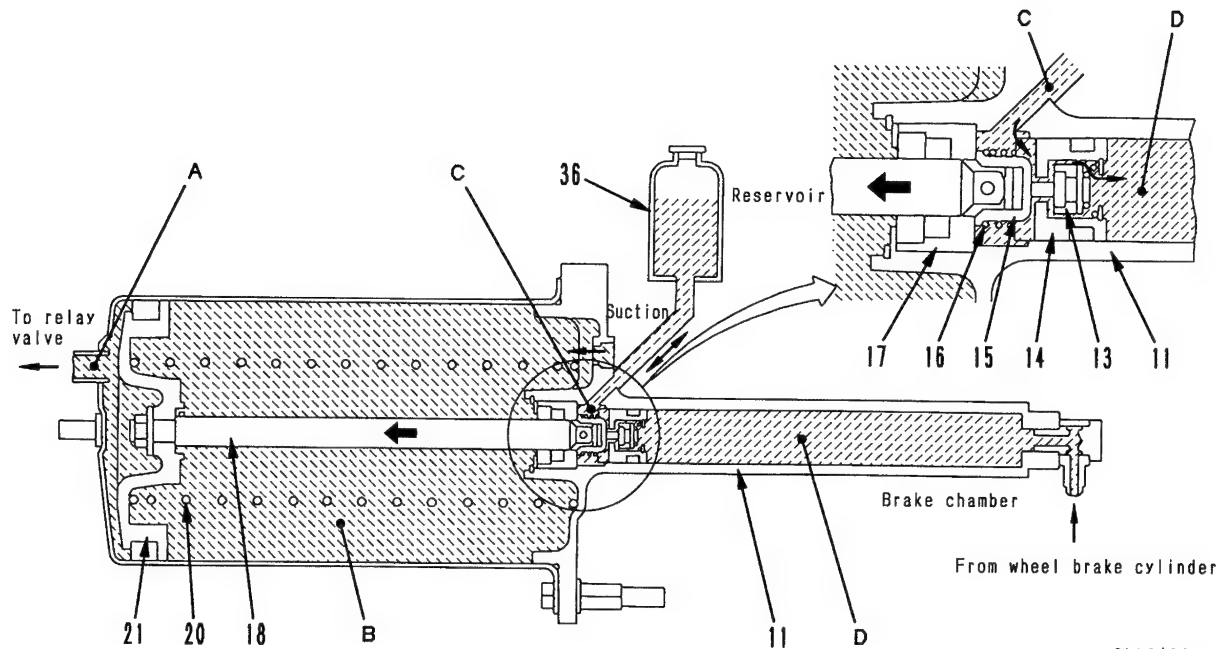
The air pressure supplied to the air cylinder portion is converted to fluid pressure using the brake oil at the air cylinder portions (No. 10-17), and is sent to the brake cylinder to actuate the brake.

- The relay valve consists of inlet valve (5) which seals the pressure from the tank, and relay piston (2) which discharges the sealed air in accordance with the set pressure of the brake valve.
- The air cylinder portion consists of air cylinder (22), push rod (18) which forms one unit with air piston (21), and return spring (22). The sliding portion of push rod (18) is connected to the exhaust port of the relay valve through sleeve (12). The opposite end receives the pressure discharge from the relay valve through tube (23).
- The oil cylinder portion consists of oil piston (14) which is connected with a pin through yoke (15) to push rod (18) and oil cylinder (11). The sealing of the fluid pressure is carried out by the tight contact of valve (13) which is inserted into oil piston (14).

023S05

OPERATION OF BRAKE BOOSTER

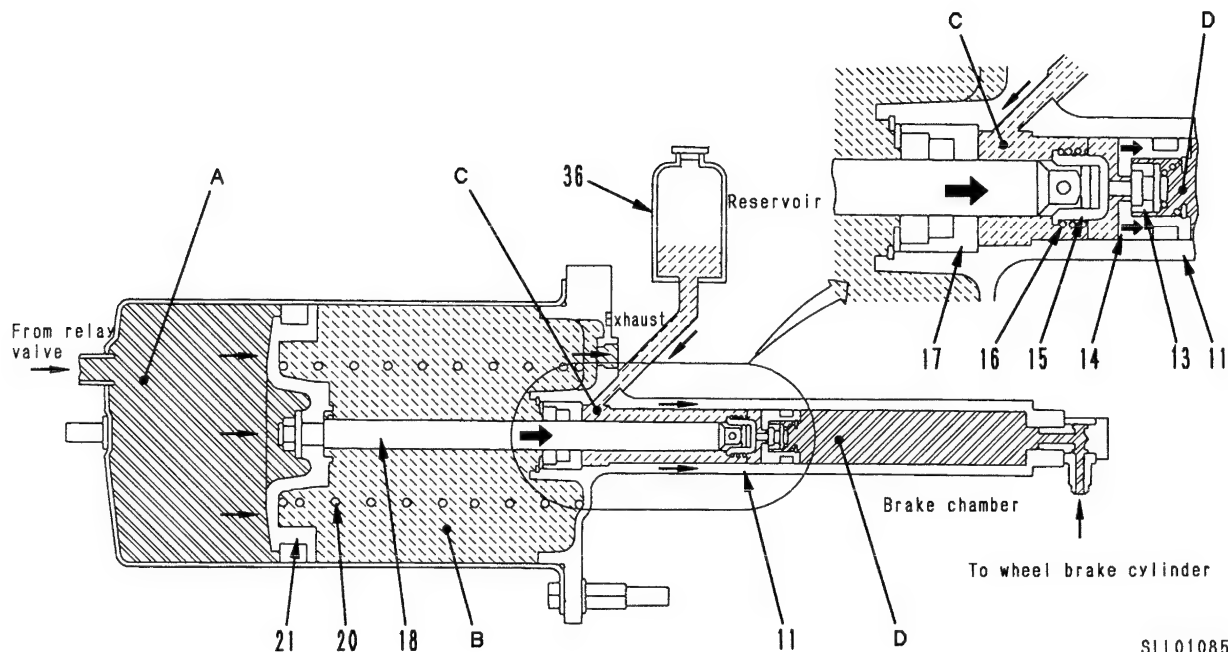
1. When brake is not depressed



SLL01084

- When the brake pedal is not being depressed, the air at port **A** returns to the relay valve and is released to the atmosphere from the exhaust port. Therefore, air piston (21), push rod (18), yoke (15), and oil piston (14) form one unit, and are moved to the left by the tension of spring (20) to a position where yoke (15) contacts retainer (17). When this happens, valve (13) separates the sealing with oil piston (14), so the oil at port **D** passes through the clearance around the outside of valve (13) and the inside diameter of oil piston (14), and connects with port **C**. Therefore, the oil flow from oil reservoir (36) to port **D** becomes free, so the oil reservoir supplies oil to port **D**.

2. When brake is applied



- When the brake pedal is depressed, the relay valve is actuated and high-pressure air enters port **A**.

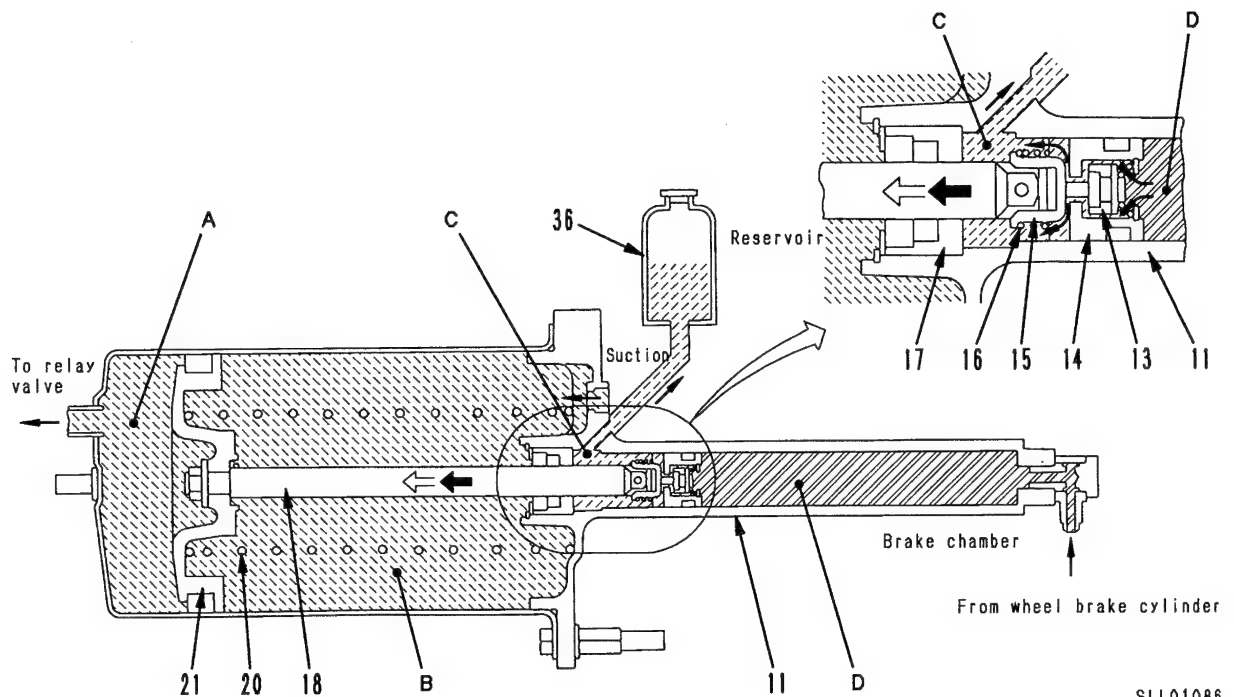
When this happens, air piston (21), push rod (18), yoke (15), and oil piston (14) move as one unit, compress spring (20), and move to the right.

At the same, oil piston (14) is pushed out by the tension of spring (16), forms close contact with valve (13), closes the passage between ports **C** and **D**, and forms the oil circuit from port **D** to the wheel brake cylinder into a closed circuit.

In this condition, oil piston (14) moves to the right, so the pressure beyond port **D** rises and the brake is applied.

The air at port **B** pushed by air piston (21) is released to the atmosphere from the exhaust port of the relay valve.

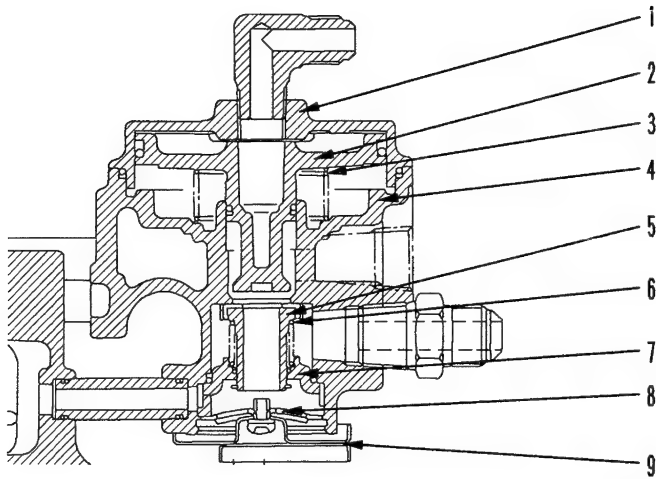
3. When brake pedal is released



SLL01086

- When the brake pedal is released, the high-pressure air at port **A** is connected to the exhaust port of the relay valve and becomes atmospheric pressure. When this happens, air piston (21), push rod (18), yoke (15), and oil piston (14) form one unit and are returned to the left by the tension of spring (20) to a position where yoke (15) contacts retainer (17). When this happens, valve (13) separates the sealing at oil piston (14), opens the passage between ports **C** and **D**, and the oil beyond port **D** passes through the passage in valve (13), returns to oil reservoir (36) from port **C**, and stops the actuation of the brake. Port **B** sucks in air from the exhaust port of the relay valve in accordance with the amount of movement of air piston (31) in order to prevent negative pressure from forming at port **B**.

RELAY VALVE



SEL00299

1. Cover
2. Relay piston
3. Piston spring
4. Valve body
5. Inlet valve
6. Valve spring
7. Valve guide
8. Exhaust check valve
9. Exhaust cover

Outline

- The relay valve is in the circuit between the dry tank and the brake booster air cylinder. It is actuated by the pilot air pressure from the brake valve to send high-pressure air swiftly from the dry tank to the air cylinder in order to reduce the time lag when the brake is actuated.

Operation

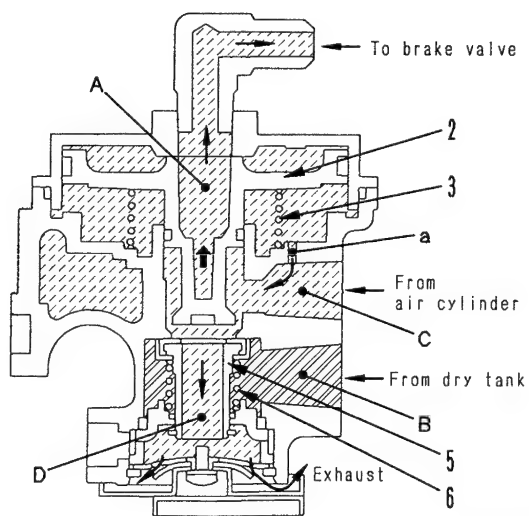
1. When brake pedal is not depressed

If the brake pedal is not being depressed, the air at port **A** returns to the brake valve and is released to the atmosphere from the exhaust port.

For this reason, piston (2) is moved up by the tension of spring (3). When this happens, valve (5) is also moved up by the tension of spring (6), contacts the valve body, closes the circuit between ports **B** and **C**, and opens the circuit between ports **C** and **D**.

When this happens, the air at port **C** (the air cylinder actuation pressure) enters port **D** and is released to the atmosphere.

The air at port **B** (the high-pressure air from the dry tank) is kept at port **B** to prepare for the next time the brake is operated.



SLL01087

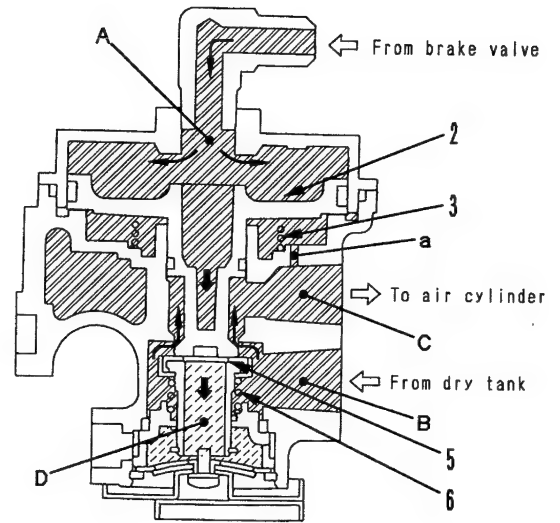
023S05

2. When brake pedal is depressed

When the brake pedal is depressed, air enters port **A** from the brake valve.

When the pressure of the air at port **A** rises, it compresses spring (3) and moves piston (2) in the downward direction. When this happens, piston (2) first contacts the top of valve (5), and closes the circuit between ports **C** and **D**. As the pressure at port **A** rises, it pushes valve (5) down further and opens the circuit between ports **B** and **C**.

Because of this action, the air at port **B** flows to port **C** and actuates the air cylinder.



SLL01088

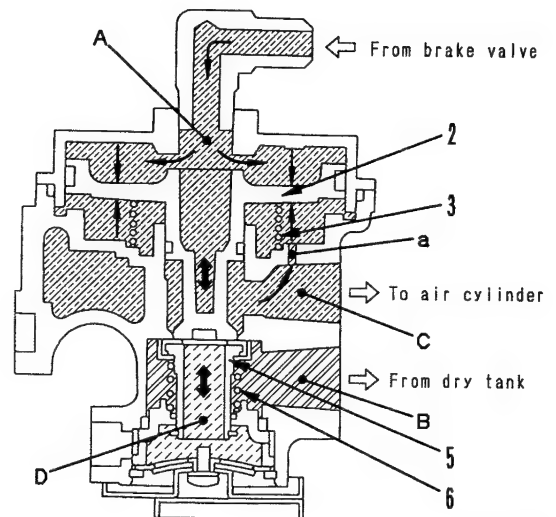
3. Brake pedal depressed and kept in position

In the condition in Item 2, the air entering port **C** from port **B** first rises to a point where it balances the pressure at port **A** (set by the brake valve), then it rises above the pressure of port **A**.

When this happens, the air at port **C** passes through passage **a**, enters port **E**, and when the pressure rises, it pushes piston (2) up gradually. Valve (5) also follows because of the tension of spring (6), closes the circuit between ports **B** and **C**, and prevents the pressure at port **C** from rising any further.

This is done in order to maintain a constant pressure at port **A**, which the brake valve sets in accordance with the amount the pedal is operated and at port **C**, which actuates the air cylinder.

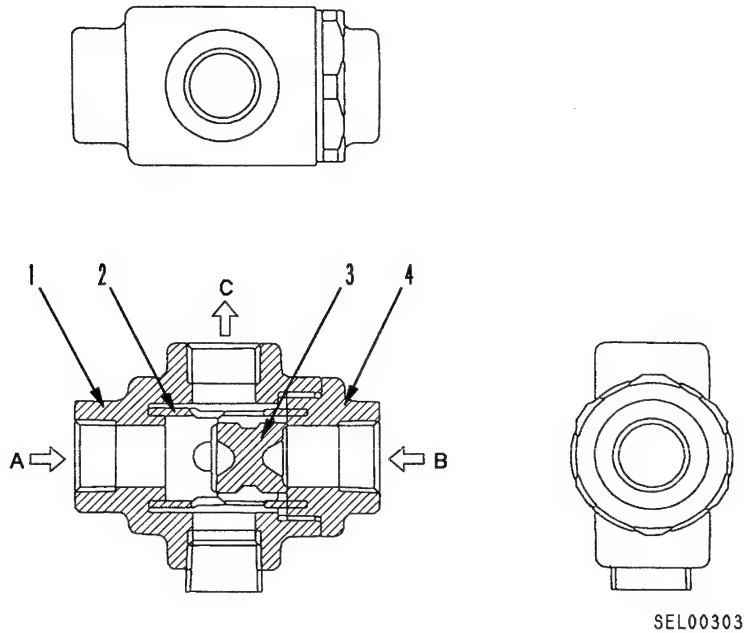
In other words, when the pedal is depressed and kept at a fixed position, the air pressure entering port **C** from port **B** is kept from rising too high.



SLL01089

023S05

BRAKE SHUTTLE VALVE



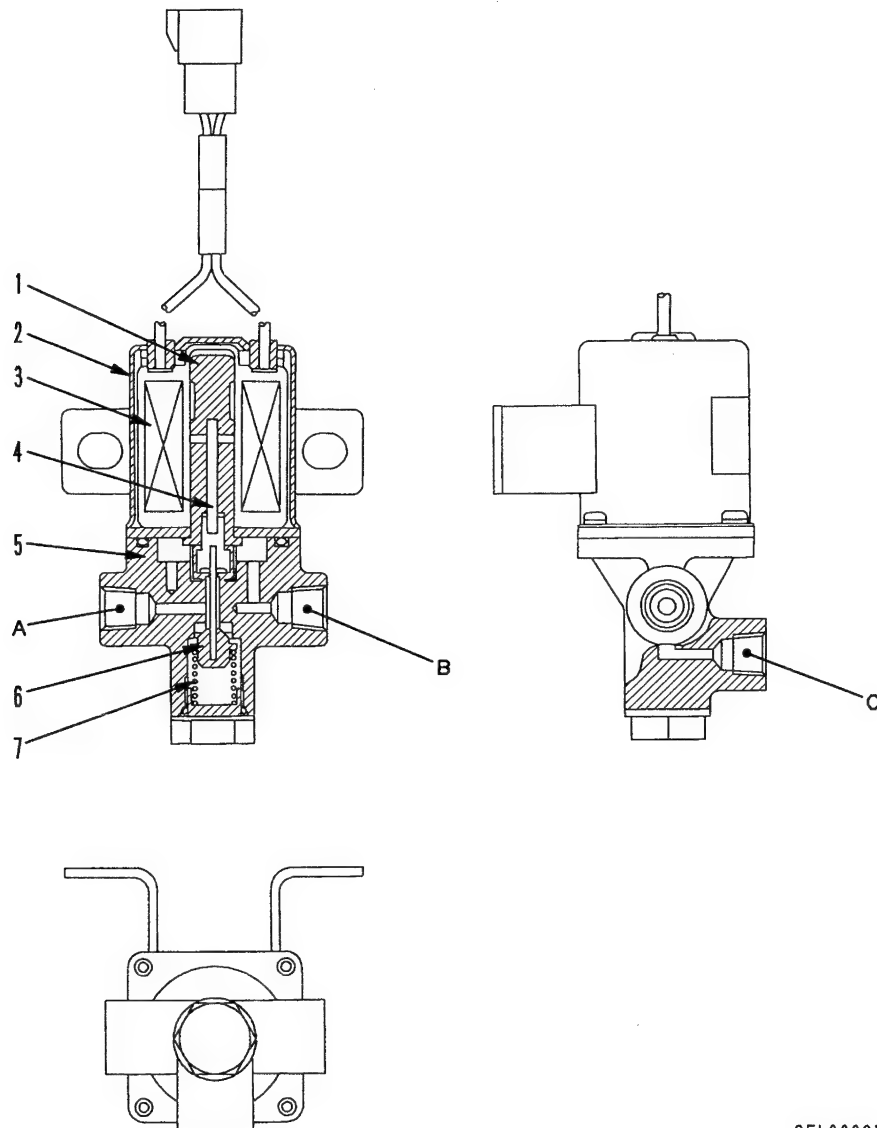
1. Valve body
2. Shuttle guide
3. Shuttle
4. Cap

- A. From auxiliary brake valve
B. From brake control valve
C. To rear brake booster

Outline

- The shuttle valve is in the circuit between the brake control valve, and the auxiliary brake valve, and the brake booster. It acts to switch the source (brake control valve or auxiliary brake valve) used for sending air to the brake booster.

AUXILIARY BRAKE VALVE



023S05

SEL00285

- | | |
|---------------|---------------------|
| 1. Plunger | A. Exhaust |
| 2. Cover | B. To brake booster |
| 3. Coil | C. From dry tank |
| 4. Core | |
| 5. Valve body | |
| 6. Valve | |
| 7. Spring | |

Outline

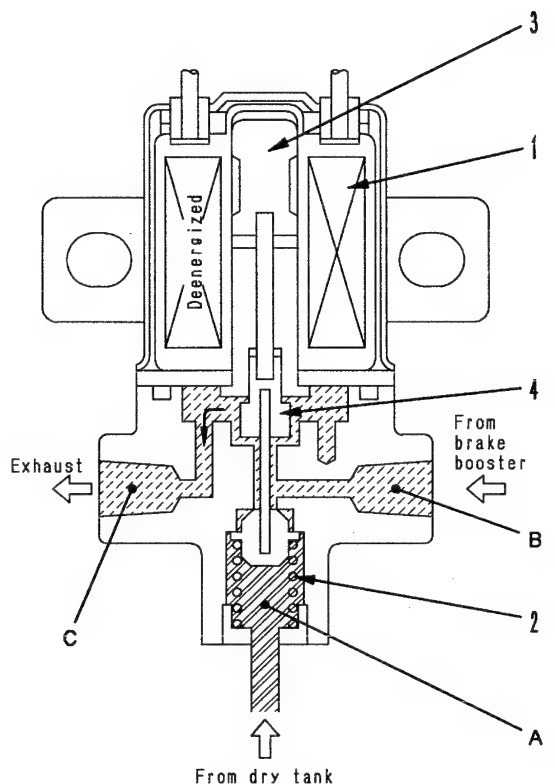
- The auxiliary brake valve is in the circuit between the dry tank and the brake booster. It is actuated by the operation of the parking brake switch, and switches the air from the dry tank to actuate the rear and front brake boosters through the shuttle valve in order to apply the brakes.
- During on-tire crane operations, the auxiliary brake valve not only applies the parking brake to the front wheels, but also applies the front and rear brakes to ensure safety during the operation.

OPERATION

1. When parking brake switch is at OFF or PARKING BRAKE

If the switch is set to the **OFF** or **PARKING BRAKE** position, solenoid (1) is de-energized. When this happens, plunger (3) is pushed up completely by the tension of spring (2), and is held in a position where it closes the circuit between ports **A** and **B** and opens the circuit between ports **B** and **C**.

Therefore, the air entering the rear and front brake boosters returns from port **B** to port **C** and is released to the atmosphere, so the rear and front brakes are released.



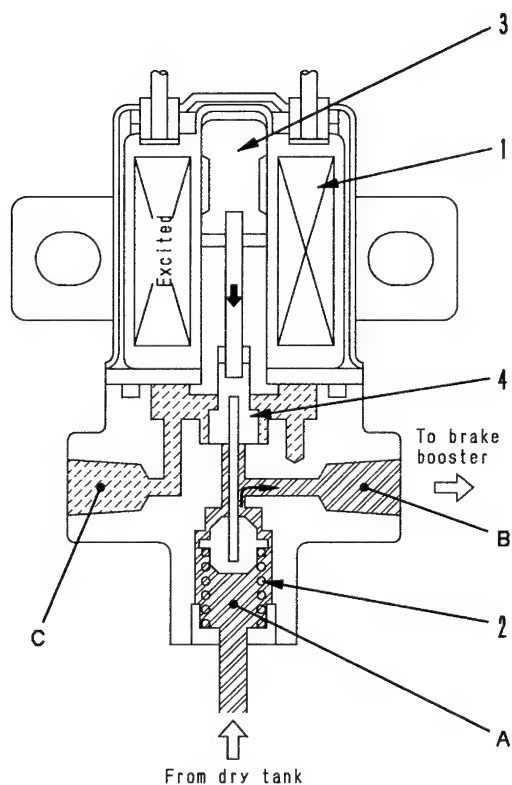
SKL01090

2. When parking brake switch is at AUXILIARY BRAKE

If the switch is set to the **AUXILIARY BRAKE** position, solenoid (1) is excited.

When this happens, plunger (3) compresses spring (2) and moves down to open the circuit between ports **A** and **B** and close the circuit between ports **B** and **C**.

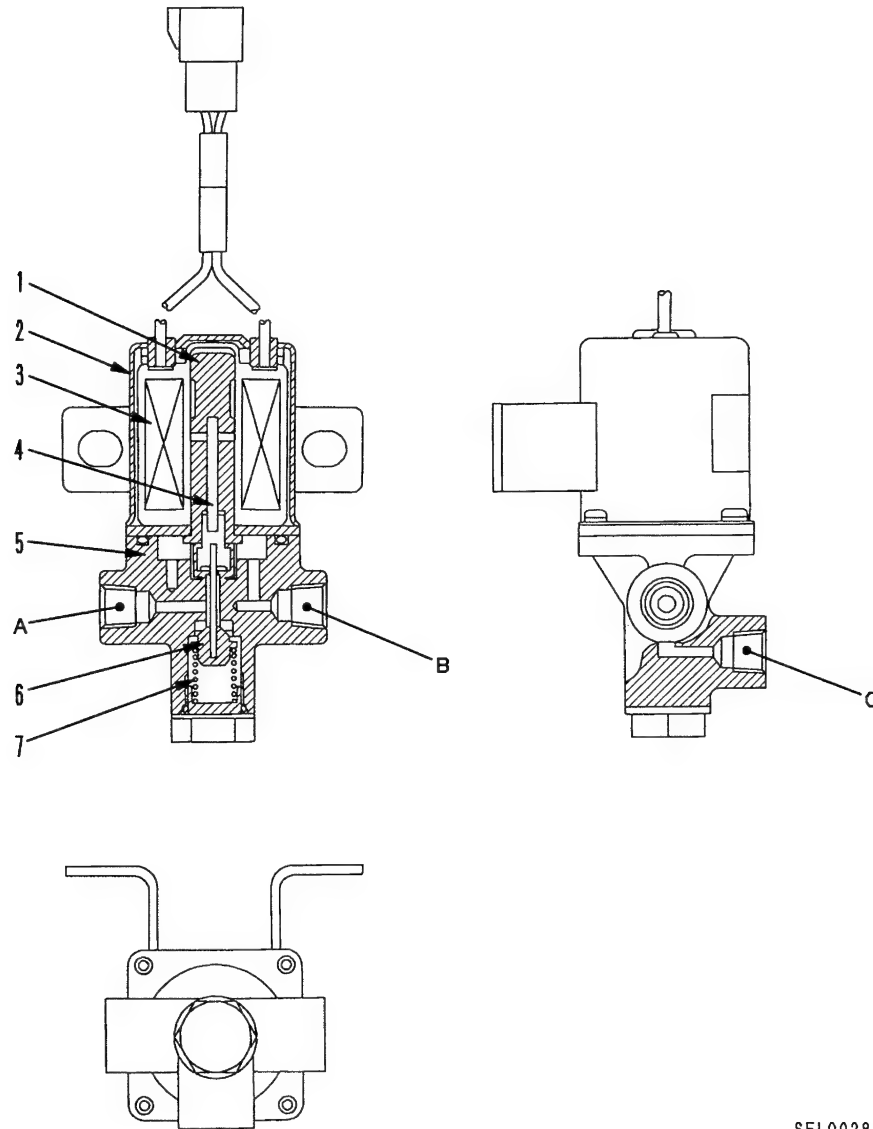
Therefore, the air from the dry tank enters port **B** from port **A**, flows to the rear and front brake boosters, and applies the rear and front brakes.



SKL01091

023S05

PARKING BRAKE VALVE



023S05

SEL00285

- | | |
|---------------|-----------------------------|
| 1. Plunger | A. Exhaust |
| 2. Cover | B. To parking brake chamber |
| 3. Coil | C. From dry tank |
| 4. Core | |
| 5. Valve body | |
| 6. Valve | |
| 7. Spring | |

Outline

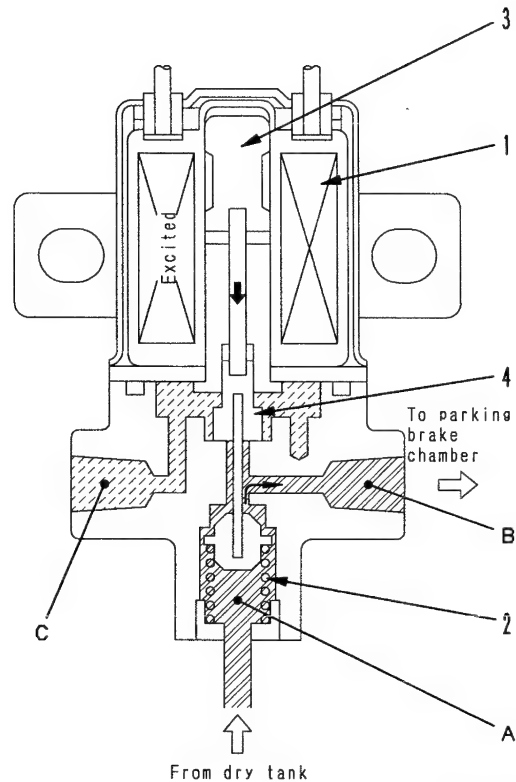
- The parking brake valve is in the circuit between the dry tank and the parking brake chamber. It is actuated by the operation of the parking brake switch, and switches the air from the dry tank to actuate the parking brake chamber.

OPERATION**1. When parking brake switch is at OFF**

If the switch is set to the **OFF** position, solenoid (1) is excited.

When this happens, plunger (3) compresses spring (2) and moves down to open the circuit between ports **A** and **B** and close the circuit between ports **B** and **C**.

Therefore, the air from the dry tank enters port **B** from port **A**, flows to the parking brake chamber, actuates it and releases the parking brake.



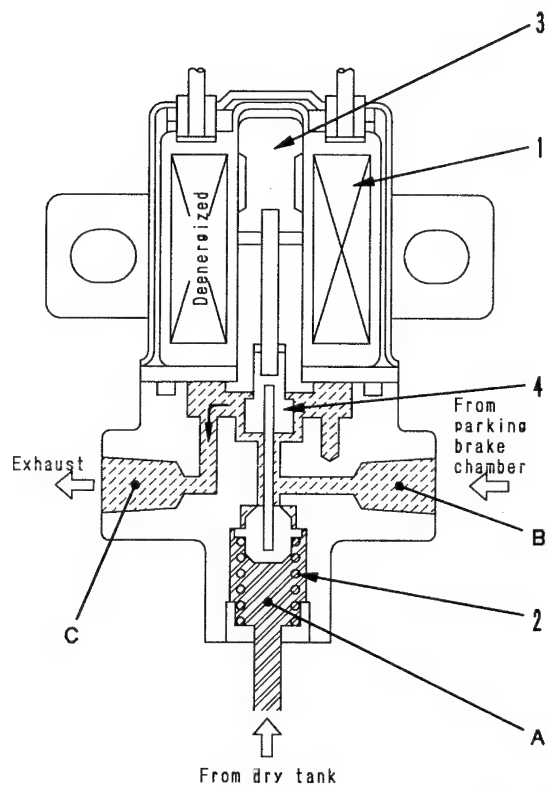
SKL01092

2. When parking brake switch is at AUXILIARY BRAKE or PARKING BRAKE

If the switch is set to the **AUXILIARY BRAKE** or **PARKING BRAKE** position, solenoid (1) is de-energized.

When this happens, plunger (3) is pushed up completely by the tension of spring (2), and is held in a position where it closes the circuit between ports **A** and **B** and opens the circuit between ports **B** and **C**.

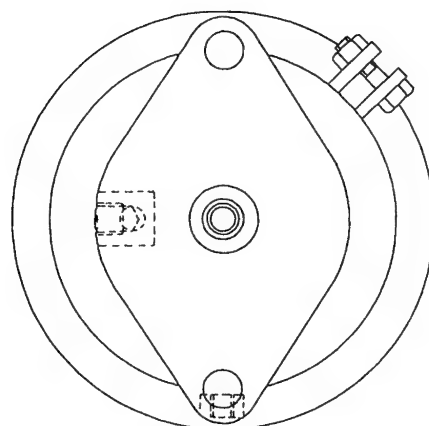
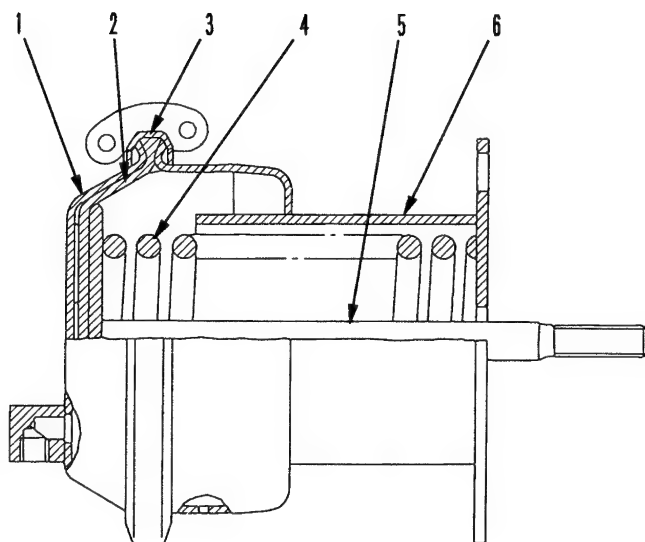
Therefore, the air in the parking brake chamber returns from port **B** to port **C**, is released to the atmosphere, and the parking brake is applied.



SKL01093

023S05

PARKING BRAKE CHAMBER



SEL00309

023S05

1. Pressure plate
2. Diaphragm
3. Clamp
4. Return spring
5. Push rod
6. Non-pressure plate

Outline

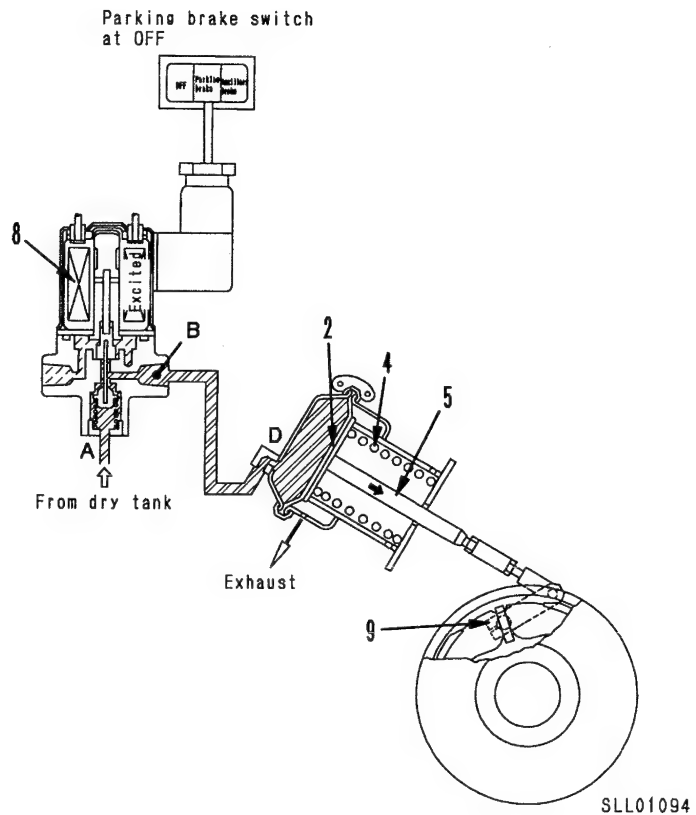
- With the parking brake chamber, push rod (5) is connected to the parking brake control lever, and the brake is released by the air pressure from the air tank; the brake is applied by switching the solenoid valve to cut off the air.

OPERATION

1. When parking brake switch is at OFF

If the switch is set to the OFF position, solenoid valve (8) is excited and high-pressure air from the dry tank enters port **D** from ports **A** and **B**.

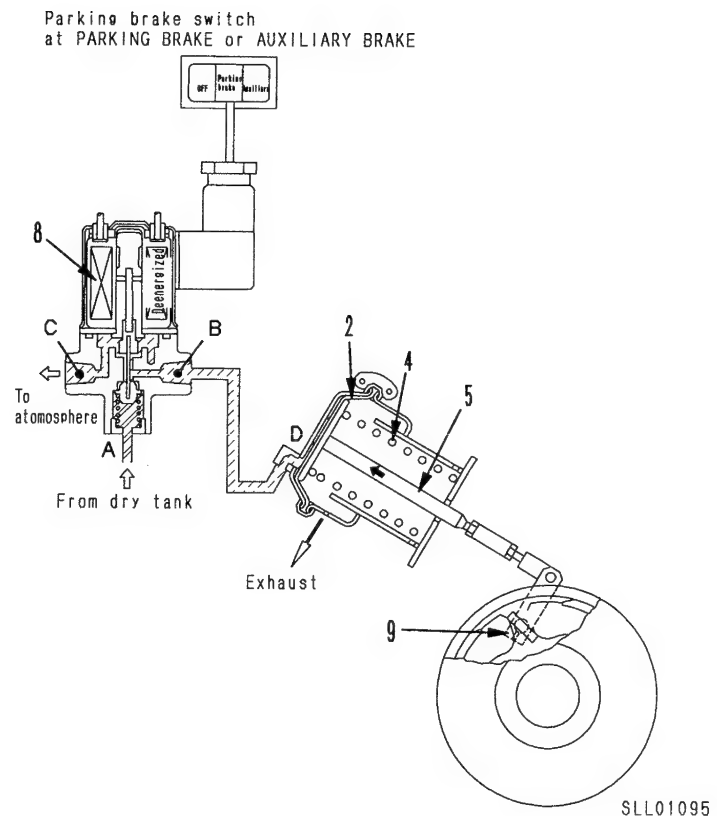
The air entering port **D** pushes diaphragm (2), compresses spring (4), pushes push rod (5) out to the right, and releases parking brake (9).



2. When parking brake switch is at AUXILIARY or PARKING BRAKE

If the switch is set to the AUXILIARY BRAKE or PARKING BRAKE position, solenoid valve (8) is de-energized and the high-pressure air from the dry tank is shut off.

When this happens, the air at port **D** returns from valve port **B** to port **C**, and is released to the atmosphere. Diaphragm (2) and push rod (5) are moved to the left by the tension of spring (4), so parking brake (9) is applied.

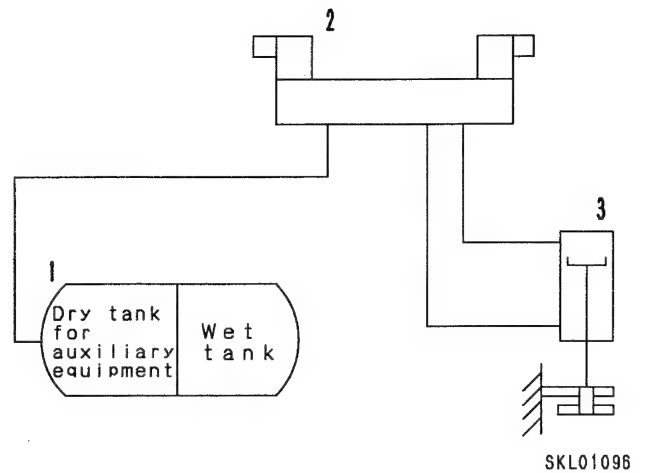


023S05

REAR STEERING LOCK AIR SYSTEM

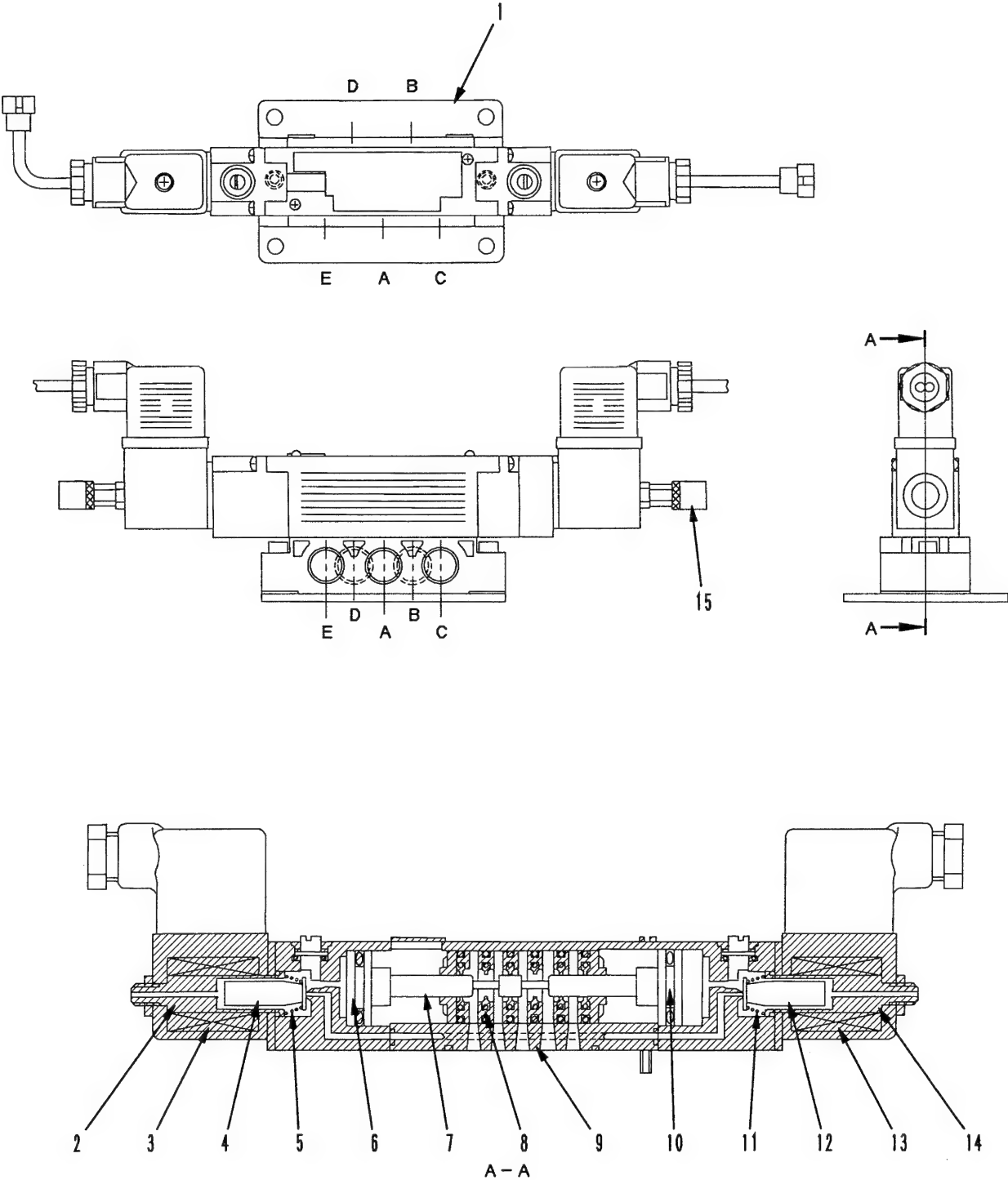
OUTLINE

- The rear steering lock air system consists of air cylinder (3) and rear steering lock valve (2), which is actuated by the rear steering lock switch.



1. Wet tank, dry tank for auxiliary equipment
2. Air filter
3. Lubricator
4. Rear steering lock valve
5. Rear steering lock cylinder

REAR STEERING LOCK VALVE



023S05

SEL00313

1. Rear steering lock valve
 2. Yoke
 3. Solenoid
 4. Plunger
 5. Spring
 6. Piston
 7. Spool
 8. Seal ring
 9. Valve body
 10. Piston
 11. Spring
 12. Plunger
 13. Solenoid
 14. Yoke
 15. Exhaust filter
-
- A. From dry tank
 - B. To rear steering lock cylinder bottom
 - C. Exhaust
 - D. To rear steering lock cylinder head
 - E. Exhaust

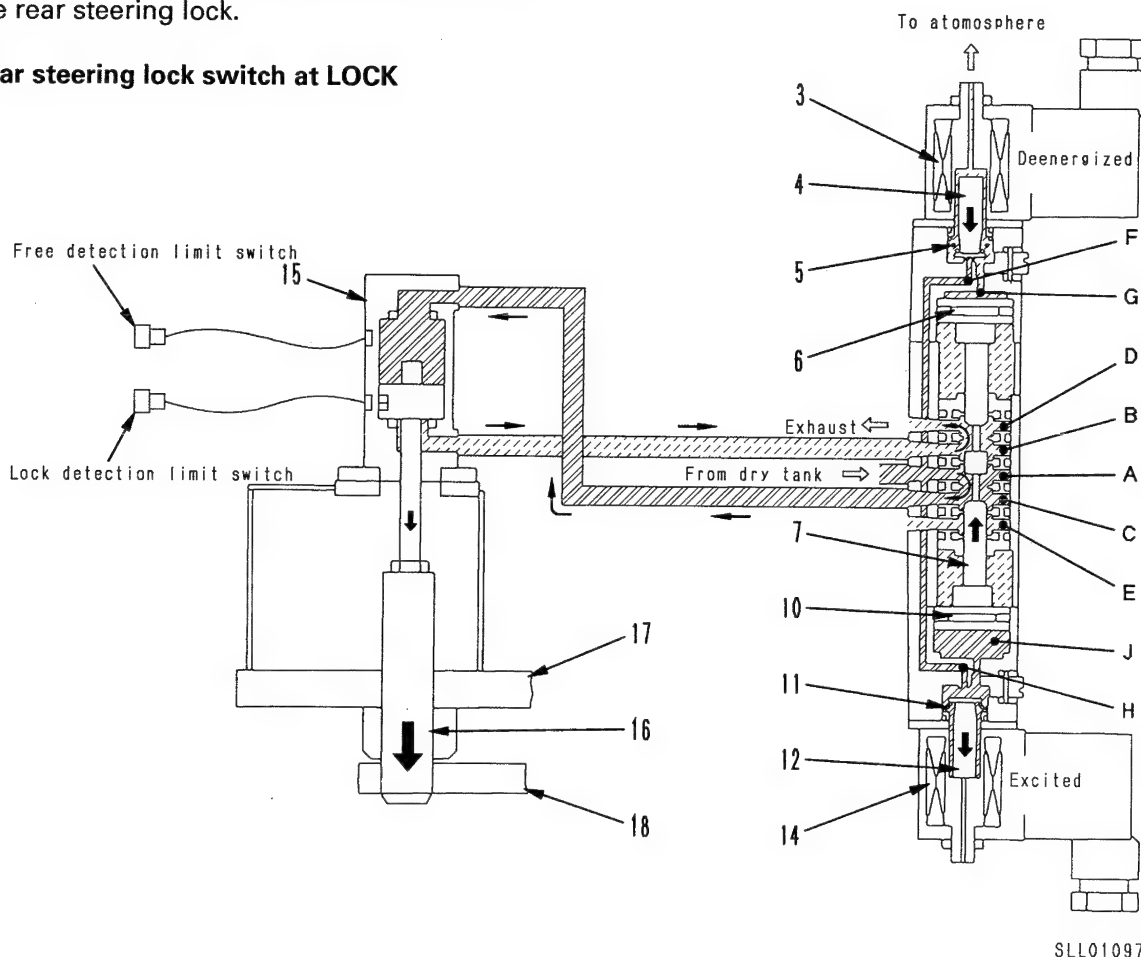
Outline

- The solenoid valve is in the circuit between the dry tank and actuator, and switches the air from the air tank to operate the actuator. The solenoid valve does not carry out the switching of spool (7) directly with solenoids (3) and (13), but actuates pistons (6) and (10) and makes the air from the dry tank into the pilot pressure to move spool (7). Solenoids (3) and (13) open and close the inlet port for the pilot air.
- **Rear steering lock valve**
When the rear steering lock switch is operated, the rear steering lock valve switches the air in the cylinder in the rear wheel steering lock mechanism assembled on top of the rear axle. For normal travel operations, lock the rear wheel steering, and make it free when traveling on rough road surfaces.

OPERATION OF REAR STEERING LOCK VALVE

- ★ Set the steering mode switch to the FRONT WHEEL position before locking or releasing the rear steering lock.

1. Rear steering lock switch at LOCK



- When the switch is set to the LOCK position, solenoid (3) is deenergized, and solenoid (14) is excited.

When this happens, plunger (4) moves down under the tension of spring (5), is pushed against the valve seat, and closes ports F and G.

Plunger (12) compresses spring (11), moves down, separates the sealing at the valve seat, and opens ports H and J.

When this happens, high pressure air from the dry tank enters port F and stops, and at the same time, the air at port G is released to the atmosphere.

The remainder of the air goes from port H and

enters port J, pushes out piston (10) and moves spool (7) up.

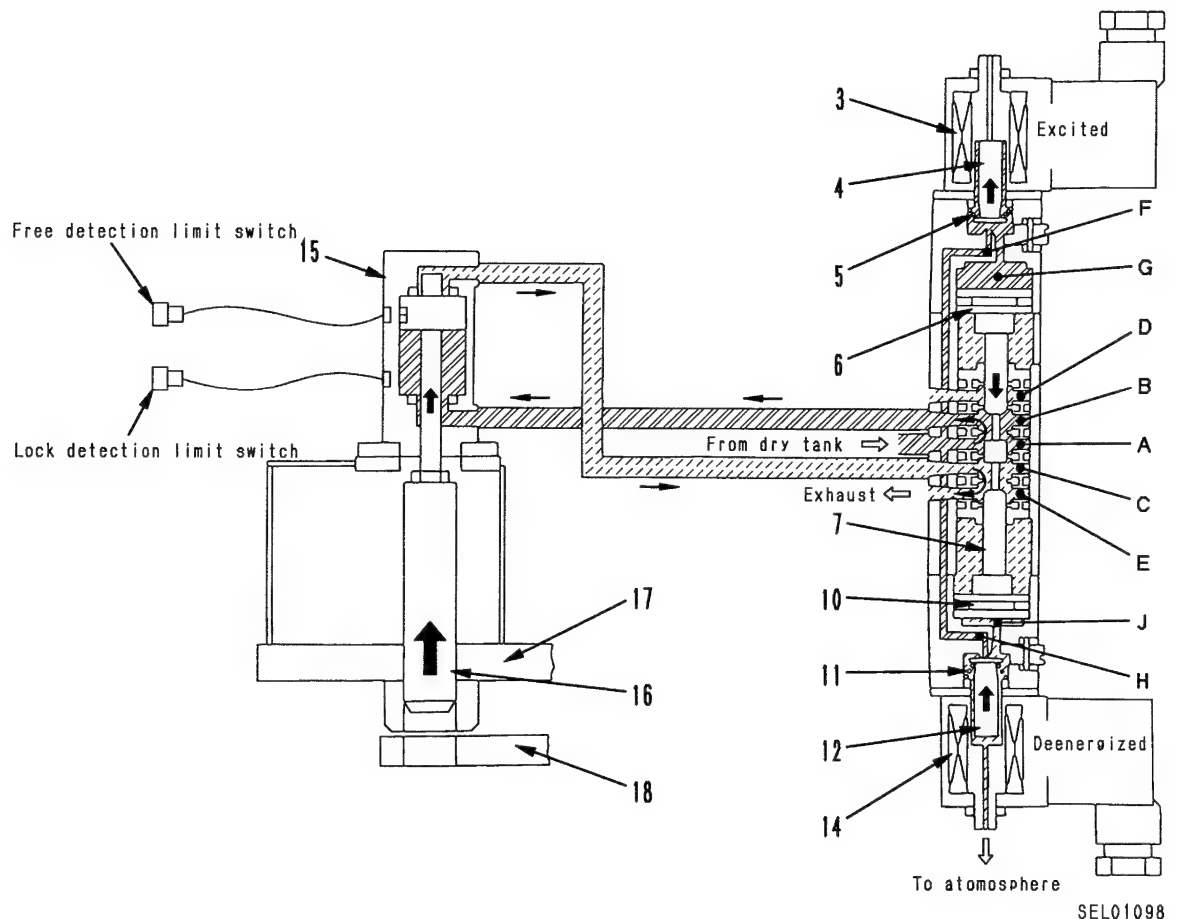
When this happens, spool (7) opens the circuit between ports A and C and the circuit between ports B and D, and closes the circuit between ports A and B.

Therefore, the high pressure air from the dry tank enters port C from port A, flows to the bottom end of cylinder (15), and extends the cylinder.

When this happens, lock pin (16), which forms one unit with cylinder (15), penetrates the hole in bracket (18) at the knuckle arm end, and the rear steering is locked.

023S05

2. Rear steering lock switch at FREE



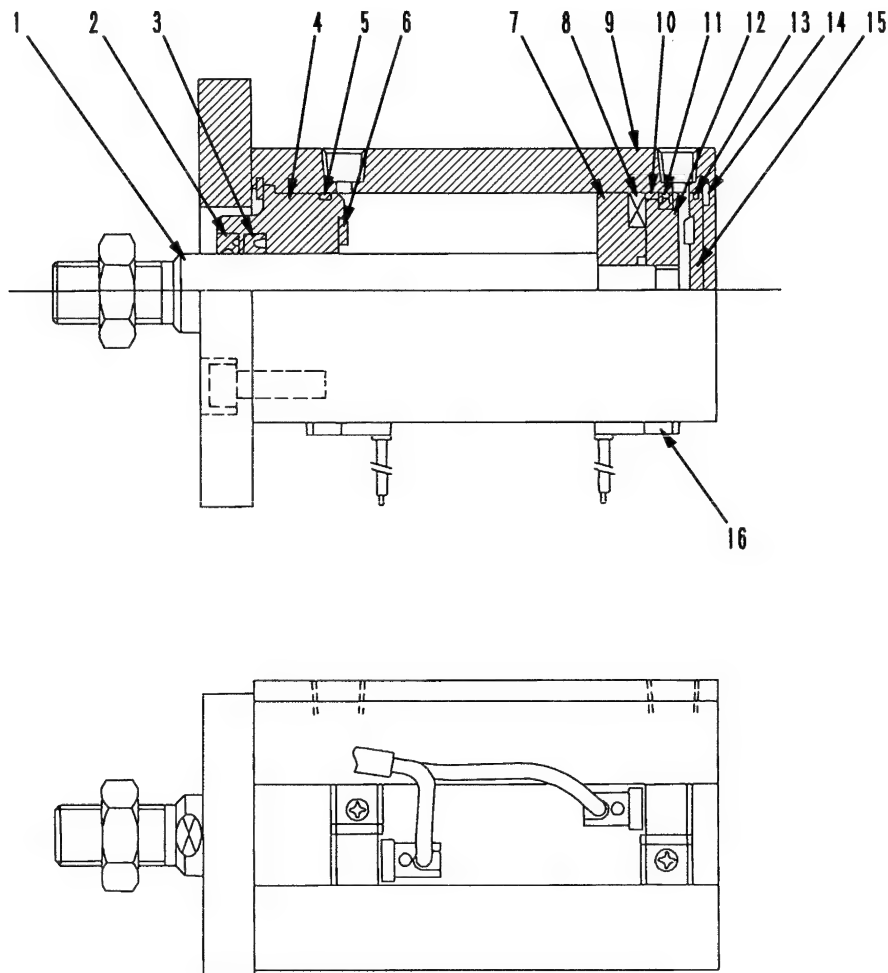
- When the switch is set to the FREE position, solenoid (3) is excited, and solenoid (14) is deenergized. When this happens, plunger (4) compresses spring (5) and moves up, separates the sealing at the valve seat, and opens ports F and G. Plunger (12) moves up under the tension of spring (11), is pushed against the valve seat, and closes ports H and J. When this happens, high pressure air from the dry tank enters port H and stops, and at the same time, the air at port J is released to the atmosphere. The remainder of the air goes from port F and enters port G, pushes out piston (6) and

moves spool (7) down.

When this happens, spool (7) closes the circuit between ports A and C, opens the circuit between ports A and B, and at the same time, opens the circuit between ports C and E and closes the circuit between ports B and D. Therefore, the high pressure air from the dry tank enters port B from port A, flows to the head end of cylinder (15), and retracts the cylinder.

When this happens, lock pin (16), which forms one unit with cylinder (15), is removed from the hole in bracket (18) at the knuckle arm end, returns to the hole in bracket (17) at the axle housing end, and the rear steering is made free.

REAR STEERING LOCK CYLINDER



- | | |
|-------------------|-------------------------|
| 1. Piston rod | 10. Wear ring |
| 2. Dust wiper | 11. Piston packing |
| 3. Rod packing | 12. Piston |
| 4. Bushing | 13. Bottom plate O-ring |
| 5. Bushing O-ring | 14. Stopper ring |
| 6. Cushion pad | 15. Cylinder bottom |
| 7. Spacer | plate |
| 8. Magnet | 16. Switch |
| 9. Cylinder | |

Outline

- The cylinder for the rear steering lock is a double-acting type piston. There is a lock pin installed to the tip of the piston rod, and the cylinder is installed on top of the rear axle.

023S05

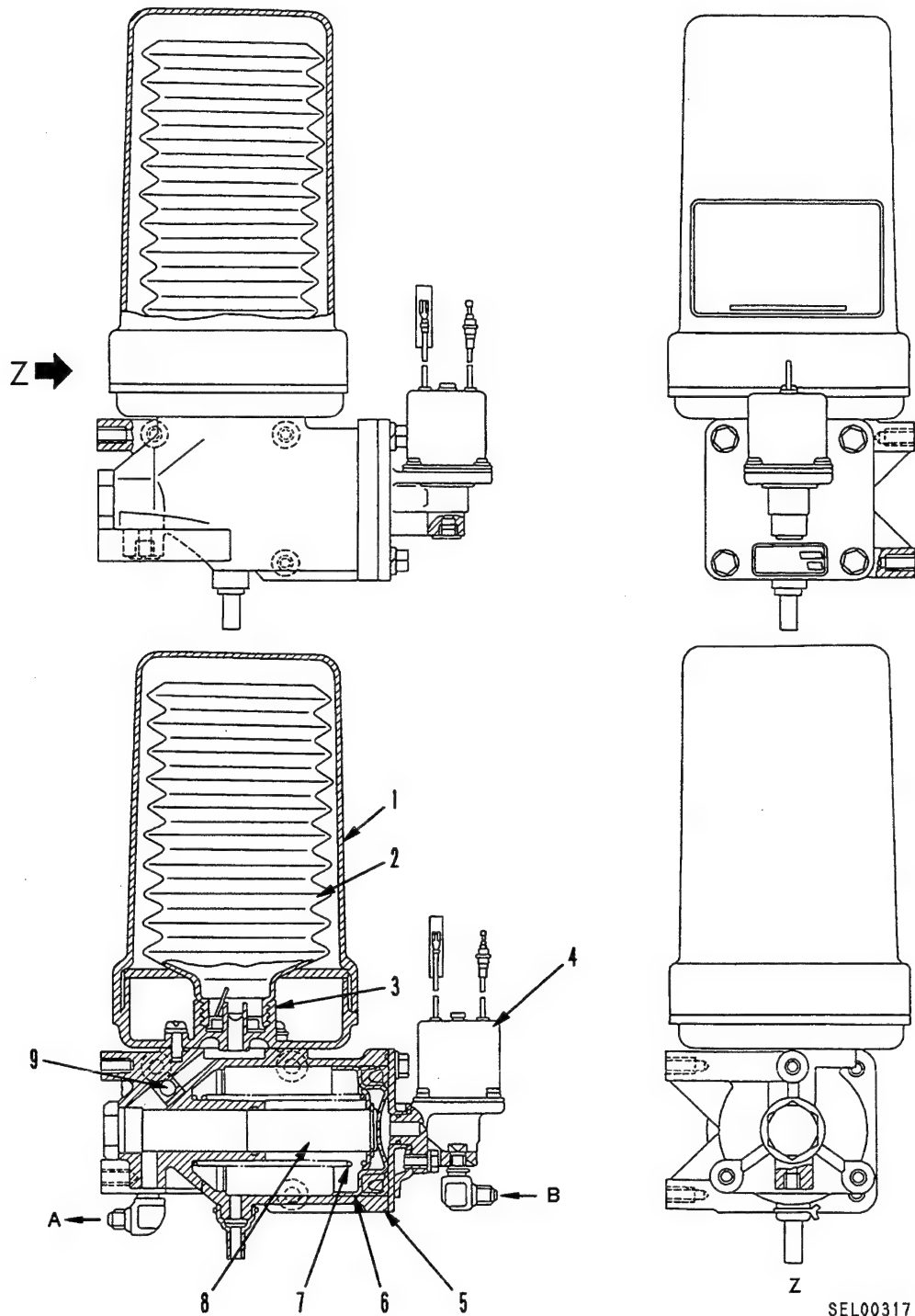
SEL00316

CENTRALIZED GREASING PUMP

SERIAL No.

X-shaped outriger specification : 50001 – 50205

H-shaped outriger specification : 53001 – 53075



1. Grease reservoir protector
2. Grease reservoir
3. Grease reservoir holder
4. Centralized greasing valve

5. Cylinder
6. Air piston
7. Piston return spring
8. Plunger

9. Check valve

- A. To greasing pipe
B. From wet tank

023S05

OUTLINE

- The centralized greasing pump is installed to the right side of the undercarriage. It sends grease to all parts of the undercarriage when the centralized greasing switch is operated.
- The centralized greasing pump can be broadly divided into the grease reservoir, air pump, and solenoid valve.
- Grease reservoir (2) is screwed to holder (3), and supplies the grease to the centralized greasing circuit.

The grease is sucked into the pump by the action of the grease pump.

- Greasing valve (4) is in the circuit between the wet tank and greasing pump. It sends the air pressure from the wet tank to the grease pump and actuates the pump.

Keep the valve control switch pressed for at least 5 seconds each time, and press it repeatedly until grease flows from the distributor.

- The grease pump is a piston pump in which plunger (8) is moved by the pressure of the air from the greasing valve and the tension of piston return spring (7) to move in a reciprocal motion.

The grease in the grease reservoir is sucked in by the pump and sent to the distributor.

OPERATION

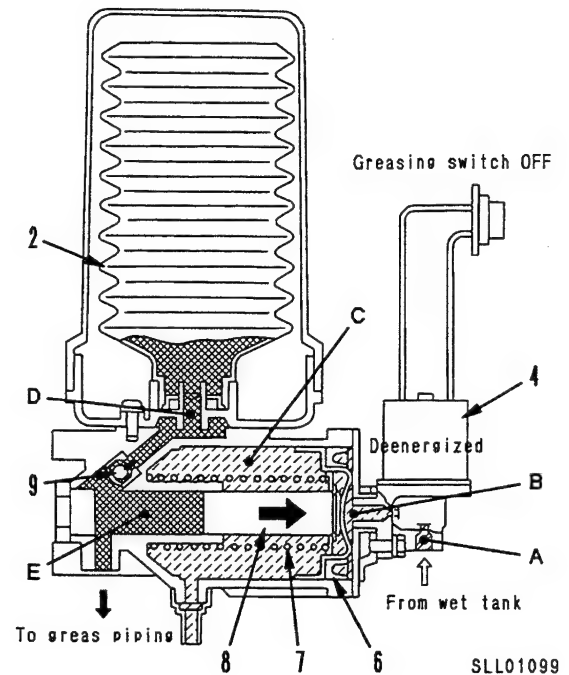
1. Greasing switch OFF

High-pressure air from the wet tank always enters port **A**.

When the greasing switch is OFF, solenoid valve (4) is deenergized, and the circuit between ports **A** and **B** is closed.

Therefore, plunger (8) and piston (6) are returned fully to the right by the tension of spring (7).

At this point, port **E** is under negative pressure, so check valve (9) is pulled in, and grease is sucked in from grease reservoir (2) to prepare for the next operation.



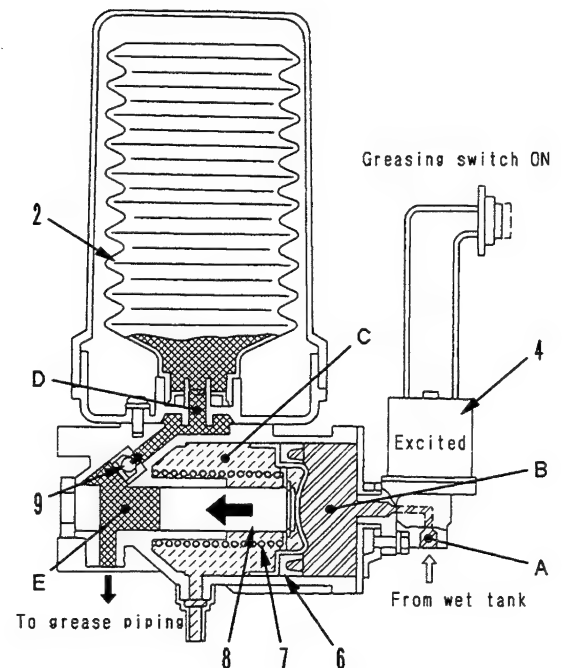
2. Greasing switch ON

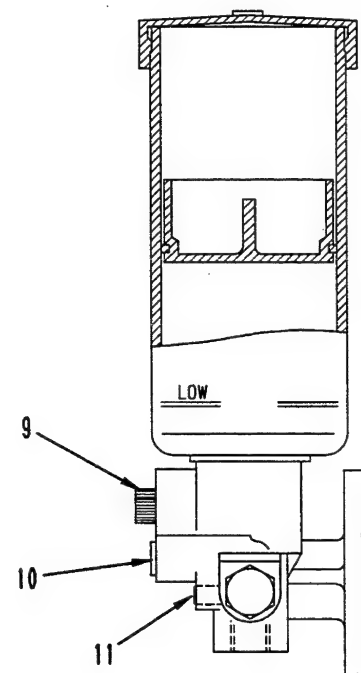
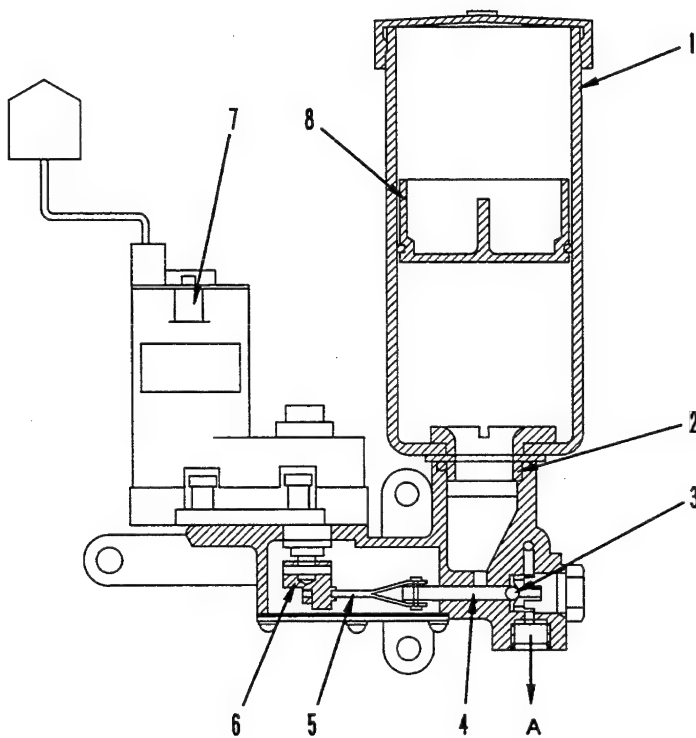
When the greasing switch is turned ON, solenoid valve (4) is excited, and the circuit between ports **A** and **B** opens.

When this happens, the air from the wet tank flows from port **A** to port **B**, and pushes out piston (6) and plunger (8) to the left.

As a result, the grease that has been sucked into port **E** is sent to the greasing piping.

At the same time, the grease pushes check valve (9) and closes the passage to the grease reservoir to prevent the grease from flowing back.



SERIAL No.**X-shaped outriger specification : 50206 and up****H-shaped outriger specification : 53076 and up**

SLL01639

023S05

- | | |
|----------------------------|-------------------|
| 1. Grease reservoir | 5. Connecting rod |
| 2. Grease reservoir holder | 6. Crank |
| 3. Check valve | 7. Electric motor |
| 4. Plunger pump | 8. Follower plate |

- | |
|------------------------|
| 9. Grease filler cap |
| 10. Relief valve |
| 11. Air bleeding screw |

A. To lubricating tube

OUTLINE

- The centralized greasing pump is installed to the right side case of the undercarriage. When the centralized greasing switch is operated, grease is sent to all parts of the undercarriage.
- The centralized greasing pump can be broadly divided into the grease reservoir, electric motor, and plunger pump.
- Grease reservoir (1) is screwed into holder (2) and supplies grease for the centralized greasing circuit.
The grease is sucked into the pump by the action of electric motor (7) and grease plunger pump (4).
- The greasing switch on the control panel is operated to actuate electric motor (7), and the plunger of plunger pump (4) is operated in a reciprocal motion by crank (6). This sucks in and pushes out the grease from the reservoir and sends it to the distributors.
- If the circuit is blocked by an obstruction in the piping or by defective operation of the divider valve, relief valve (10) is actuated and the grease is returned to the reservoir.
- With plunger pump (4), the rotation of the motor is converted to a reciprocal motion by connecting rod (5) and crank (6) installed to electric motor (7), and the plunger is actuated.

023S05

OPERATION

1. Operation of greasing pump

When greasing switch (12) is turned ON, electric motor (7) is actuated. This moves the plunger of plunger pump (4) in a reciprocal motion through connecting rod (5) and crank (6) installed to the motor, and pushes out the grease. When this happens, the grease sucked into the cylinder in that stroke is sent to the grease piping from port A.

At the same time, the circuit to the greasing piping is shut off by check valve (3) during the suction stroke, so the grease in the grease reservoir is sucked into the cylinder.

During the discharge stroke, the valve opens and grease is sent to the grease piping from port A.

2. Stopping greasing pump

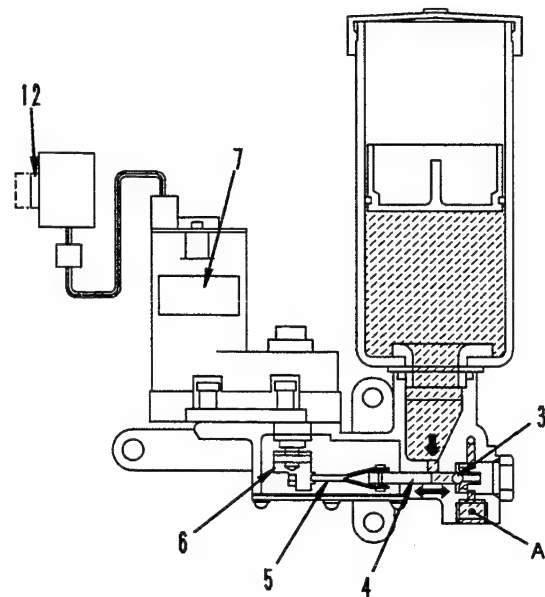
There are two ways of stopping the greasing pump: automatic stop and forced stop.

1) Automatic stop

When the divider valve switch installed to the farthest distributor in the grease piping is operated, the electric circuit of the electric motor opens and the motor stops. This condition shows that grease has reached every greasing port (distributor).

2) Forced stop

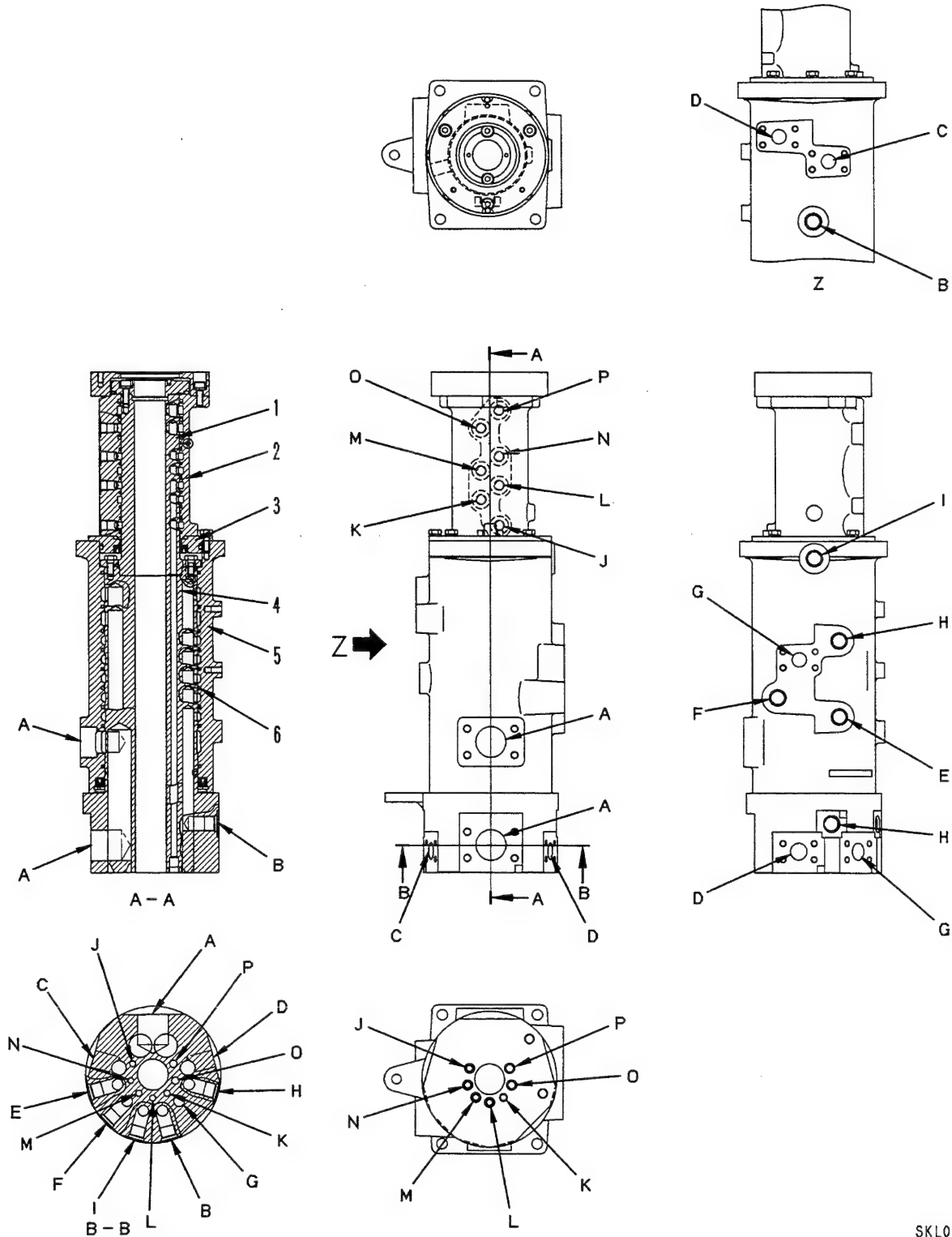
If any problem occurs in the greasing pump or greasing piping and it is necessary to stop the pump, operate the STOP switch on the operating panel.



SLL01640

023S05

HYDRAULIC, HOT WATER, AIR CENTER SWIVEL JOINT



SKL00320

023S05

OUTLINE

- The center swivel joint secures shafts (1) and (4) to the undercarriage and installs bodies (2) and (5), which rotate and slide on the slipper seal, to the upper structure. In this way it connects the hydraulic, air, and hot water circuits between the undercarriage and upper structure.
The slipper seal forms a partition in each circuit, and acts to make the space at the circumference of the body and shaft into piping.
- Piping is installed to shafts (1) and (4), and the center swivel joint supplies the oil from the hydraulic pump installed to the undercarriage, the air from the air compressor, and the hot water from the engine and radiator to the upper structure.
At the same time, it makes it possible to carry out steering, acceleration, and braking operations from the upper structure.
- The electric swivel joint is installed on top of this center swivel joint, and the wiring passes through the hole in the center of shafts (1) and (4).
★ For details, see ELECTRICAL COMPONENTS.

- ★ The letters in the diagram indicate the names of the hydraulic and air ports, and have the purposes shown in the table below.

Name of port	Category	Purpose
A	Hydraulic swivel	For hydraulic tank drain
B		For accumulator charge
C		For boom hoist, telescope, power tilt, outrigger, suspension lift
D		For winding in, winding out of winch
E		For steering cylinder
F		For steering cylinder
G		For swing, steering
I		For drain
B		For steering, cooler, accumulator charge
H	Air swivel	For pilot
J		For front brake
K		For accelerator control
L		For rear brake
M	Hot water swivel	For rear brake
N		For front brake
O	Hot water swivel	For operator's compartment heater (out)
P		For operator's compartment heater (in)

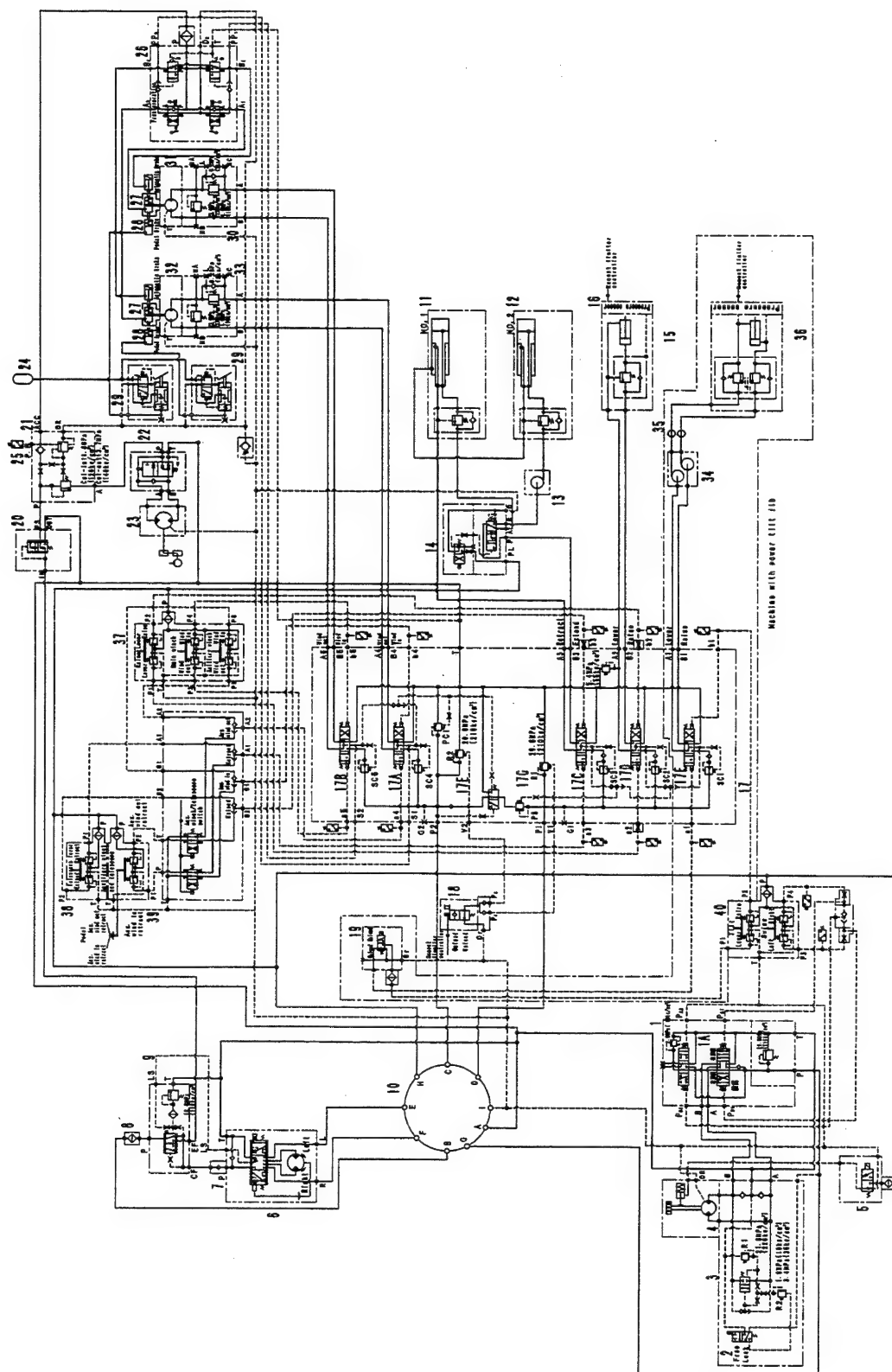
- Upper shaft
- Upper body (upper rotor)
- Seal cage
- Lower shaft
- Lower body (lower rotor)
- Slipper seal

HYDRAULIC CIRCUIT DIAGRAM (STEERING, SWING, SUSPENSION, WORK EQUIPMENT)

UPPER

★ For details of this page, see page 90-11.

SVL01717



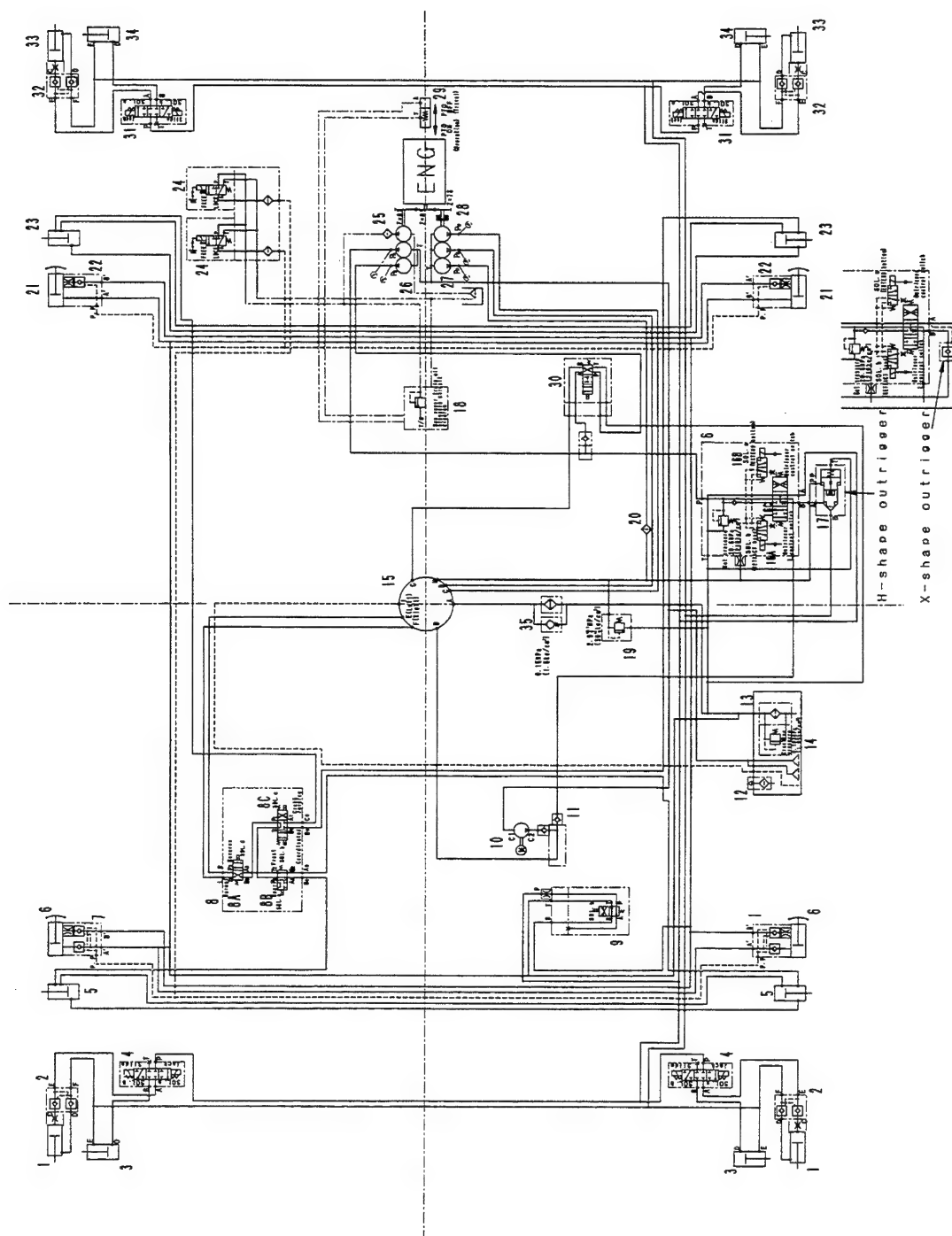
023S05

1. Swing control valve
 - 1A. Spool
2. Swing FREE/LOCK selector valve
3. Swing brake
4. Swing motor
5. Swing holding brake valve
6. Steering unit
7. Check valve
8. Line strainer
9. Priority valve
10. Center swivel
11. No. 1 telescope cylinder
12. No. 2 telescope cylinder
13. Telescope hose reel
14. No. 1/No. 2 cylinder selector valve
15. Boom hoist cylinder
16. Boom shaft weight sensor
17. Main control valve
 - 5-spool : (Machine with power tilt jib)
 - 4-spool : (Machine with manual tilt jib)
 - 17A. Auxiliary winch valve
 - 17B. Main winch valve
 - 17C. Boom telescope valve
 - 17D. Boom hoist valve
 - 17E. Flow control valve
 - 17F. Power tilt valve
(Machine with power tilt jib)
 - 17G. Flow control valve
18. Unload pilot valve
19. Jib unload valve
(Machine with power tilt jib)
20. Max. flow control valve
21. Charge valve
22. Overrun prevention valve
23. Air conditioner drive motor
24. Accumulator
25. Pressure switch
26. Winch clutch valve
27. Free wheel clutch
28. Brake cylinder
29. Brake master
30. Counterbalance valve
31. Main winch motor
32. Auxiliary winch motor
33. Counterbalance valve
34. Power tilt hose reel
(Machine with power tilt jib)
35. Swivel joint
(Machine with power tilt jib)
36. Power tilt cylinder
(Machine with power tilt jib)
37. Pilot valve
(boom hoist, main winch, auxiliary winch)
38. Pilot valve (boom telescope)
39. Pilot valve
(auxiliary winch and boom telescope)
40. Pilot valve (power tilt jib, swing)

023S05

LOWER

★ For details of this page, see page 90-13.



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023S05

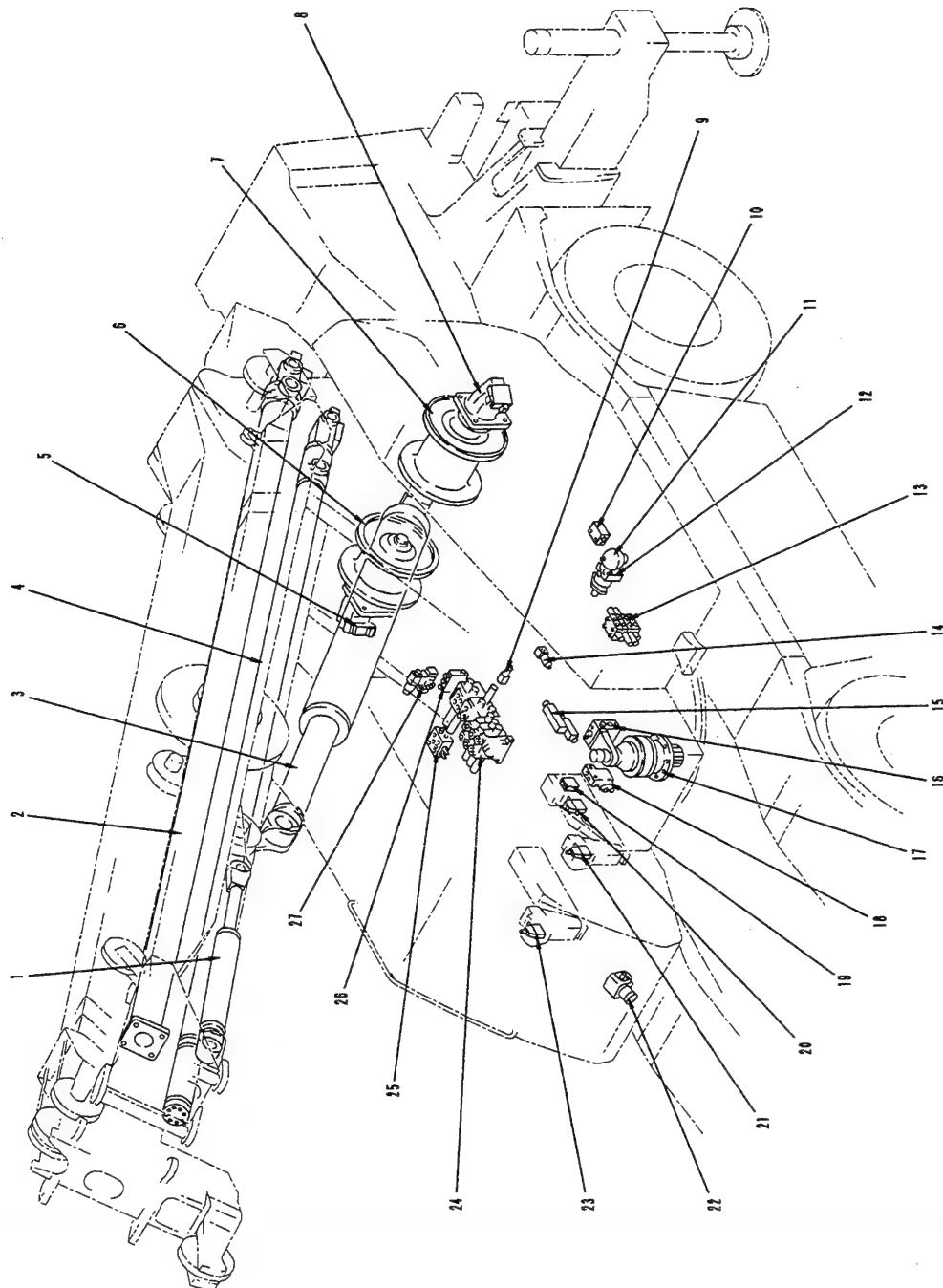
1. Jack cylinder
2. Pilot double check valve
3. Slide cylinder
4. Outrigger individual valve
5. Steering cylinder
6. Suspension lock cylinder
7. Pilot double check valve
8. Steering mode selector solenoid valve
 - 8A. Reverse steering compensation solenoid valve
 - 8B. Rear wheel steering solenoid valve
 - 8C. 4-wheel steering and rear reverse steering solenoid valve
9. Suspension selector solenoid valve
10. Emergency steering electrical pump
11. Check valve
12. Breather
13. Filter
14. Hydraulic tank
15. Center swivel
16. Outrigger selector valve
 - 16A. Solenoid valve
 - 16B. Solenoid valve
 - 16C. Spool
17. Check valve
18. Power train hydraulic circuit
19. PPC relief valve
20. PPC line filter
21. Suspension lock cylinder
22. Pilot check valve
23. Steering cylinder
24. Suspension lock selector solenoid valve
25. Transmission filter
26. Hydraulic pump
27. Hydraulic pump
28. PTO clutch
29. Engine speed set cylinder
30. Swing, outrigger merge selector valve
31. Outrigger individual valve
32. Pilot check valve
33. Jack cylinder
34. Slide cylinder
35. Oil cooler

WORK EQUIPMENT, STEERING HYDRAULIC EQUIPMENT DRAWING (1/3)

UPPER STRUCTURE

★ For details of this page, see page 90-15.

1. Power tilt cylinder
(Machine with power tilt jib)
2. Boom No. 2 telescope cylinder
3. Boom hoist cylinder
4. Boom No. 1 telescope cylinder
5. Auxiliary winch motor
6. Auxiliary winch drum
7. Main winch drum
8. Main winch motor
9. Jib unload valve
(Machine with power tilt jib)
10. Cab cooler check valve
11. Accumulator
12. Air conditioner compressor
drive motor
13. Swing valve
14. Swing holding brake solenoid
valve
15. Max. flow control valve
16. Swing FREE/LOCK selector
valve
17. Swing motor
18. Priority valve
19. Auxiliary winch and telescope
pilot valve (pedal)
20. Telescope pilot valve
21. Swing & tilt pilot valve
22. Steering unit
23. Boom, winch pilot valve
24. Main control valve
25. Winch clutch valve
26. Unload pilot valve
27. Boom telescope selector valve



SLL00321

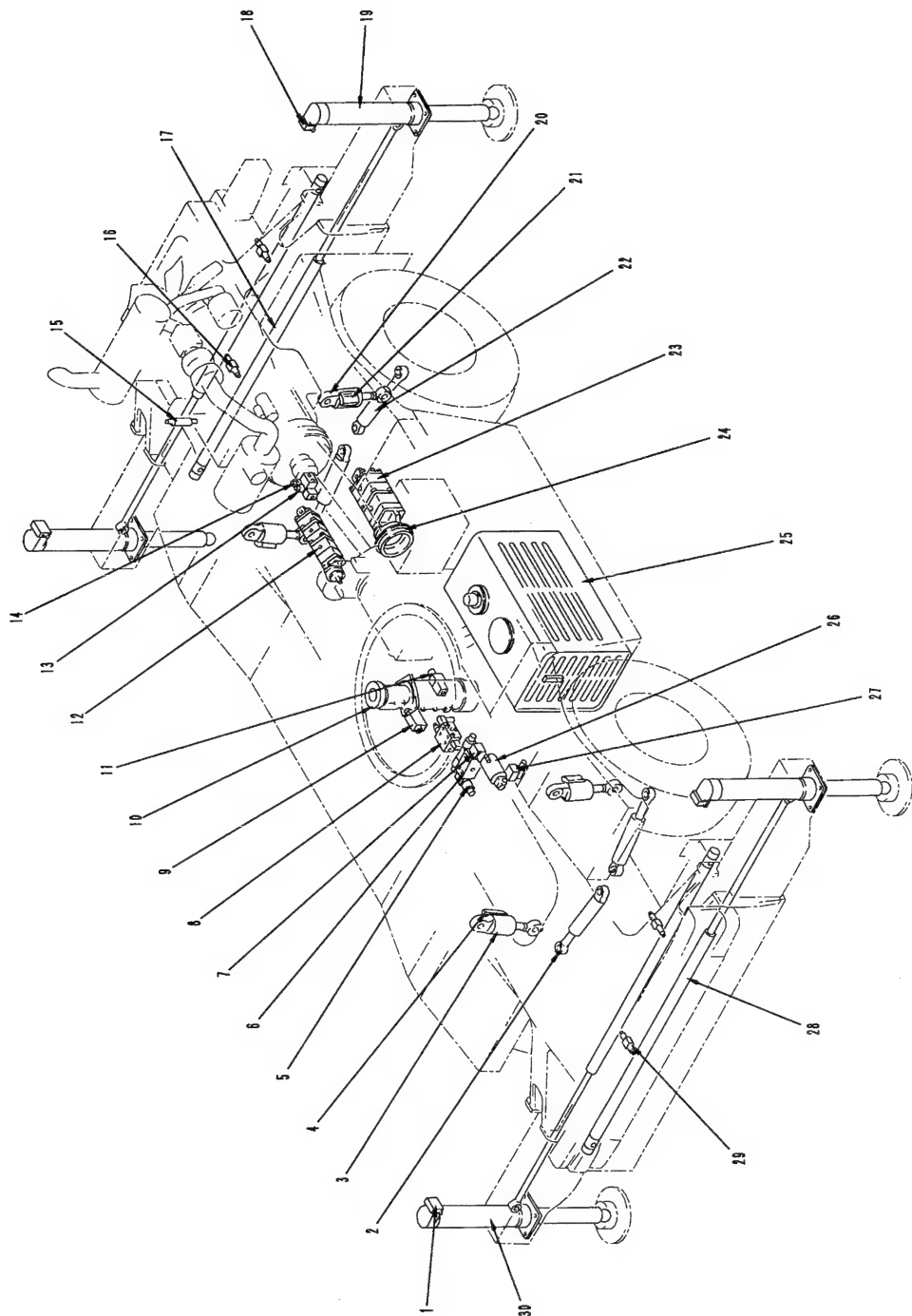
023S05

WORK EQUIPMENT, STEERING HYDRAULIC EQUIPMENT DRAWING (2/3)

UNDERCARRIAGE H-SHAPED OUTRIGGER SPECIFICATION

★ For details of this page, see page 90-17.

1. Outrigger jack pilot check valve
2. Steering cylinder
3. Suspension lock cylinder
4. Suspension lock double pilot check valve
5. Reverse steering selector valve
6. Steering mode selector valve
7. Rear wheel steering selector valve
8. Outrigger selector valve
9. Outrigger slide pilot check valve
10. Center swivel joint
11. Swing, outrigger merge selector valve
12. Transmission, steering, outrigger, swing pump
13. Suspension selector solenoid valve (front)
14. Suspension selector solenoid valve (rear)
15. Engine speed set cylinder
16. Outrigger individual valve
17. Outrigger slide cylinder
18. Outrigger jack pilot check valve
19. Outrigger jack cylinder
20. Outrigger lock cylinder
21. Suspension lock pilot check valve
22. Steering cylinder
23. Hydraulic pump
24. PTO hydraulic clutch
25. Hydraulic tank
26. Emergency steering motor
27. Suspension selector solenoid valve
28. Outrigger slide cylinder
29. Outrigger individual valve
30. Outrigger jack cylinder



SLL00322

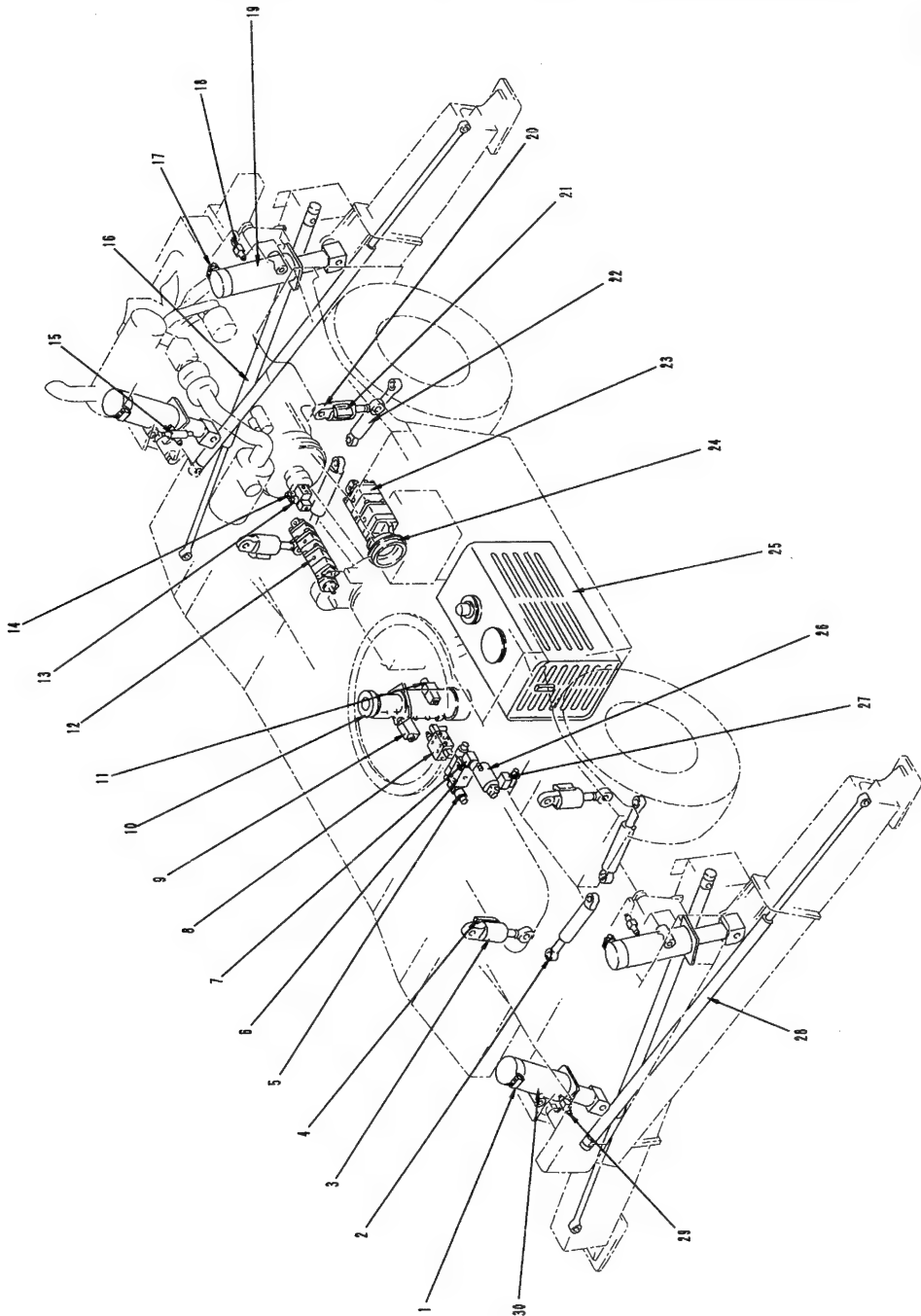
023S05

WORK EQUIPMENT, STEERING HYDRAULIC EQUIPMENT
DRAWING (3/3)

UNDERCARRIAGE
X-SHAPED OUTRIGGER SPECIFICATION

★ For details of this page, see page 90-19.

- 1. Outrigger jack pilot check valve
- 2. Steering cylinder
- 3. Suspension lock cylinder
- 4. Suspension lock double pilot check valve
- 5. Reverse steering selector valve
- 6. Steering mode selector valve
- 7. Rear wheel steering selector valve
- 8. Outrigger selector valve
- 9. Outrigger slide pilot check valve
- 10. Center swivel joint
- 11. Swing, outrigger merge selector valve
- 12. Transmission, steering, outrigger, swing pump
- 13. Suspension selector solenoid valve (front)
- 14. Suspension selector solenoid valve (rear)
- 15. Engine speed set cylinder
- 16. Outrigger slide cylinder
- 17. Outrigger jack pilot check valve
- 18. Outrigger individual valve
- 19. Outrigger jack cylinder
- 20. Suspension lock cylinder
- 21. Suspension lock pilot check valve
- 22. Steering cylinder
- 23. Hydraulic pump
- 24. PTO hydraulic clutch
- 25. Hydraulic tank
- 26. Emergency steering motor
- 27. Suspension selector solenoid valve
- 28. Outrigger slide cylinder
- 29. Outrigger individual valve
- 30. Outrigger jack cylinder



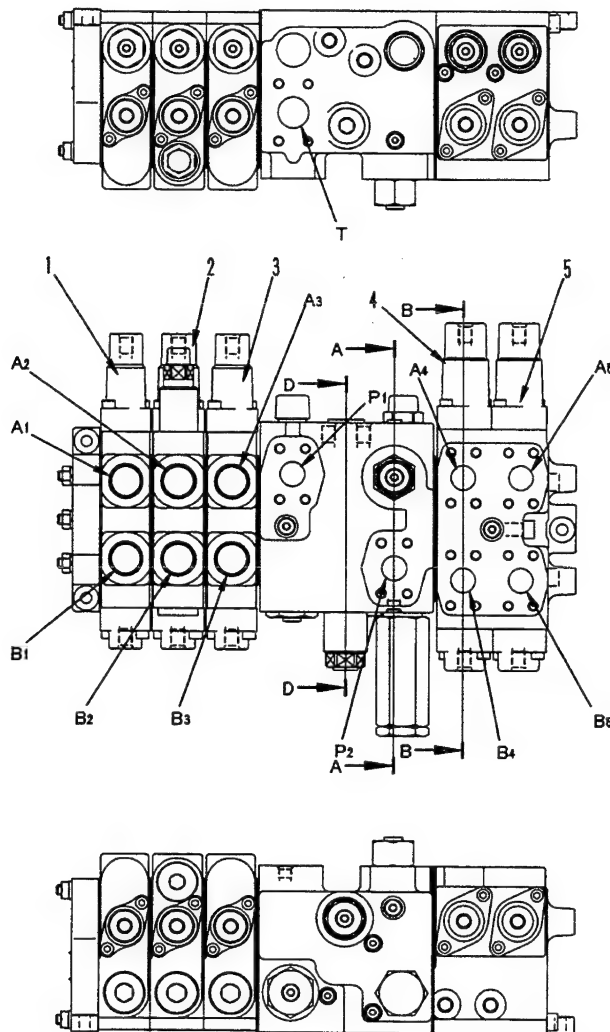
S.L.00323

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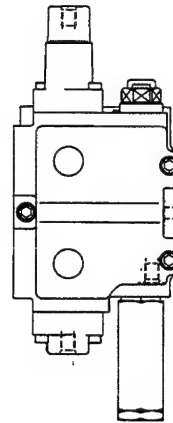
MAIN CONTROL VALVE

5-spool valve : Machine with power tilt jib

4-spool valve : Machine with manual tilt jib



1. Power tilt jib valve
(Machine with power tilt jib)
2. Boom hoist valve
3. Boom telescope valve
4. Auxiliary winch valve
5. Main winch valve



SKL00325

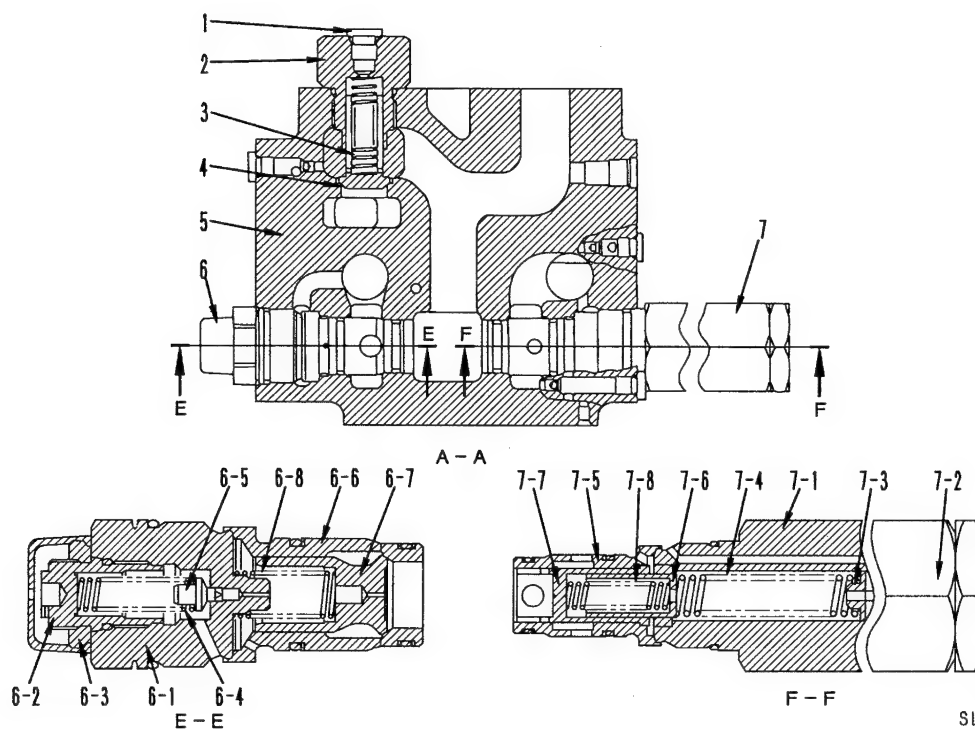
- P1 : From boom pump
 P2 : From winch pump
 T : To hydraulic tank
 A1 : To jib LOWER (cylinder bottom)
 A2 : To boom LOWER (hoist cylinder head)
 A3 : To boom RETRACT (telescope cylinder head)
 A4 : To auxiliary winch (wind out)
 A5 : To main winch (wind out)
 B1 : To jib RAISE (cylinder head)
 B2 : To boom RAISE (hoist cylinder bottom)
 B3 : To boom EXTEND
 (telescope cylinder bottom)
 B4 : To auxiliary winch (wind in)
 B5 : To main winch (wind in)

Outline

- The main control valve is a 5-spool valve with 5 sets of selector valves and pressure control valves for the boom, winch, and power tilt. The valves for the boom are in the circuit between the boom pump and the boom hoist, boom telescope, and power tilt cylinder; the winch valve is in the circuit between the winch pump and the main winch and auxiliary winch motors.

Control valve for machine with manual tilt jib consists a 4-spool valve with 4 sets of selector valves and pressure control valve. Power tilt jib valve is eliminated.

Relief valves with unload valve are assembled at the inlet port of the boom circuit and the inlet port of the winch circuit. The back-pressure ports have a circuit to the unload pilot valve, which is related to the overload prevention system. It is designed to lower the actuation pressure if any abnormality should occur. The explanation here is an explanation of the boom control valve.

WINCH RELIEF VALVE**WINCH FLOW CONTROL VALVE**

SLD00326

1. Plug
2. Plug
3. Plunger
4. Plunger
5. Valve block
6. Winch relief valve
- 6-1. Body
- 6-2. Adjustment screw
- 6-3. Nut
- 6-4. Spring
- 6-5. Poppet
- 6-6. Body
- 6-7. Plunger
7. Winch flow control valve
- 7-1. Body
- 7-2. Plug
- 7-3. Spring seat
- 7-4. Spring
- 7-5. Body
- 7-6. Spring seat
- 7-7. Plunger
- 7-8. Spring

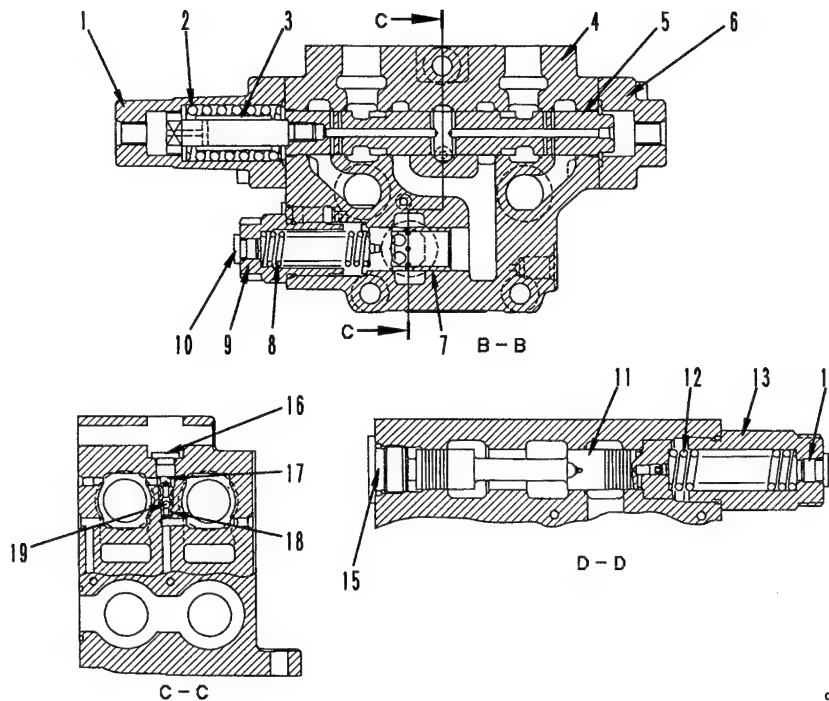
OUTLINE**1. Winch relief valve**

- The winch relief valve is a cartridge type and consists of a hydraulic relief and main poppet.
- The winch relief valve (6-1 – 6-5) sets the hydraulic pressure in the winch circuit to 20.6 MPa {210 kg/cm²}. The spring chamber of plunger poppet (6-7) is interconnected with the unload pilot valve which is related electrically with the overload prevention system.

2. Winch flow control valve

- With flow control valve (7-1 – 7-8), when the two sets of winch valves are at the neutral position, the back pressure port is connected to the return circuit through the shuttle valve of the winch valve. This returns the oil from the winch pump to the return circuit at low pressure. The shuttle valve switches the high-pressure pilot pressure from the winch valve MAIN WINCH circuit or AUXILIARY WINCH circuit and sends it to the back-pressure port of the flow control valve.

WINCH VALVE



SLD00327

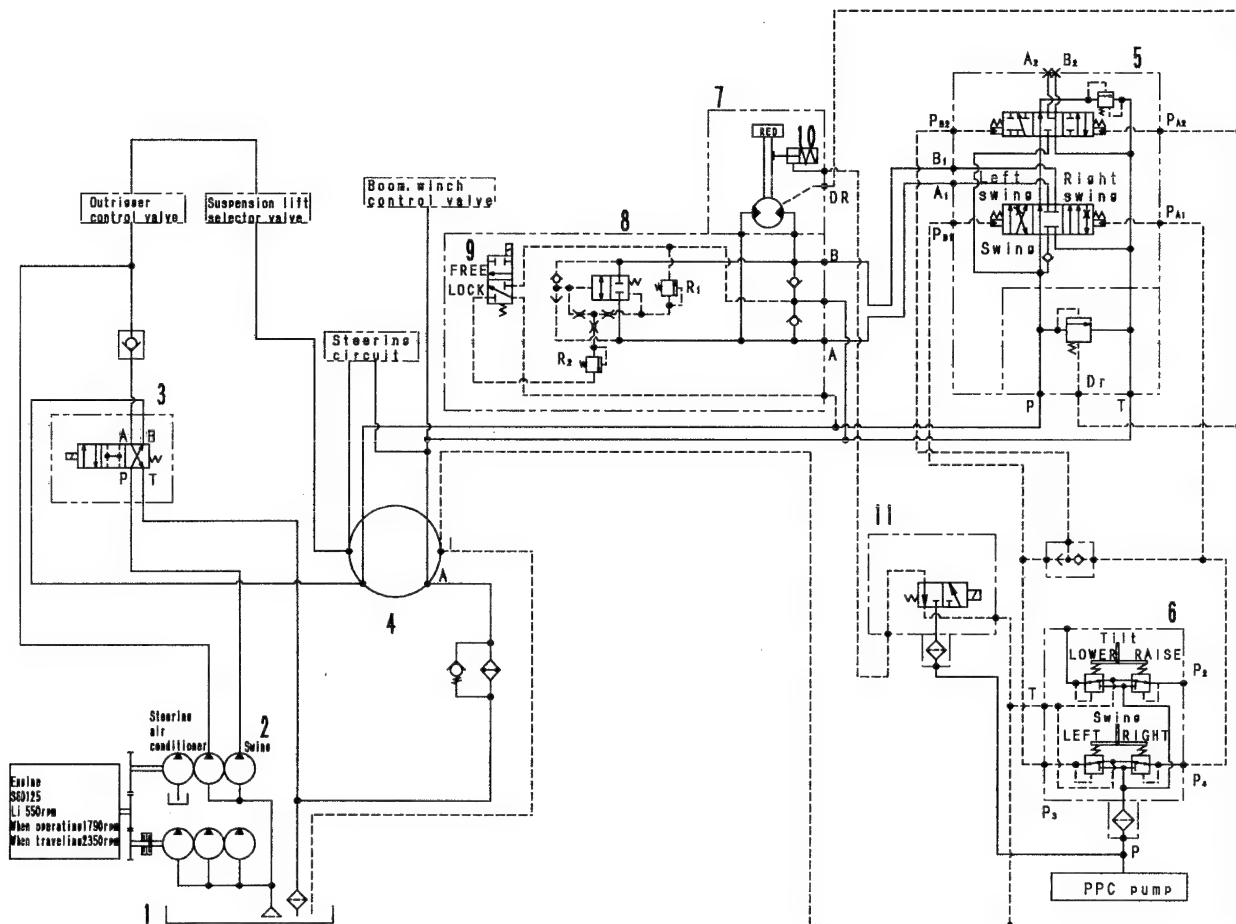
1. Cover
2. Spring
3. Bushing
4. Body
5. Spool
6. Cover
7. Plunger
8. Spring
9. Plug
10. Plug
11. Spool
12. Spring
13. Plug
14. Plug
15. Plug
16. Plug
17. Guide
18. Valve seat
19. Ball

Outline

- The same type of winch valve is used for the main winch and the auxiliary winch. They each consist of a valve spool, shuttle valve assembly, and pressure compensation valve.
- Valve spool (5) can be switched to three operating positions: "WIND IN", "WIND OUT", and "NEUTRAL".
- Shuttle valve (11) – (14) covers the main winch and auxiliary winch, and when the valve spools are at the neutral position, the pilot pressure to the flow control valve is relieved and the oil from the winch pump is returned from the flow control valve to the return circuit.
- Pressure compensation valve (7) – (10) supplies oil to the valve spool in accordance with the amount the spool is open, regardless of the load on the main winch and auxiliary winch.
- Merge valve (11) – (15) merges the oil from the boom pump with the oil from the winch pump, and sends it to the winch to wind in or wind out the line at high speed.

The boom circuit is the priority circuit, so during boom telescope or hoist operations, only the excess oil from the boom circuit flows to the winch circuit.

SWING HYDRAULIC SYSTEM



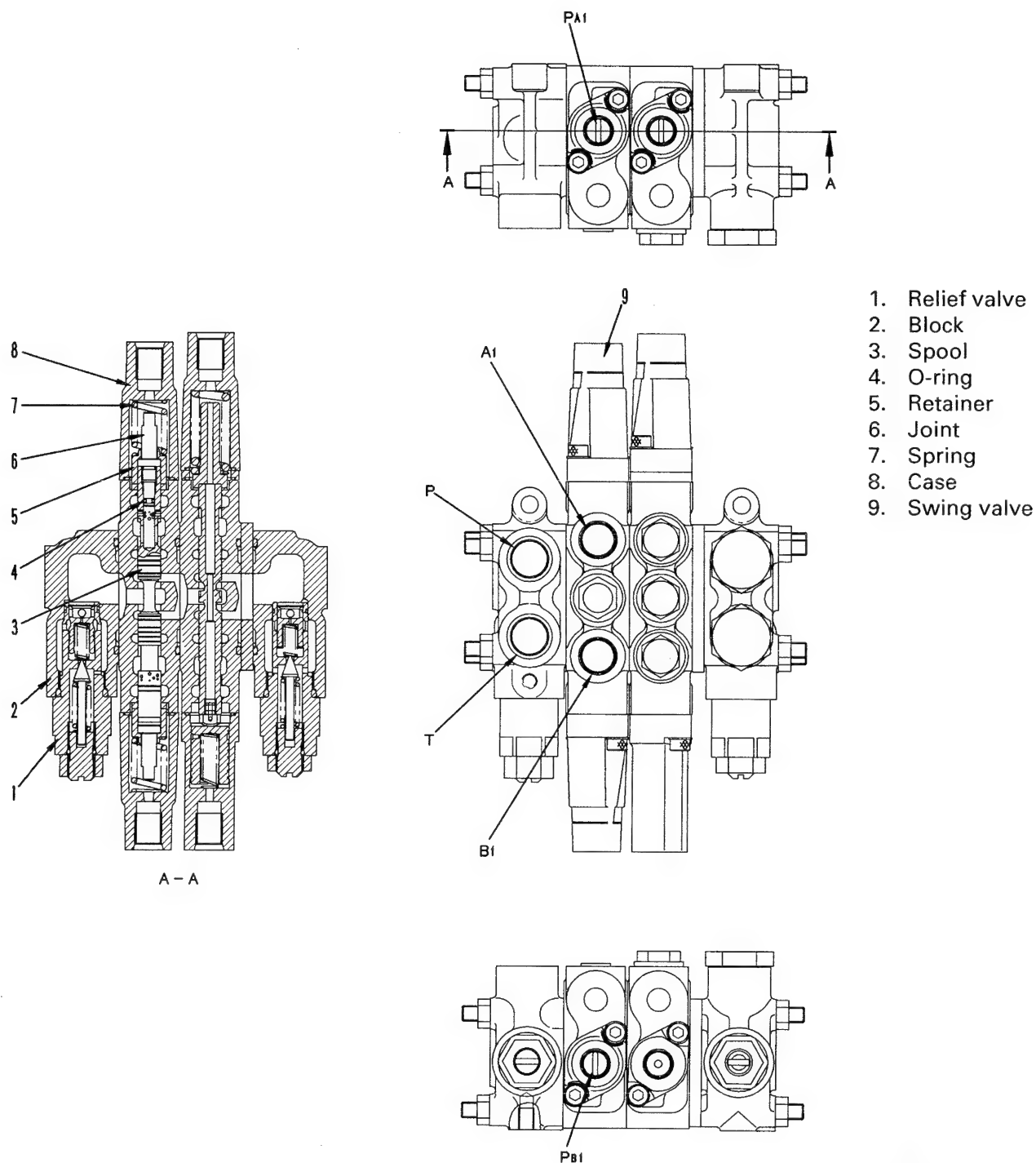
SKL01102

1. Hydraulic tank
2. Swing pump
3. Swing pump, outrigger merge selector valve
4. Center swivel joint
5. Swing valve
6. Pilot valve
7. Swing motor
8. Swing brake valve
9. Parking valve
10. Swing holding brake valve

Outline

- The swing hydraulic system consists of steering pump (2), and the motor and valves operated by the swing lever in the operator's compartment.
- The oil in hydraulic tank (1) is sucked up by swing pump (2), passes through outrigger and pump merge selector valve (3), and is then supplied to the swing circuit.
The oil supplied to the swing circuit enters swing valve (5).
When the lever (swing lever) of pilot valve (6) is operated, the pilot control pressure flows to swing valve (5), the spool of swing valve (5) is actuated, pressure oil is sent from swing pump (2) to the swing motor, rotates swing motor (7), and the upper structure swings on the swing circle.
- If FREE/LOCK selector valve (9) inside swing brake valve (8) is set to the FREE position and the swing lever is returned to the neutral position during swing operations, a suitable oil pressure is applied to the swing motor by swing brake valve (8) to make it easy to stop the swing smoothly.
If FREE/LOCK selector valve (9) is set to the LOCK position and the swing lever is returned to the neutral position during swing operations, pressure oil is supplied to the swing motor in accordance with the movement of the lever, so it is easy to stop the swing at the desired position.
- Braking force is applied to the swing brake inside swing motor (7) by a spring.
- The swing holding brake is a valve to cancel the swing brake. It cancels the swing brake by applying the pilot pressure to the opposite end of the swing brake spring chamber.

SWING VALVE

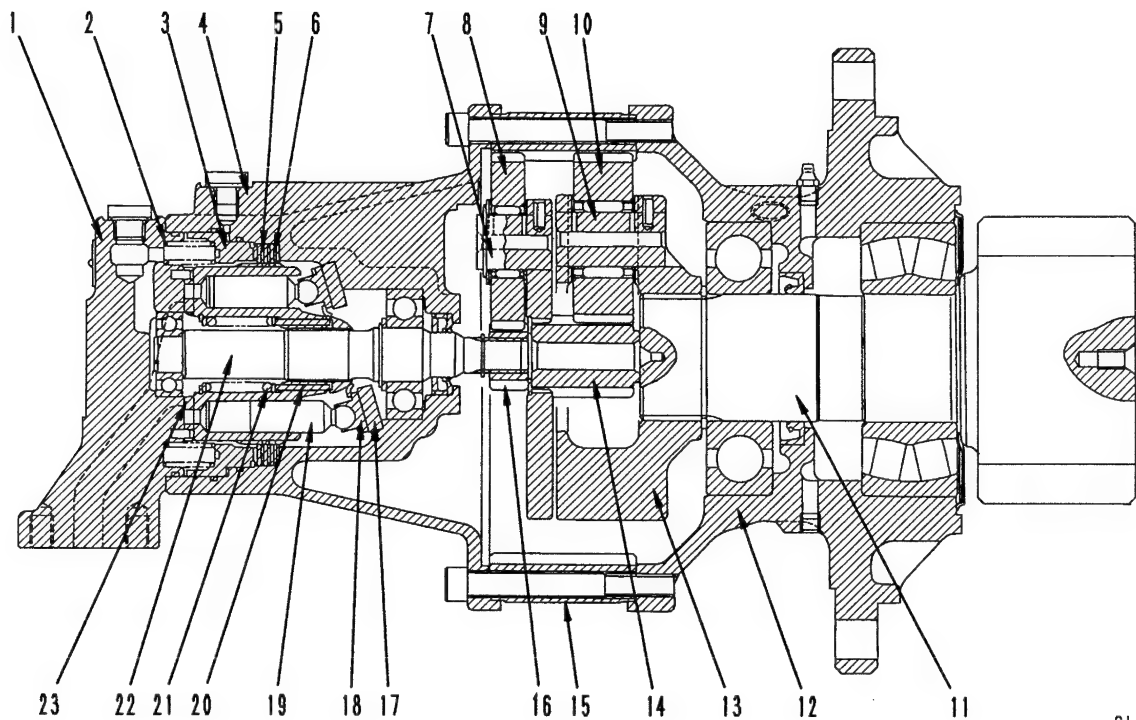


- A1 : To swing motor (right swing)
 B1 : To swing motor (left swing)
 P : From swing pump
 (from outrigger merge selector valve)
 T : To hydraulic tank
 PA1 : PPC valve (left swing)
 PB1 : PPC valve (right swing)

Outline

- The swing control valve is actuated by the operation of the swing PPC valve lever (swing control lever) on the left side of the operator's compartment. It acts to switch the direction of rotation of the swing motor.

SWING MOTOR, MACHINERY



SLL00330

- | | | |
|----------------------|-----------------------|---------------------|
| 1. Valve cover | 9. Pin No. 2 | 17. Shoe plate |
| 2. Spring, brake | 10. Planet gear No. 2 | 18. Shoe |
| 3. Brake piston | 11. Drive shaft | 19. Piston |
| 4. Casing C2 | 12. Casing | 20. Push rod |
| 5. Separator plate | 13. Carrier No. 2 | 21. Cylinder spring |
| 6. Friction plate | 14. Sun gear No. 2 | 22. Drive shaft |
| 7. Pin No. 1 | 15. Ring gear | 23. Valve plate A |
| 8. Planet gear No. 1 | 16. Sun gear No. 1 | |

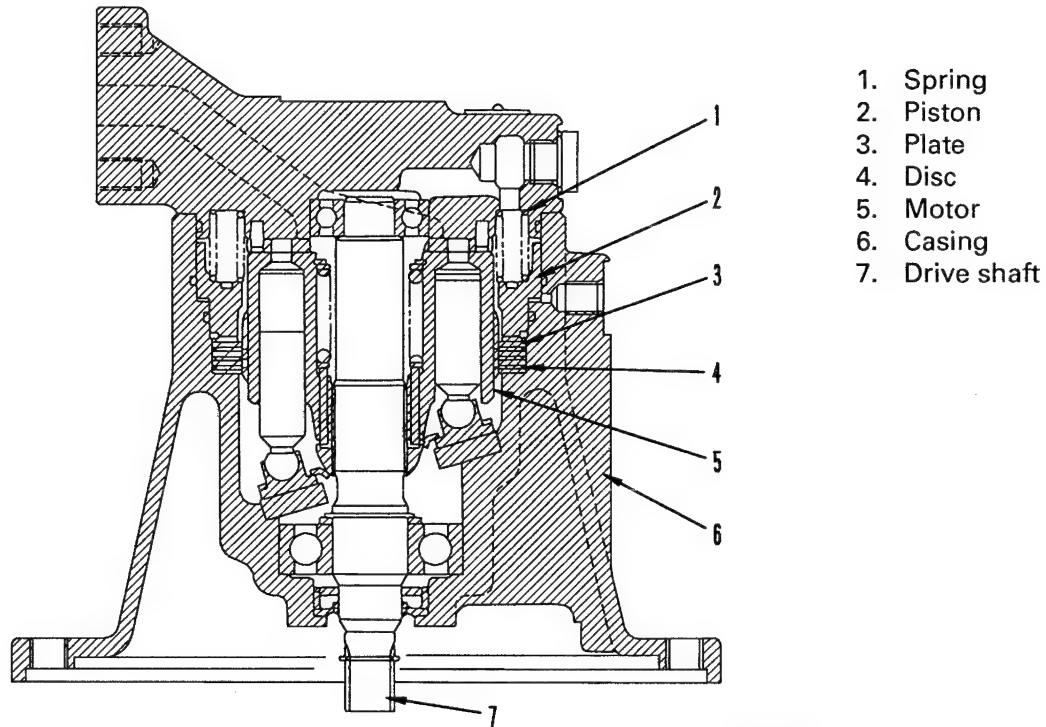
Outline

- The swing motor can be broadly divided into two parts: the hydraulic motor and the swing machinery.
- The hydraulic motor is a swash plate, axial piston type motor. Nine sets of pistons (19) slide under the pressure of oil entering the cylinder from the oil pressure port of valve cover (1). This rotates the cylinder and makes the drive shaft rotate.
- The swing machinery is a 2-stage reduction system consisting of No. 1 sun gear (16), No. 1 planet gear (8), and ring gear (15), and through this ring gear, No. 2 planet gear (8) and No. 2 sun gear (14). It acts to reduce the rotating speed from the hydraulic motor and increases the swing force, and reduces the swing speed to a suitable speed.

023S05

SWING HOLDING BRAKE AND BRAKE SOLENOID VALVE

SWING HOLDING BRAKE



SLL00331

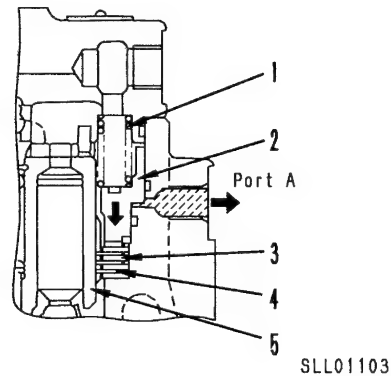
023S05

Outline

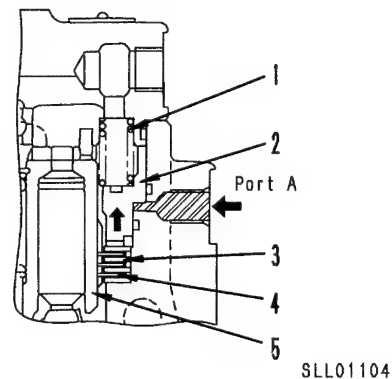
- The swing holding brake is a multiple disc brake, and is used when the swing motor is kept continuously in a stop condition. It must not be used for braking the motor during the swing operation.

Operation

- When swing holding brake lever is applied
If the switch is set to the ON position, the oil at port A is returned to the tank. When this happens, piston (2) is returned in the downward direction by the tension of spring (1), plate (3) and disc (4) are brought into tight contact, and motor (5) and the casing are fixed in position. Drive shaft (7) is interconnected with the gear shaft, so the swing structure is fixed and the holding brake is applied.
- When swing holding brake lever is released
If the switch is set to the OFF position, pilot pressure is applied to port A, so piston (2) compresses spring (1) and moves up. This movement creates a clearance between plate (3) and disc (4), so motor (5) and the casing are set free and the holding effect is removed.

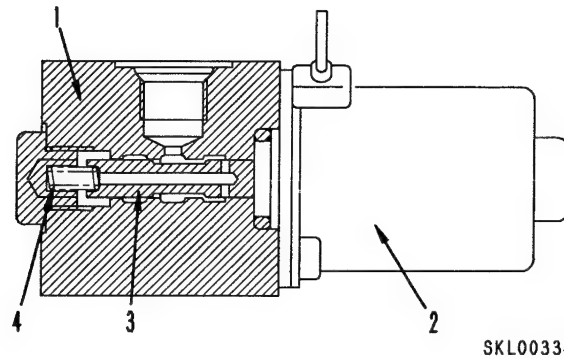


SLL01103



SLL01104

BRAKE SOLENOID VALVE



1. Body
2. Solenoid
3. Spool
4. Spring
5. Plug

Outline

- The brake solenoid valve is a solenoid valve which switches the entry and exit of pressure oil to the multiple disc brake of the swing holding brake.

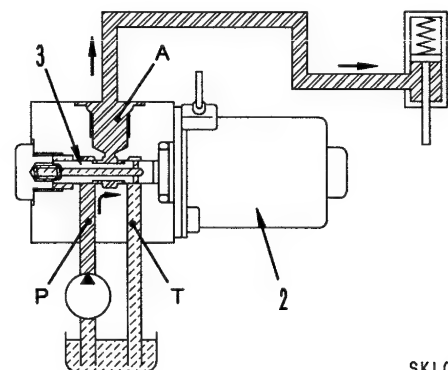
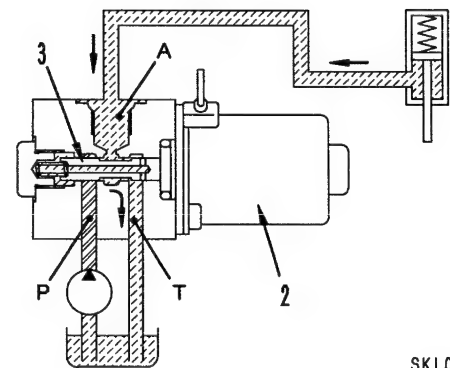
Operation

1. When the swing holding brake switch is at the ON position, if the swing brake switch on the front panel inside the operator's compartment is set to the ON position, current is not flowing in swing holding brake solenoid valve (2), so spool (3) inside the valve does not move. The oil at swing motor brake port A flows from port A of the valve to port T and is returned to the tank.

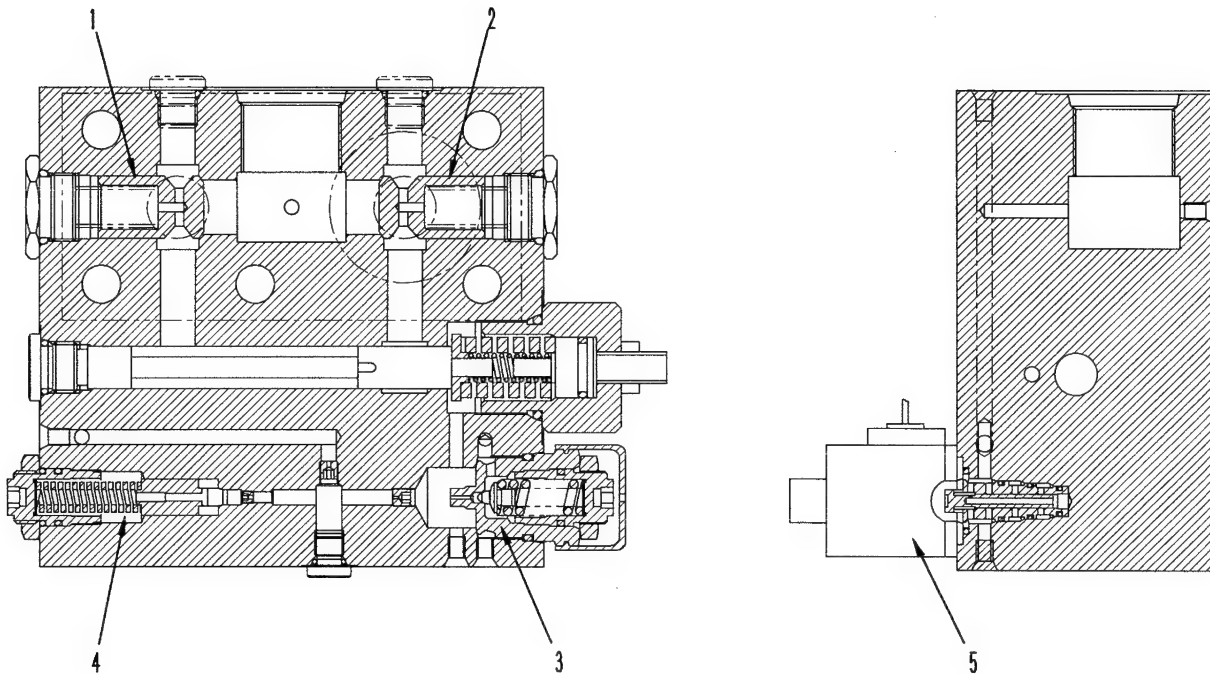
Therefore, the brake is applied.

2. When the swing holding brake switch is OFF, if the swing brake switch on the front panel inside the operator's compartment is set to the OFF position, electricity flows through swing holding brake solenoid valve (2), so spool (3) moves, valve port P and port A are connected, and at the same time, port T is shut OFF.

As a result, the pressurized oil from the PPC pump flows from port P through port A, enters port A of the swing motor brake, and the brake is released.



SWING BRAKE VALVE



SKL00337

023S05

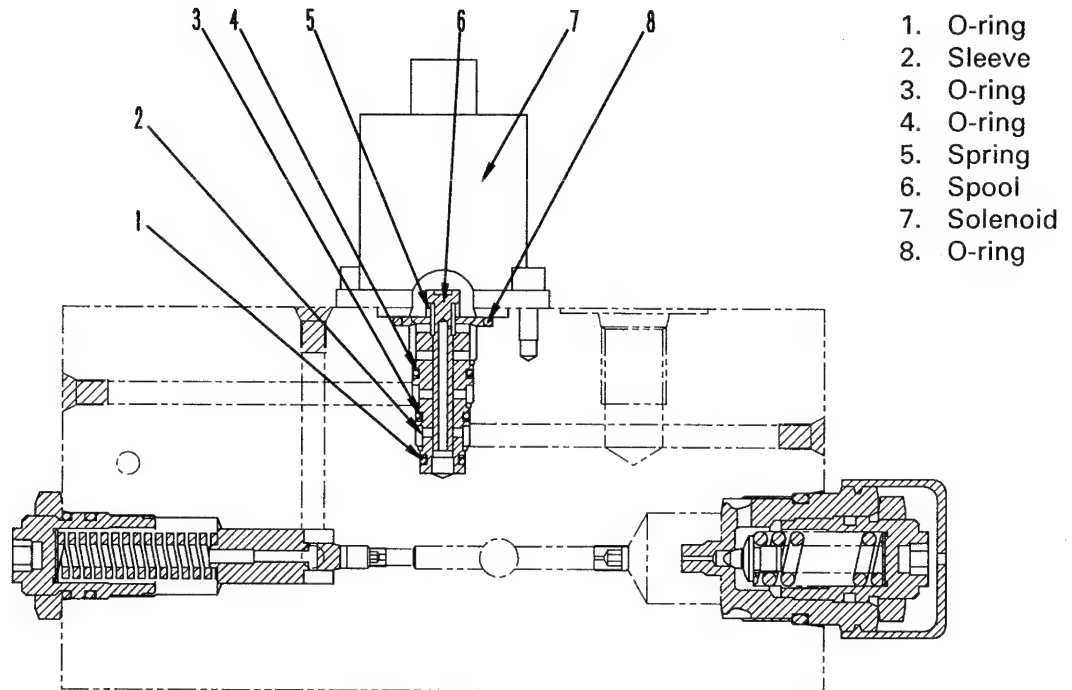
1. Anti-cavitation check valve
2. Anti-cavitation check valve
3. High-pressure setting relief valve
4. Low-pressure setting relief valve
5. Swing FREE/LOCK selector valve

Outline

- The swing brake valve is in the circuit between the hydraulic motor and the swing control valve. When the selector valve is operated to stop the machine, it functions to raise the brake pressure to a suitable pressure to apply braking force.
- The swing brake valve has the following four functions.
 - 1) Low-pressure setting relief valve to generate braking pressure when the swing is stopped at the FREE position
 - 2) High-pressure setting relief valve to protect the swing motor circuit

- 3) Anti-cavitation valve to prevent negative pressure in the swing motor when stopping (particularly when swinging at high speed)
- 4) Solenoid selector valve to switch the brake pressure between high and low pressure (swing FREE/LOCK selector valve)
When the brake pressure is used at the high pressure side, it is called THE LOCK CIRCUIT; and when the brake pressure is used at the low pressure side, it is called THE FREE CIRCUIT.

SWING FREE/LOCK SELECTOR VALVE



1. O-ring
2. Sleeve
3. O-ring
4. O-ring
5. Spring
6. Spool
7. Solenoid
8. O-ring

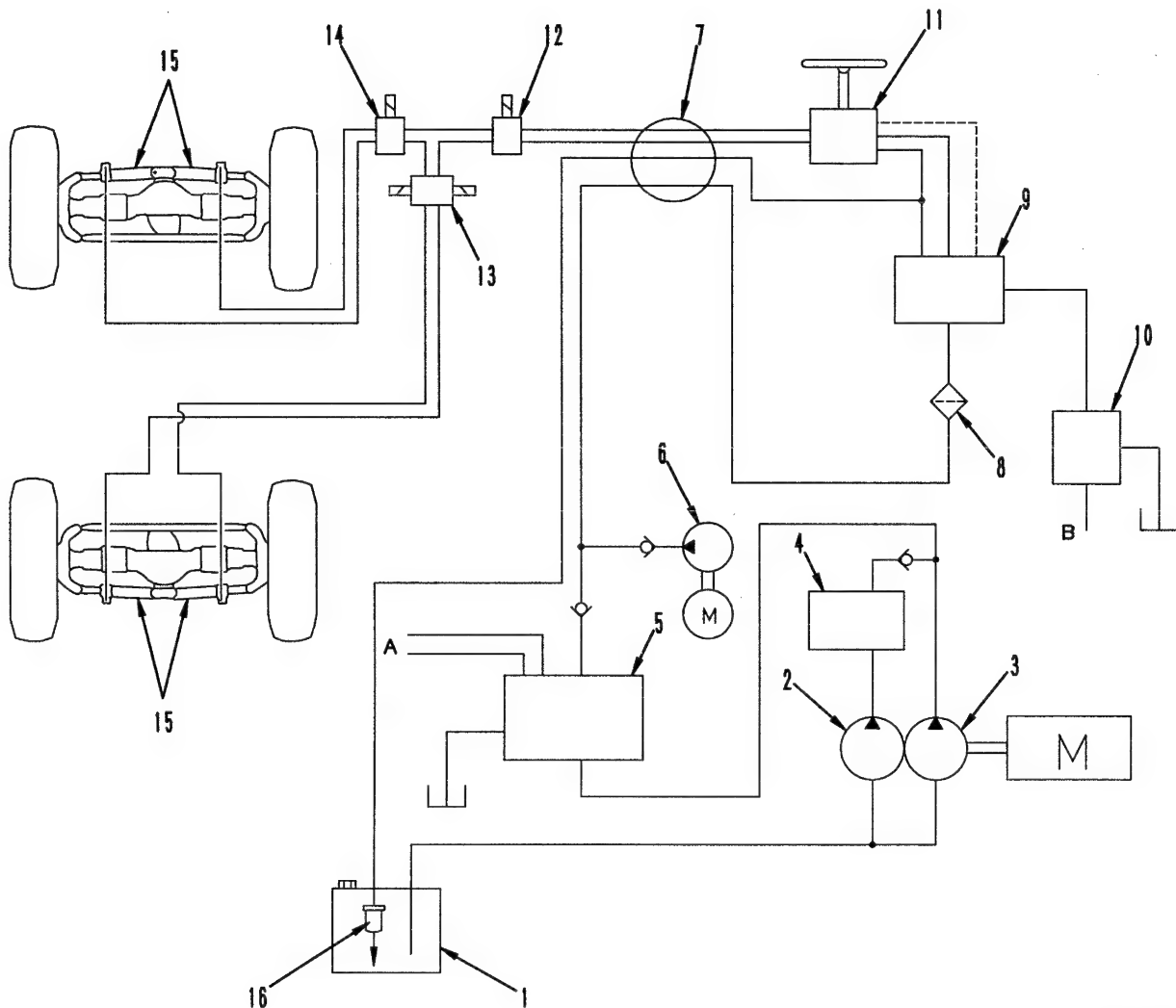
023S05

SKL00338

Outline

- The swing FREE/LOCK selector valve is part of the swing brake valve, and the FREE/LOCK circuit acts to shut in (LOCK) the swing motor pressure or release (FREE) it at a suitable pressure when stopping the swing.
- The swing FREE/LOCK selector valve releases the pressure generated by the swing motor from the brake valve when the FREE/LOCK selector switch is at the FREE position. This reduces the motor pressure and makes it easy to stop smoothly when stopping the swing.
- When the FREE/LOCK selector switch is set to the LOCK position and the swing lever is returned to the neutral position, pressure oil is supplied according to the operation of the lever. The pressure generated by the swing motor cannot escape from the brake valve, so it is easy to stop at the desired position when stopping the swing.
When the swing control lever is at the neutral position and external force tries to rotate the upper structure, the swing motor pressure does not escape, so the swing motor is held in position.

STEERING HYDRAULIC SYSTEM



SLL00339

- | | |
|---|---|
| 1. Hydraulic tank | 10. Flow control valve |
| 2. Swing pump | 11. Steering unit |
| 3. Steering pump | 12. Reverse steering compensation valve |
| 4. Swing pump, outrigger merge selector valve | 13. Steering mode selector valve |
| 5. Outrigger control valve | 14. Rear wheel steering selector valve |
| 6. Emergency steering pump | 15. Steering cylinder |
| 7. Center swivel joint | 16. Hydraulic filter |
| 8. Line filter | A. To outrigger |
| 9. Priority valve | B. To cab cooler circuit |

023S05

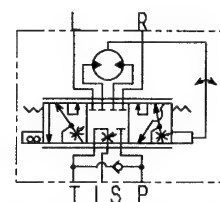
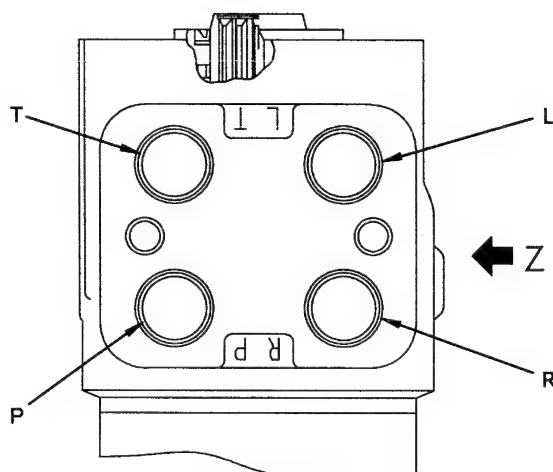
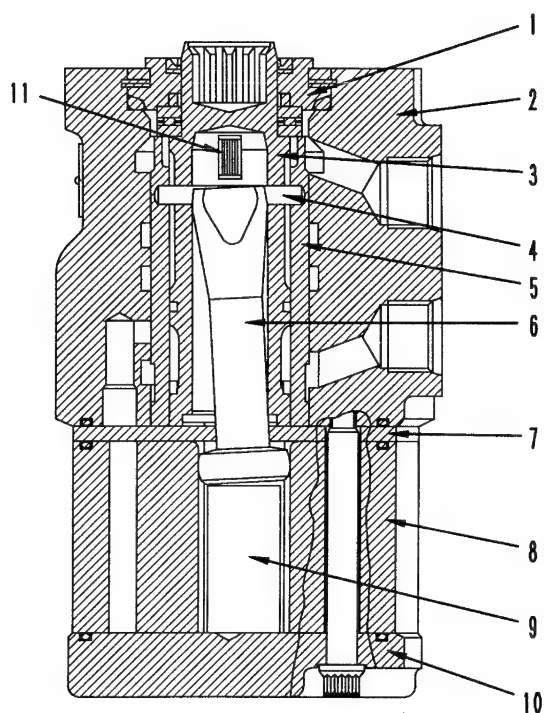
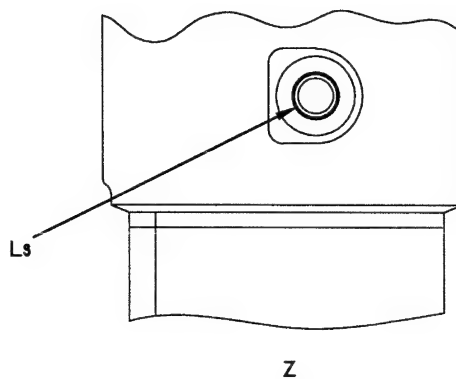
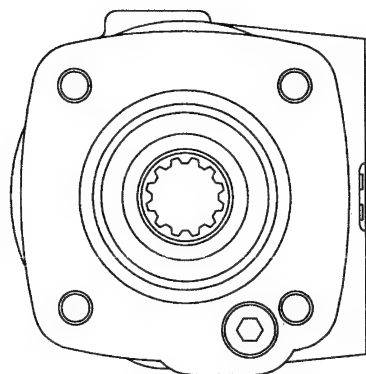
Outline

- The steering hydraulic system consists of steering pump (3), swing pump (2), steering unit (11) in the operator's compartment, the valves actuated by the switches, and the cylinders.
- The oil in hydraulic tank (1) is sucked up by steering pump (3), passes through line filter (8), and enters priority valve (9) where it is divided efficiently between the steering circuit and the cab cooler (air conditioner) circuit.
- When the engine is running at low speed, the oil discharged from swing pump (2) is merged with the steering circuit by merge selector valve (4) to improve the steering performance when the engine is running at low speed.
- The oil divided and sent to the steering circuit enters steering cylinder (15) by the action of steering unit (11), and determines the direction of travel of the machine.

When the steering mode switch in the operator's compartment is operated, mode selector valve (13) or rear wheel steering selector valve (14) are actuated to make it possible to choose between 2-wheel steering (front wheels or rear wheels) and 4-wheel steering.

When the upper structure is swung and faces the rear, if the reverse steering compensation switch is operated, and case of front 2-wheel steering or 4-wheel steering is used, reverse steering compensation valve (12) is actuated. In the case of rear 2-wheel steering, mode selector valve (13) and rear-wheel steering selector valve (14) are actuated. This switches the left and right circuits to steering cylinder (15), so even when the upper structure is facing the rear, the same steering wheel operation is possible as when the upper structure is facing the front (the machine travels in the same direction as the steering wheel is turned).

STEERING UNIT (ORBIT ROLL UNIT)



Hydraulic circuit diagram

SKL01105

1. Gland
2. Housing
3. Spool
4. Center pin
5. Sleeve
6. Drive shaft
7. Spacer
8. Gerotor
9. Spacer

10. End cover
11. Centering spring

- L. To left steering cylinder
 R. To right steering cylinder
 P. From steering pump
 T. To tank
 LS. Load sensing port

023S05

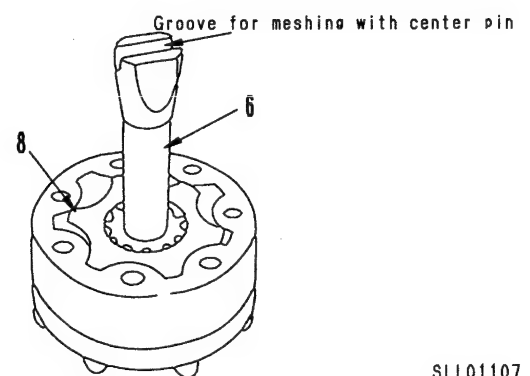
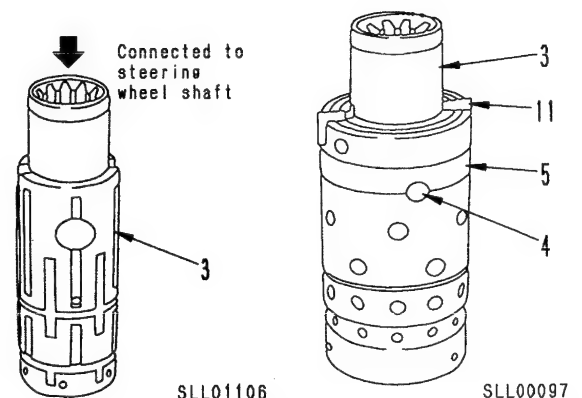
Outline

- The steering unit is connected directly to the shaft of the steering wheel. It switches the flow of oil from the steering pump to the left and right steering cylinders to determine the direction of travel of the machine.
- The steering unit, broadly speaking, consists of the following components: rotary type spool (3) and sleeve (5) which have the function of selecting the direction, and Gerotor (8) which acts as a hydraulic motor during normal steering operations, and as a hand pump (in fact, the operating force of the steering wheel is too high, so it cannot be operated) when the steering pump or engine have failed and the supply of oil has stopped.
- Even when the steering wheel is at the neutral position, the steering unit is a dynamic signal type which sends the oil from the load sensing (LS) port to the drain port. This improves the steering response when starting in cold weather.

Structure

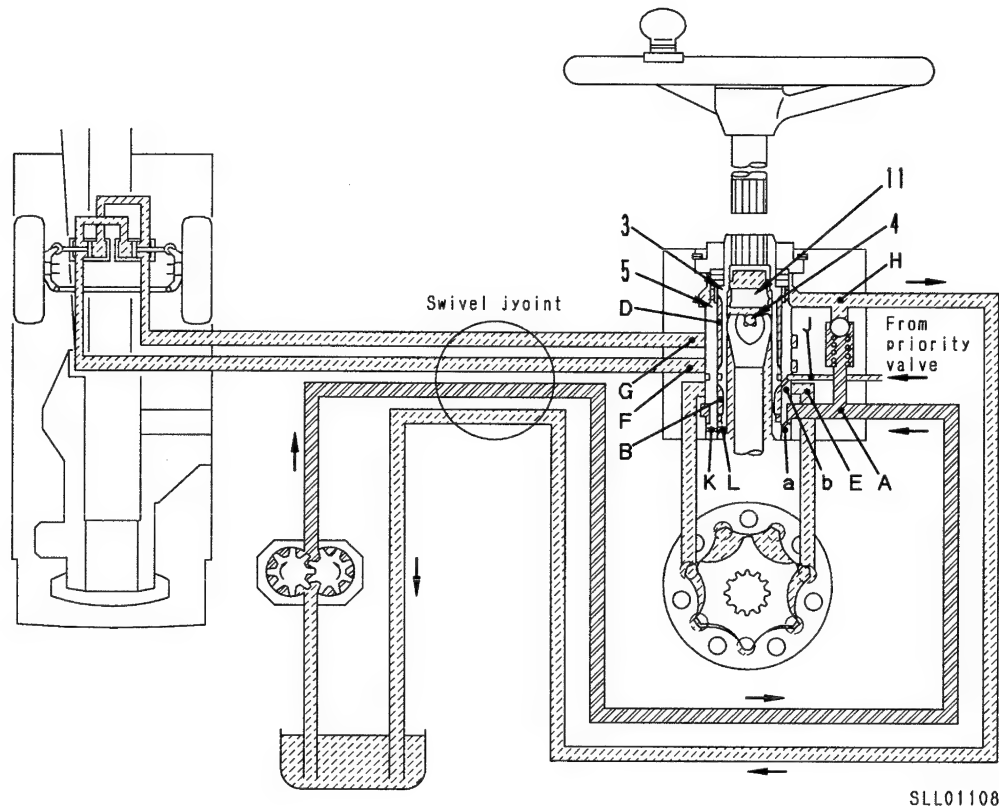
- Spool (3) is directly connected to the drive shaft of the steering wheel, and is connected to sleeve (5) by center pin (4) (it does not contact the spool when the steering wheel is at neutral) and centering spring (11).
- The top of drive shaft (6) is meshed with center pin (4), and forms one unit with sleeve (5), while the bottom of drive shaft (6) is meshed with the spline of Gerotor (8).
- There are four ports in housing (2), and they are connected to the pump circuit, tank circuit, and the circuits at the head end and bottom end of the left and right front and rear steering cylinders.

The pump port and tank port are connected by the check valve inside the body, and if the pump or engine fail, the oil can be sucked in directly from the tank by this check valve.

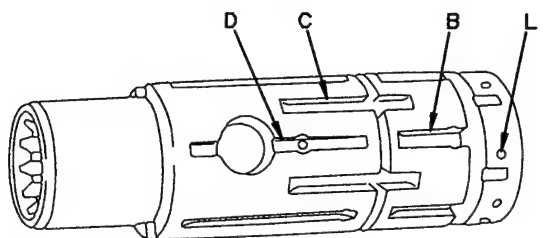


OPERATION

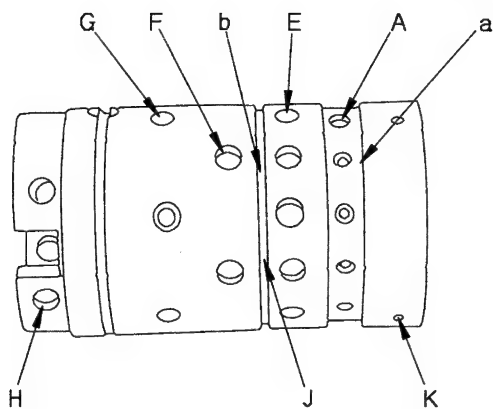
1. When steering wheel is at neutral



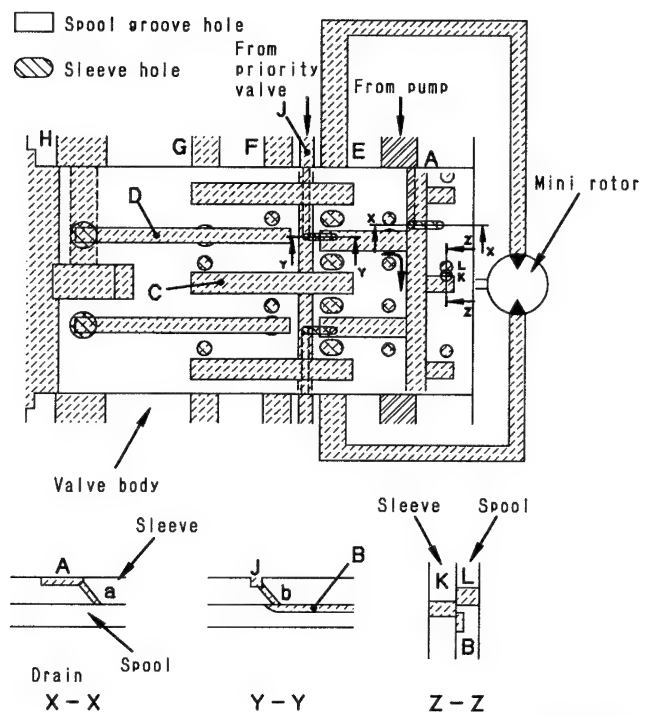
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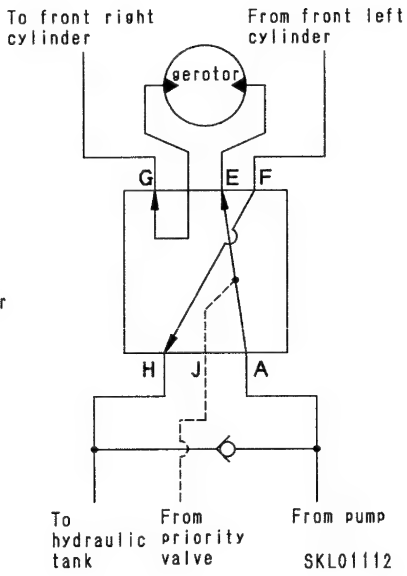
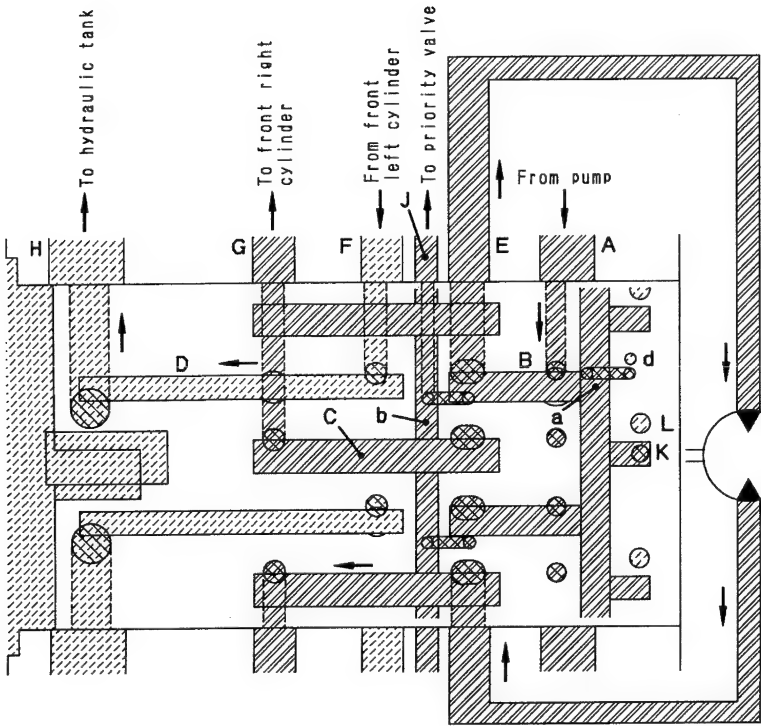
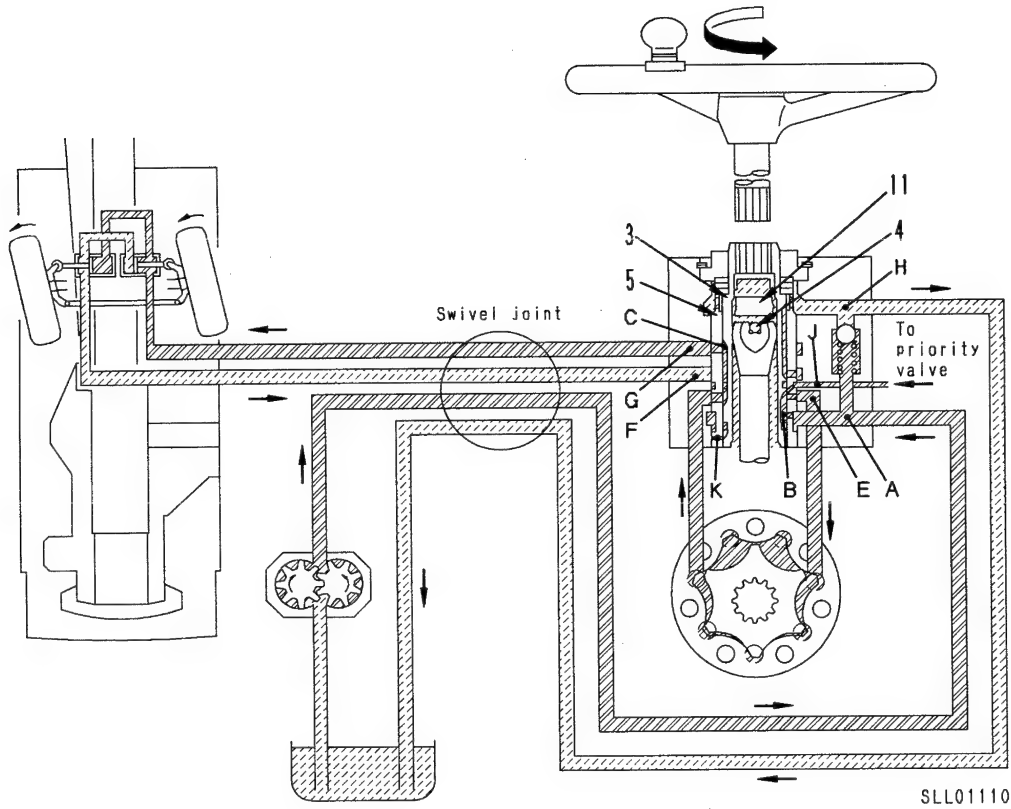


SKL01109

- When the steering wheel is at **neutral**, centering spring (11) makes spool (3) and sleeve (5) stop at a position where center pin (4) is at the center of the oblong hole in spool (3).
At this point, pump port **A** of the sleeve and ports **E**, **F**, and **G** to the steering cylinder and Gerotor, and vertical grooves **B**, **C**, and **D** of the spool are shut off.
Orifice **a** of pump port **A** is also shut off.
Orifice **b** of port **J** from the priority valve is connected through vertical groove **B** of the spool and port **K** of the sleeve to drain port **L** of the spool.
In addition, port **K** of the sleeve is connected to drain port **L** of the spool and vertical groove **B**.
- By cutting and connecting these ports and grooves, the oil from port **A** is cut off at orifice **a**. The oil which forms the pilot pressure of the priority valve passes from port **J** through orifice **b**, then through vertical groove **D** and port **H**, and is returned to the hydraulic tank.
For details of the operation of the priority valve, see PRIORITY VALVE.

023S05

2. When steering wheel is turned (steering to left)



023S05

023S05

- When the steering wheel is turned to the left, spool (3), which is connected by the spline of the steering shaft, also turns to the left.

When this happens, the spool and sleeve (5) are interconnected by centering spring (11), so the spool compresses the centering spring.

Therefore, a difference in the angle of rotation (angle variation) is generated between the spool and sleeve equal to the amount that the centering spring is compressed.

When this happens, first, port **A** and vertical groove **B** are connected, then vertical groove **B** and port **E** to the Gerotor, and port **E** from the Gerotor and vertical groove **C** are connected. Finally, vertical groove **C** and port **G** to the head end of the front right cylinder are connected.

In addition, port **K** of the sleeve gradually closes the connection of vertical groove **B** and port **L**.

Port **F** from the head end of the front left cylinder is connected to vertical groove **D** (connected to drain port **H**) at the same time as port **A** and vertical groove **B** are connected.

When this happens, orifice **b** of port **J** is connected to vertical groove **B**, so the oil from the priority valve flows to port **A**.

- By cutting and connecting the above ports and grooves, the oil from the pump enters vertical groove **B** from port **A**, then flows to port **E** to the Gerotor, and turns the Gerotor. The oil discharged from the Gerotor enters vertical groove **C** from port **E**, and flows from port **G** to the head end of the front right cylinder.

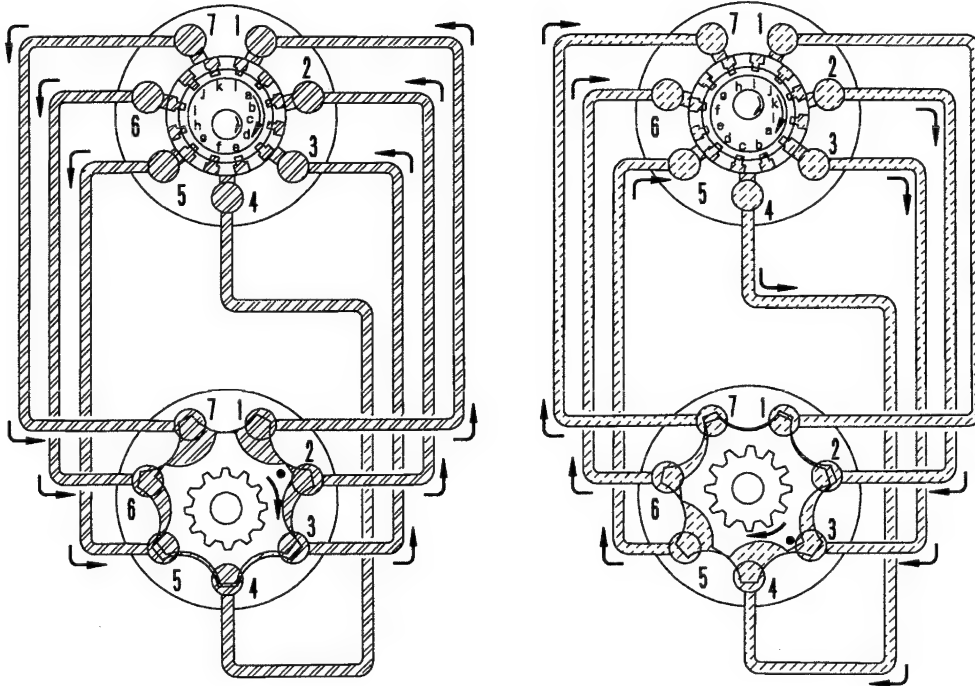
The oil from the head end of the front left cylinder enters vertical groove **D** from port **F** and is drained to the hydraulic tank.

- For details of the operation of the Gerotor, see the next page.

3. When steering wheel is stopped

When the operation of the steering wheel is stopped, the difference in rotation between the spool and sleeve is returned to the neutral condition by the reaction of centering spring (11).

CONNECTION BETWEEN HAND PUMP AND SLEEVE



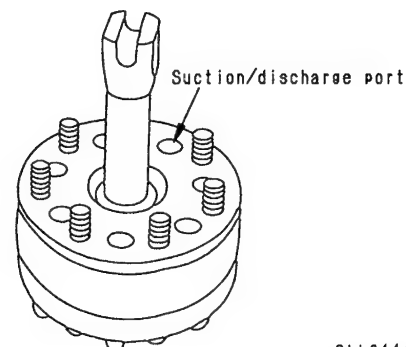
SEZ00223

- The diagrams above show the connections with the sleeve ports used to connect the suction and discharge ports of the gerotor.
- If the steering wheel has been turned to the right, ports **a, c, e, g, i,** and **k** are connected by the vertical grooves in the spool to the pump side. At the same time, ports **b, d, f, h, j,** and **l** are connected to the head end of the front left steering cylinder in the same way.

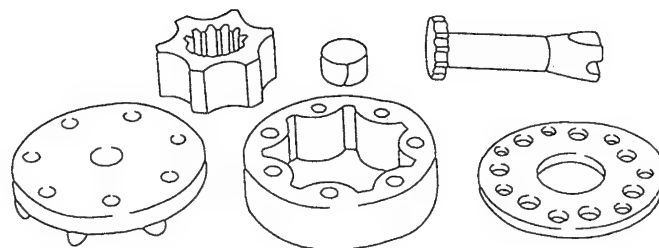
In the condition in Fig. 1, ports **1, 2,** and **3** are the discharge ports of the Gerotor set. They are connected to ports **l, b,** and **d,** so the oil is sent to the cylinder.

Ports **5, 6,** and **7** are connected and the oil flows in from the pump.

If the steering wheel is turned 90°, the condition changes to the condition shown in Fig. 2. In this case, ports **1, 2,** and **3** are the suction ports, and are connected to ports **i, k,** and **c.** Ports **5, 6,** and **7** are the discharge ports, and are connected to ports **d, f,** and **h.**



SLL01113



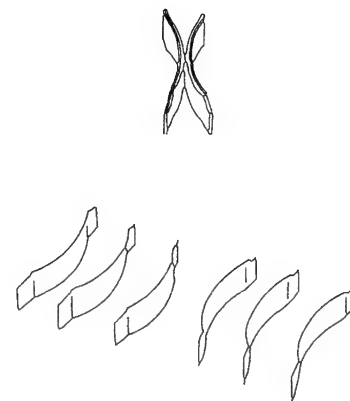
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023S05

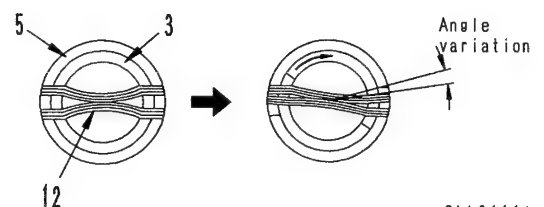
- In this way, the ports acting as the discharge ports of the Gerotor are connected to the ports going to the steering cylinder, while the ports acting as the suction ports are connected to the pump circuit.
- Adjustment of discharge according to amount steering wheel is turned
For each $1/7$ turn of the steering wheel, the inside teeth of the Gerotor advance one tooth, and the oil from the pump is discharged in an amount that matches this movement.
Therefore, the amount of oil discharged is directly proportional to the amount the steering wheel is turned.

Role of centering spring

- Centering spring (12) consists of three X-shaped leaf springs each. It is assembled between spool (3) and sleeve (5) as shown in the diagram on the right.
When the steering wheel is turned, the spool compresses the spring, and a difference (angle variation) is generated in the turning angle of the spool and sleeve.
As a result, the port of the spool and sleeve is connected and oil is sent to the cylinder. However, when the rotation of the steering wheel is stopped, the rotation of the gerotor also stops, so no more oil is sent to the cylinder, and the oil pressure rises.
To prevent this, when the rotation of the steering wheel is stopped, the centering spring turns the spool by an amount equivalent to the difference (angle variation) in the rotating angle from the spool, and returns the steering wheel to the NEUTRAL condition.

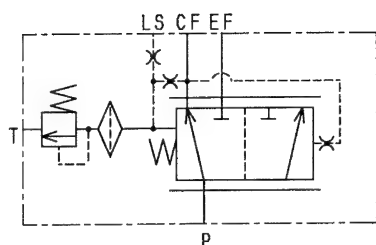
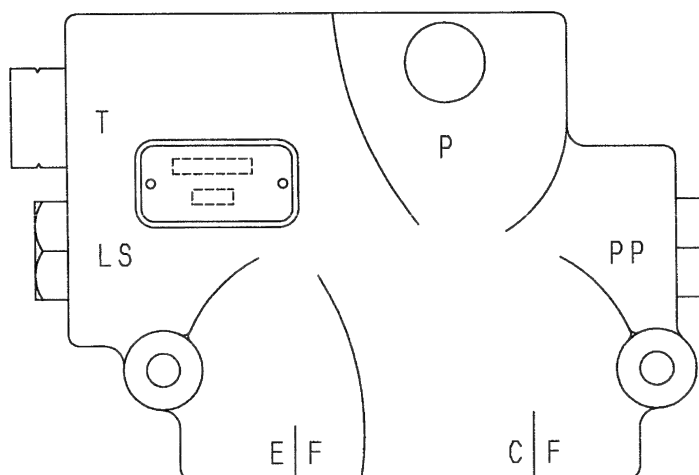
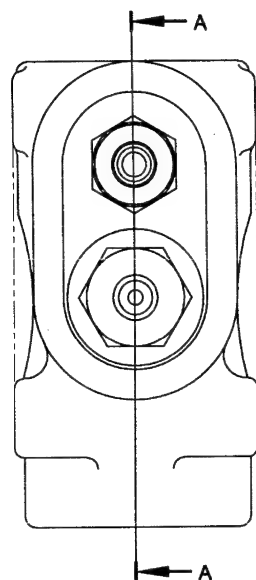


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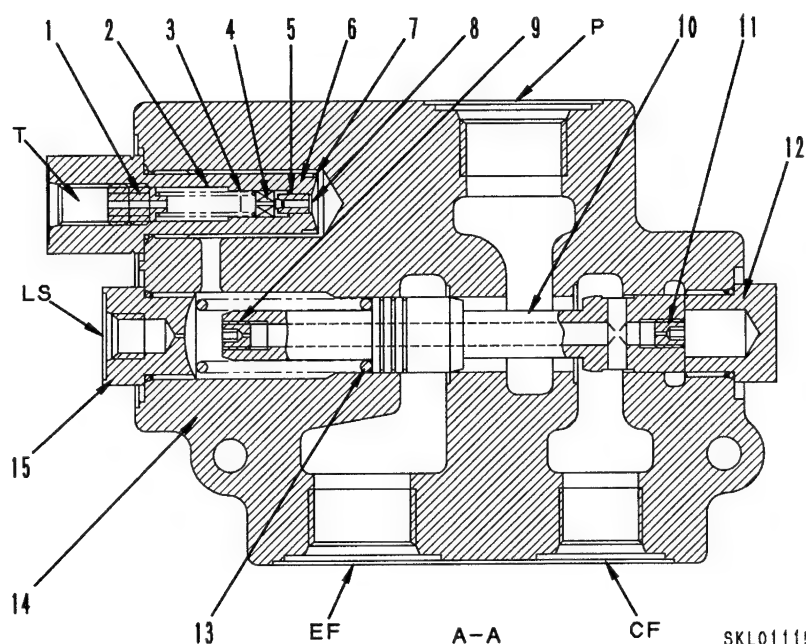


SLL01114

PRIORITY VALVE



Hydraulic circuit diagram



SKL01115

- | | |
|----------------------------|---------------------------------|
| 1. Screw | 12. Plug |
| 2. Guide | 13. Spring |
| 3. Spring | 14. Housing |
| 4. Poppet | 15. Plug |
| 5. Seat | |
| 6. Body | P. Port P (from pump) |
| 7. Ring | CF. Port CF |
| 8. Screw | (to steering unit) |
| 9. Screw (throttle valve) | EF. Port EF (to air con- |
| 10. Spool | ditioner circuit) |
| 11. Screw (throttle valve) | T. Port T (to tank) |

Outline

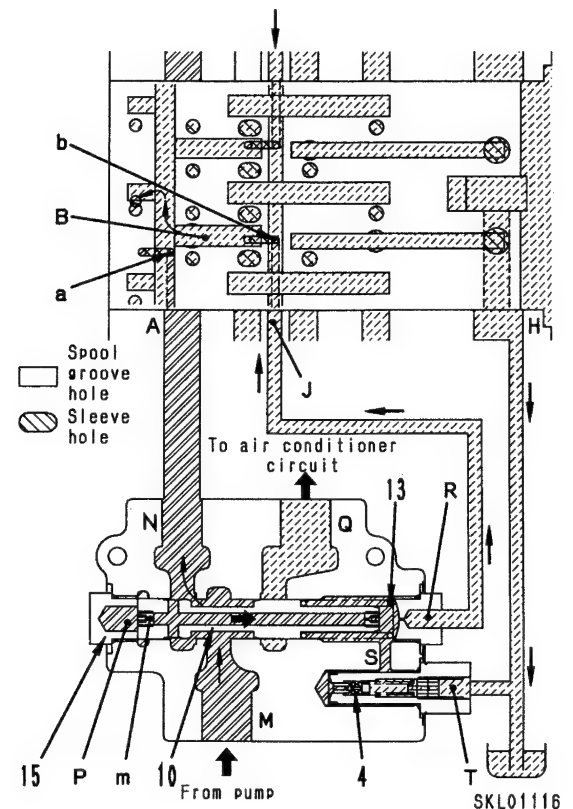
- The priority valve is in the circuit from the steering pump to the outrigger control valve and steering unit. It acts to give priority to the steering and to divide the oil from the steering pump to the steering unit and to the air conditioner circuit through the flow control valve. It also sets the oil pressure in the circuit from the priority valve to the steering unit to protect the circuit.

023S05

OPERATION

1. When steering wheel is at neutral

- When the engine is stopped, spool (10) is pushed against plug (15) by the tension of spring (13), so the circuit between ports **M** and **N** is fully open, while the circuit between ports **M** and **Q** is fully closed. When the engine is started and the steering pump starts to turn, the oil from the pump enters port **N** from port **M**, and then goes to port **A** of the steering unit. The oil entering port **A** is throttled by orifice **a**, so the pressure in the circuit rises.
- When this happens, the oil passing through orifice **m** in spool (10) and entering port **P** compresses spring (13), and moves spool (10) to the right. This stabilizes the condition so that the circuit between ports **M** and **Q** is almost fully open and the circuit between ports **M** and **N** is almost fully closed, so the oil from the pump almost all flows to the air conditioner circuit.
- The oil passing through orifice **m** passes through the inside of spool (10) and applies back pressure to the spool. At the same time, it also flows from port **R** to port **J** of the steering unit, passes inside the steering unit, and returns to the hydraulic tank from drain port **H**.



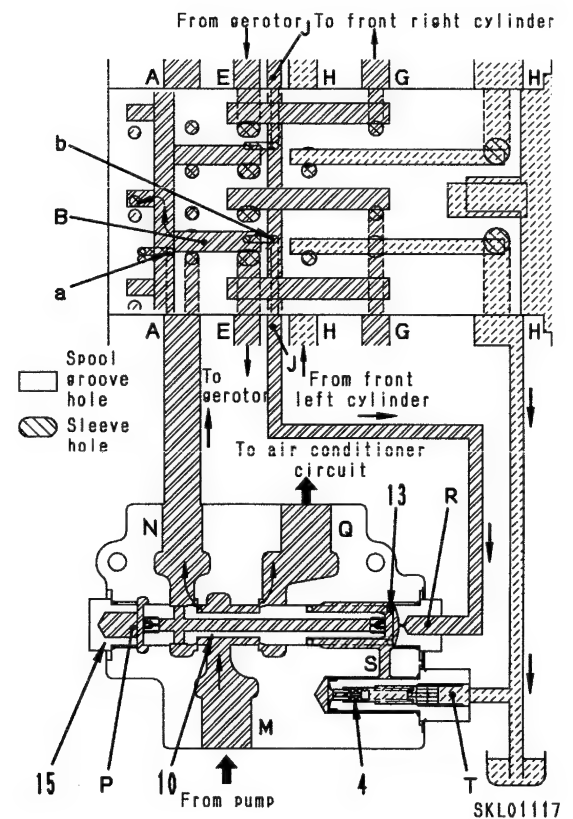
2. When steering wheel is turned to left

When the steering wheel is turned to the left, an angle variation is generated between the spool and sleeve of the steering unit, and the oil flow is switched. (For details, see STEERING UNIT.)

The oil from the pump flows from port **M** to ports **N** and **A**, and the degree of opening of the sleeve (port **A**) and spool (port **B**) creates a difference between the pressure up to port **A** and the pressure beyond port **B**. The oil from port **B** flows to the Gerotor, and then to the front right cylinder, while the remaining oil passes through orifice **b**, flows to port **J**, and then enters port **R**. It merges here with the oil flowing inside the spool.

When this happens, spool (10) stabilizes at a position where the differential pressure between the circuit up to port **A** and circuit beyond port **B** (pressure at port **P** - pressure at port **R**) and the load of spring (13) are balanced. It adjusts the degree of opening from port **M** to ports **N** and **Q**, and distributes the flow to both circuits.

The ratio of this distributed flow is determined by the degree of opening of port **A** and port **B**, in other words, the angle variation between the sleeve and spool of the steering unit. This degree of opening is adjusted steplessly by the amount the steering wheel is turned.

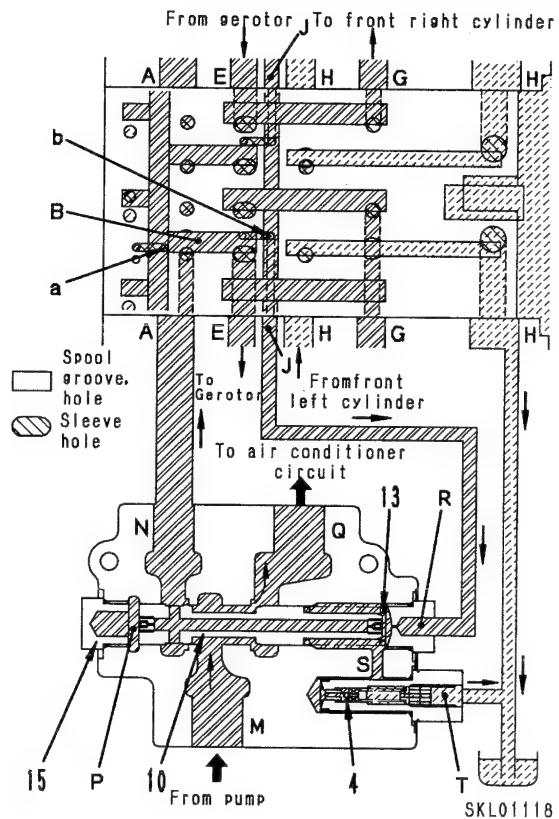


3. When steering cylinder is at end of stroke

If the operator tries to turn the steering wheel further when the steering cylinder has reached the end of its stroke, the circuit from port **M** through port **N** to port **S** is kept open and the pressure rises.

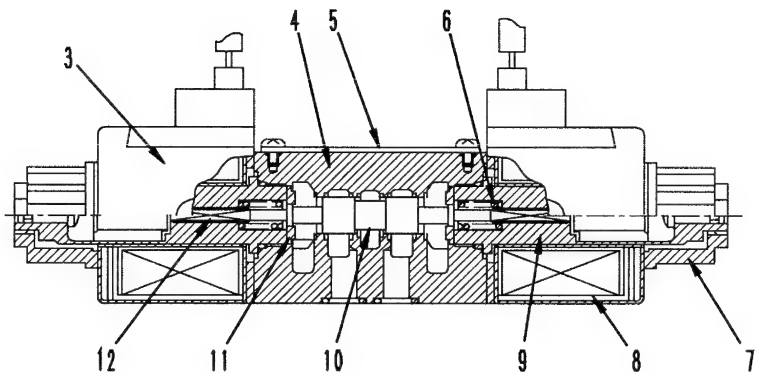
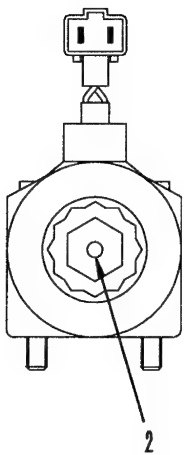
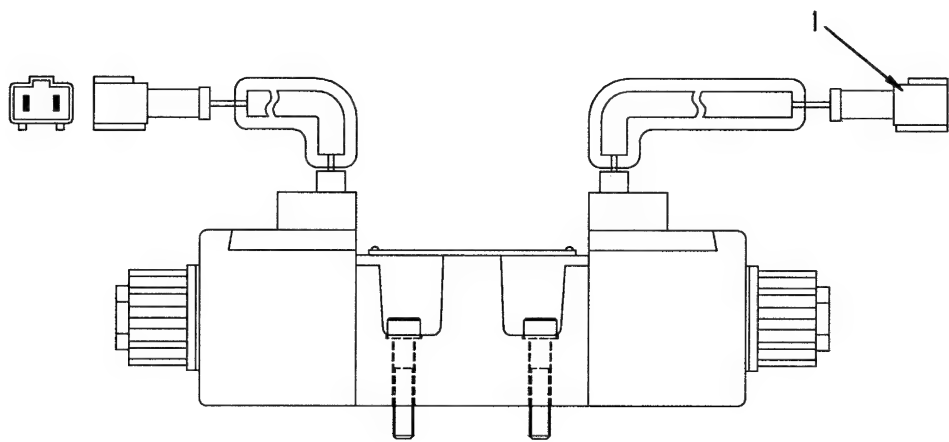
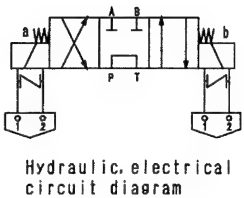
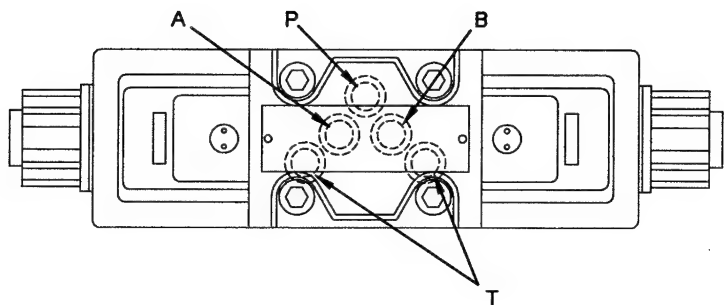
When this pressure rises to 18.6 MPa (190 kg/cm²), relief valve (4) opens and the oil is relieved to the hydraulic tank. Because of the flow of this oil, differential pressure is created on both sides of orifice **r**, so the balance is lost between the load of spring (13) and the pressure up to port **A** and the pressure beyond port **B**. As a result, the pressure up to port **A** becomes relatively higher.

For this reason, the pressure at port **P** moves spool (10) even further to the right from the condition in Item 2. This stabilizes the condition and makes the circuit between ports **M** and **N** almost fully closed, and the circuit between ports **M** and **Q** almost fully open.



023S05

STEERING MODE SELECTOR VALVE



SKL01119

1. Connector
2. Manual push pin
3. Solenoid assembly
4. Valve body
5. Cover
6. Spring

7. Nut
8. Coil assembly
9. Core assembly
10. Spool
11. Spacer
12. Push pin

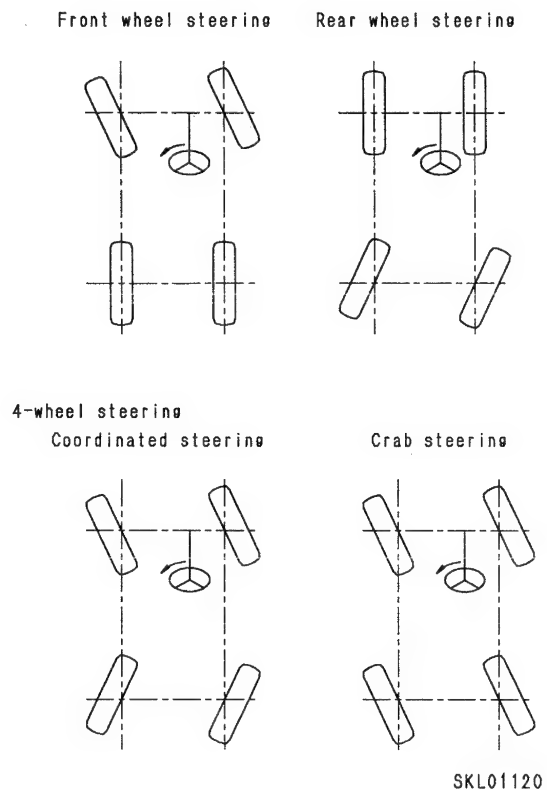
- A. Port A (cylinder port)
- B. Port B (cylinder port)
- P. Port P (pump port)
- T. Port T (tank port)

OUTLINE

- The steering mode selector valve is a solenoid valve assembled in the circuit between the steering unit and the reverse steering compensation valve and steering cylinder. When the steering mode switch in the operator's compartment is operated, it switches the oil from the steering unit and selects the steering method for the machine.
- Four types of steering method are available for this machine: front wheel steering, which can be used when traveling at high speed, two types of 4-wheel steering that can be used when traveling at low speed (crab steering, which makes it easy to move the machine to the side, and coordinated steering, which provides a smaller turning radius), and rear wheel steering.

STRUCTURE

- The steering mode selector valve consists of the direction control group that switches the flow of oil from the steering unit and two sets of solenoid assemblies (1) and (4), which operate the two push rods when the steering mode switch in the operator's compartment is operated.
The direction control group consists of the valve body, spool, and spool return springs.



OPERATION

- Some of the oil from the steering unit goes to cylinder port **S**, and the rest of the oil goes to port **A** of the mode selector valve in accordance with the direction in which the steering wheel is turned.

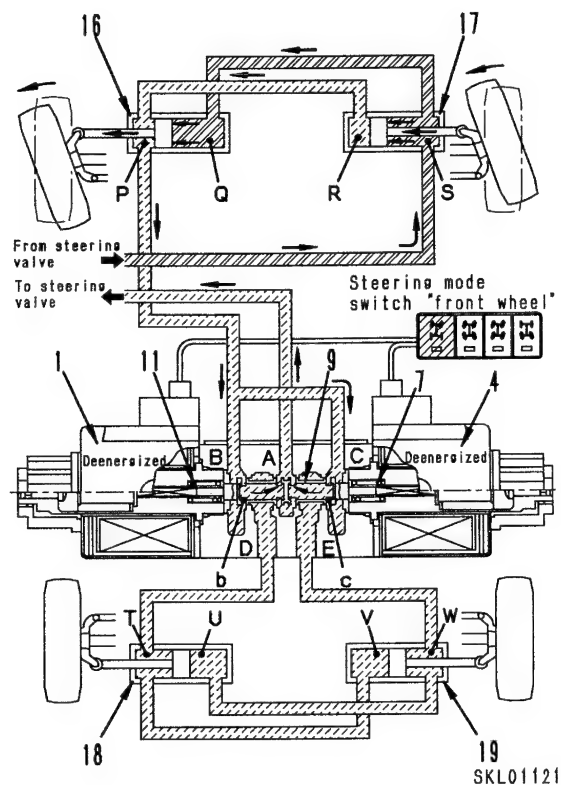
1. Front wheel steering (left turn)

If the mode switch is set to "FRONT WHEEL", the two sets of solenoid assemblies (1) and (4) are deenergized, and spool (9) is returned to the NEUTRAL position by the tension of springs (7) and (11). In this condition, if the steering wheel is turned to the left, the oil from the steering valve goes to cylinder ports **S** and **Q**, and pushes left and right front cylinders (16) and (17) to the left.

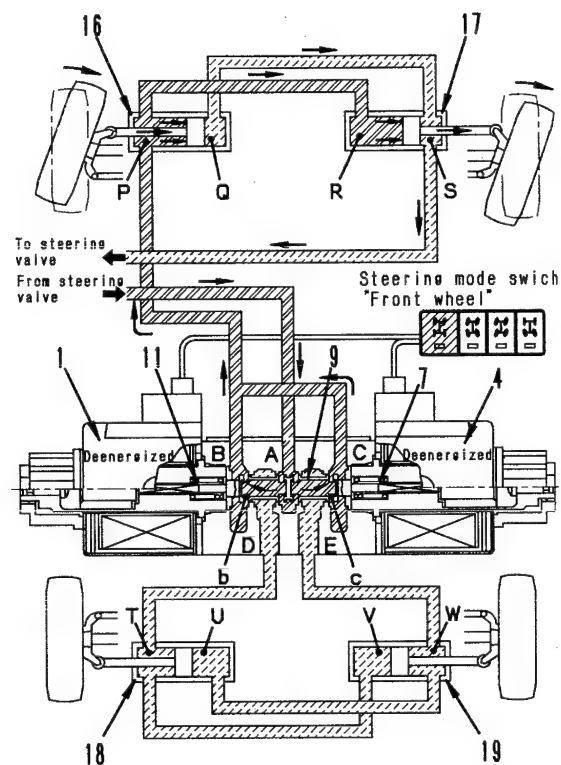
When this happens, the oil pushed out from cylinder ports **R** and **P** goes from mode selector valve ports **B** and **C** through orifices **b** and **c** in the spool, flows to port **A** and returns to the drain port of the steering unit. With the above movement of the cylinders, the machine turns to the left.

2. Front wheel steering (right turn)

If the mode switch is set to "FRONT WHEEL" and the steering wheel is turned to the right, the oil from the steering valve flows in the opposite way from the explanation given above for turning left, pushes left and right front cylinders (16) and (17) to the right, and the machine turns to the right.



SKL01121



SKL01122

3. Coordinated steering (left turn)

If the mode switch is set to "4 WHEEL", solenoid assembly (1) is excited, pushes the push rod, and moves spool (9) to the right.

When this happens, the circuit between ports **C** and **E** of the mode selector valve opens, and at the same time, the circuit between ports **A** and **D** also opens.

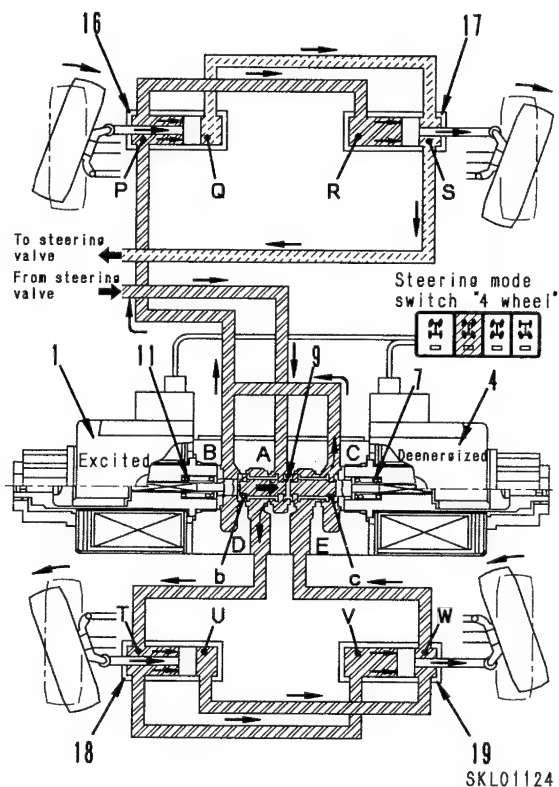
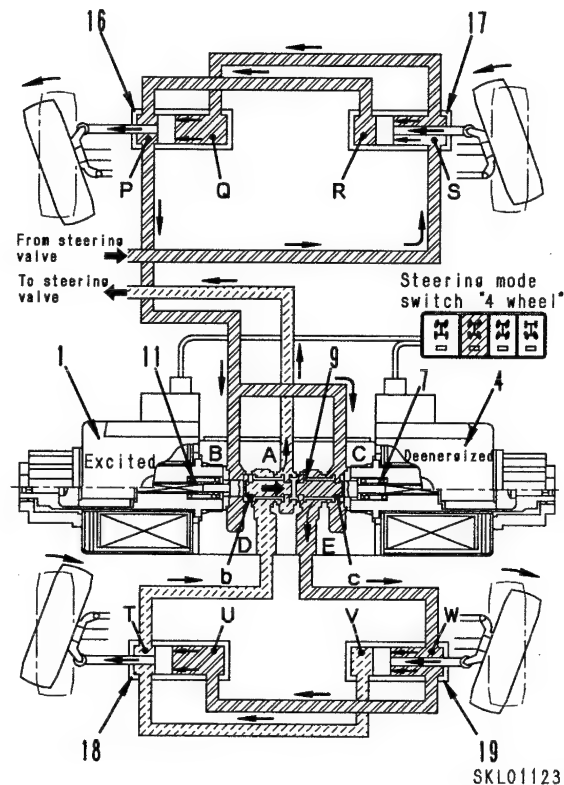
In this condition, if the steering wheel is turned to the left, the oil from the steering unit enters cylinder ports **S** and **Q**, and pushes left and right front cylinders (16) and (17) to the left.

When this happens, the oil pushed out from cylinder ports **R** and **P** enters ports **B** and **C** of the mode selector valve. It then flows from port **E**, which is opened by the switch, enters cylinder ports **W** and **U**, and moves left and right rear cylinders (18) and (19) to the left by the same amount that the left and right front cylinders are pushed out.

In other words, the circuit from cylinder ports **R** and **P** to ports **W** and **U** forms a closed circuit, and for this reason, the oil in this circuit is pushed by the pressurized oil from the steering unit and pushes left and right rear cylinders (18) and (19) to the left.

When this happens, the oil pushed out from cylinder ports **V** and **T** flows from port **D** of the mode selector valve to port **A**, and then returns from port **A** to the drain port of the steering unit.

With the above movement of the cylinders, the machine turns to the left using coordinated steering.



4. Coordinated steering (right turn)

If the mode switch is set to "4 WHEEL" and the steering wheel is turned to the right, the oil from the steering valve flows in the opposite way from the explanation given above for turning left, pushes the four cylinders to the right, and the machine turns to the right using coordinated steering.

5. Crab steering (left turn)

If the mode switch is set to "CRAB", solenoid assembly (4) is excited, pushes the push rod, and moves spool (9) to the left.

When this happens, the circuit between ports **B** and **D** of the mode selector valve opens, and at the same time, the circuit between ports **A** and **D** also opens.

In this condition, if the steering wheel is turned to the left, the oil from the steering unit enters cylinder ports **S** and **Q**, and pushes left and right front cylinders (16) and (17) to the left.

When this happens, the oil pushed out from cylinder ports **R** and **P** enters ports **B** and **C** of the mode selector valve. It then flows from port **D**, which is opened by the switch, enters cylinder ports **T** and **V**, and moves left and right rear cylinders (18) and (19) to the right by the same amount that the left and right front cylinders are pushed out.

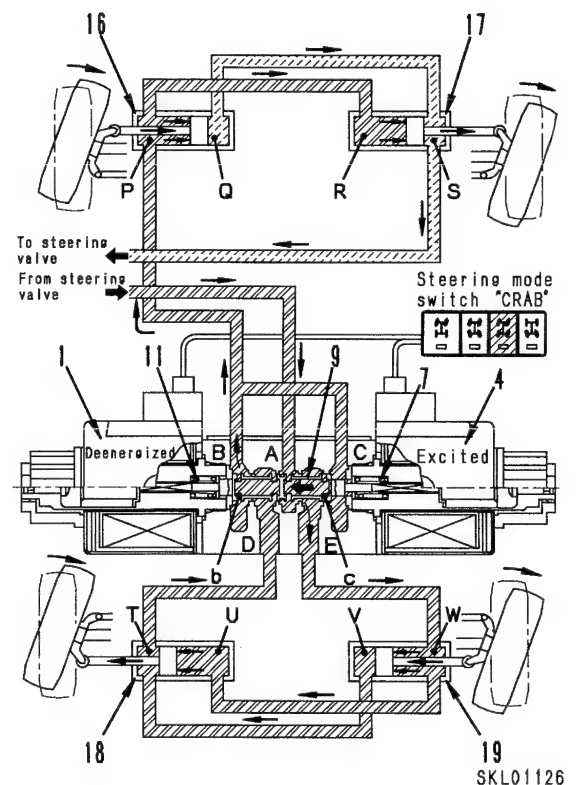
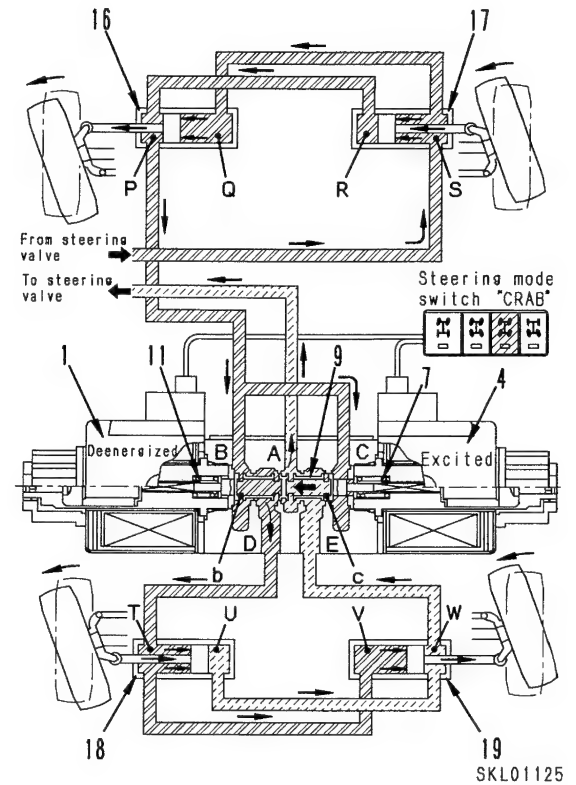
In other words, the circuit from cylinder ports **R** and **P** to ports **T** and **V** forms a closed circuit, and for this reason, the oil in this circuit is pushed by the pressurized oil from the steering unit and pushes the left and right rear cylinders to the right.

When this happens, the oil pushed out from cylinder ports **U** and **W** flows from port **E** of the mode selector valve to port **A**, and then returns from port **A** to the drain port of the steering unit.

With the above movement of the cylinders, the machine turns to the left using crab steering.

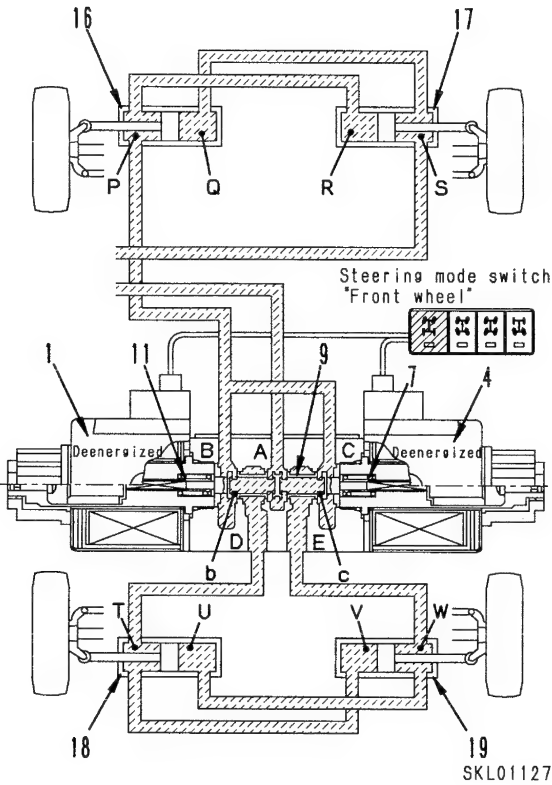
6. Crab steering (right turn)

If the mode switch is set to "CRAB" and the steering wheel is turned to the right, the oil from the steering valve flows in the opposite way from the explanation given above for turning left, pushes the left and right front cylinders to the right and the left and right rear cylinders to the left, and the machine turns to the right using crab steering.



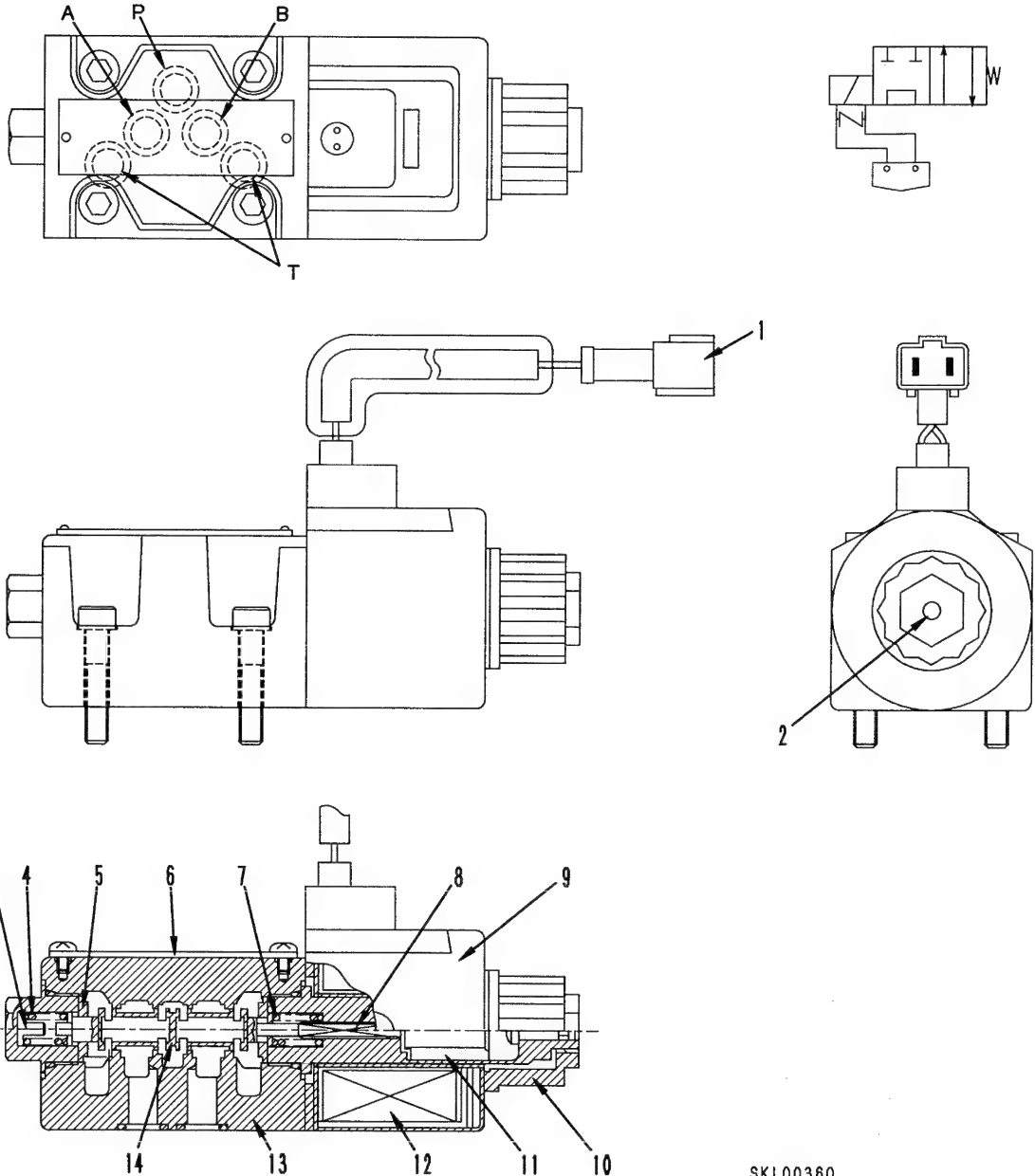
7. Traveling straight

When the steering wheel is at NEUTRAL (the mode switch can be at any position), the steering unit is at the hold position, so the circuit to all the cylinders from the steering unit is a closed circuit. Therefore, all the cylinders are kept in the same position and the machine travels in a straight line.



023S05

REAR WHEEL STEERING SELECTOR VALVE



SKL00360

- | | |
|----------------------|---------------------------|
| 1. Connector | 10. Nut |
| 2. Manual push pin | 11. Core assembly |
| 3. Stopper | 12. Coil assembly |
| 4. Spring | 13. Valve body |
| 5. Spacer | 14. Spool |
| 6. Cover | A. Port A (cylinder port) |
| 7. Spring | B. Port B (cylinder port) |
| 8. Push pin | P. Port P (pump port) |
| 9. Solenoid assembly | T. Port T (tank port) |

Outline

- The rear wheel steering selector valve is in the circuit between the steering unit and the steering mode selector valve and reverse steering compensation valve. When the steering mode switch is at the "Rear 2-wheel" position, it stops the flow of oil to the front 2-wheel steering cylinder, and changes the direction of only the rear wheels when the steering wheel is operated.

023S05

OPERATION

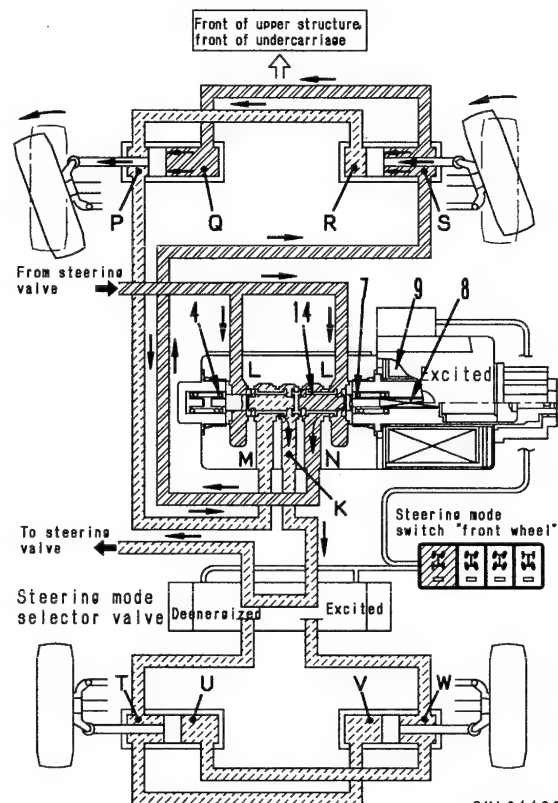
1. Front 2-wheel steering (4-wheel steering is the same)

If the steering mode selector switch is set to any position other than "REAR 2-WHEEL", solenoid assembly (9) of the rear steering selector valve is excited.

When this happens, solenoid assembly (9) pushes out plunger (8) and moves spool (14) to the left.

As a result, the spool opens ports **L** and **N**, closes ports **L** and **M**, and at the same time, opens ports **K** and **M** and closes ports **K** and **N**.

In this condition, if the steering wheel is turned to the left, the machine will turn left. (For details, see the explanation of the operation of the steering mode selector valve.)



SKL01128

2. Rear 2-wheel steering

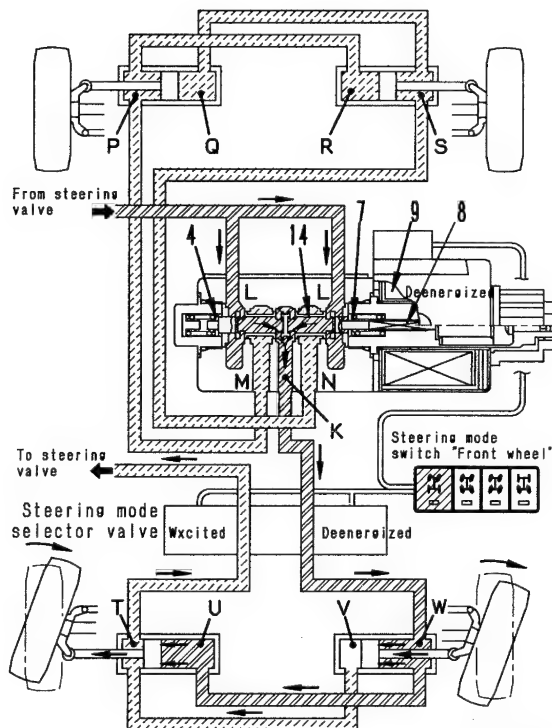
If the steering mode selector switch is set to "REAR 2-WHEEL", solenoid assembly (9) of the rear steering selector valve is not excited.

Therefore, spool (14) is held at the NEUTRAL position by the tension of springs (4) and (7).

As a result, the circuits between ports **L** and **N** and between ports **K** and **M** are closed, and the circuit between ports **L** and **K** is opened.

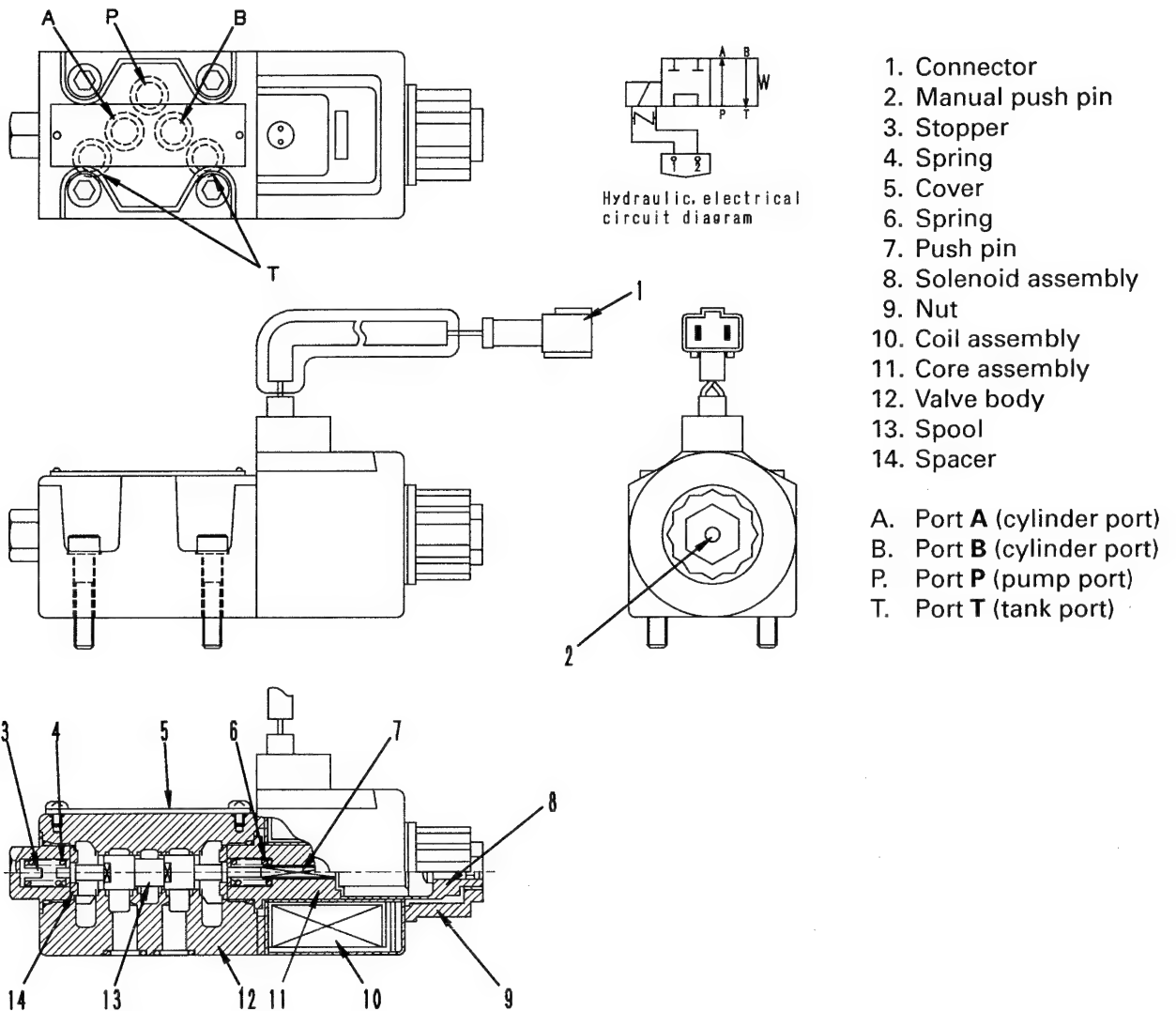
The flow of oil to the four cylinder ports is the reverse of the condition in Item 1.

When the steering wheel is turned to the left, the machine turns left.



SKL01129

REVERSE STEERING COMPENSATION VALVE



SKL01130

Outline

- The reverse steering compensation valve is in the circuit between the steering unit and steering mode selector valve and front right steering cylinder. If the upper structure is swung to face the rear, the steering can be changed by pressing the reverse steering compensation switch in the operator's compartment (the pilot lamp inside the switch lights up). This allows the machine to turn in the same direction as the direction in which the steering wheel is turned, thereby giving

the same feeling as when traveling forward. However, this can only be actuated when using front wheel steering or 4-wheel coordinated steering. Be careful when operating crab steering because the direction of travel is the reverse of the direction in which the steering wheel is turned.

Reverse steering can only be used when the upper structure is within a range of 10° at the rear of the machine. Outside that range it is not actuated.

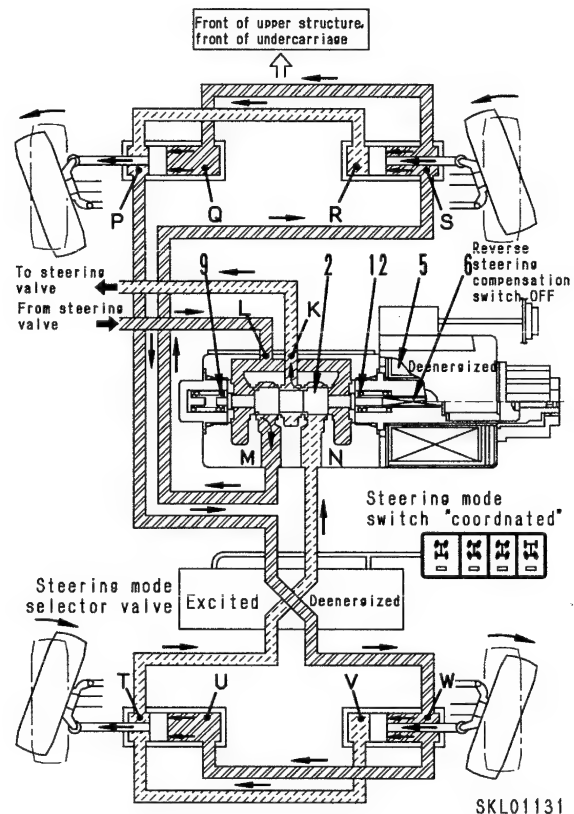
OPERATION

1. When reverse steering compensation switch is OFF (coordinated steering, normal travel)

When the upper structure is facing the front as normal, if the reverse steering compensation switch is OFF (the pilot lamp inside the switch is out), solenoid assembly (5) of the reverse steering compensation valve is not excited.

Therefore, spool (2) is held at the NEUTRAL position by the tension of springs (9) and (12), and the circuits between ports **L** and **N** and ports **K** and **M** are open.

In this condition, if the steering mode switch is set to "4-WHEEL" and the steering wheel is turned to the left, the machine will turn left. (For details, see the explanation of operation of the steering mode selector valve.)



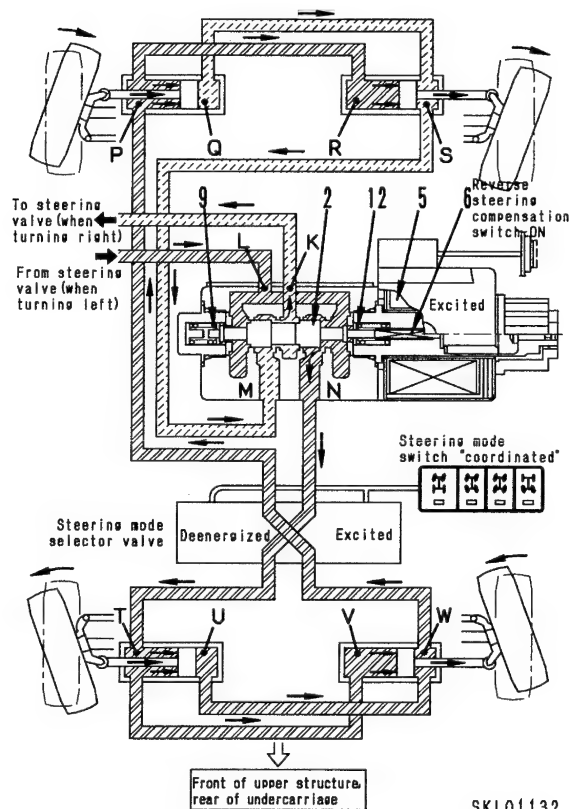
2. When reverse steering compensation switch is ON (coordinated steering, reverse travel)

If the upper structure is turned from the condition in Item 1 and is swung to face the rear, and the reverse steering compensation switch is turned ON (the indicator lights up), solenoid assembly (5) of the reverse steering compensation valve is excited.

When this happens, solenoid assembly (5) pushes out plunger (6) and moves spool (2) to the left.

As a result, the spool closes the circuit between ports **L** and **N** and opens the circuit between ports **L** and **M**. At the same time, it closes the circuit between ports **K** and **M** and opens the circuit between ports **K** and **N**, so the flow of oil to the four cylinder ports is the reverse of the condition in Item 1.

In this condition, if the steering mode switch is set to "4-WHEEL" and the steering wheel is turned to the left, the machine will turn to the left.

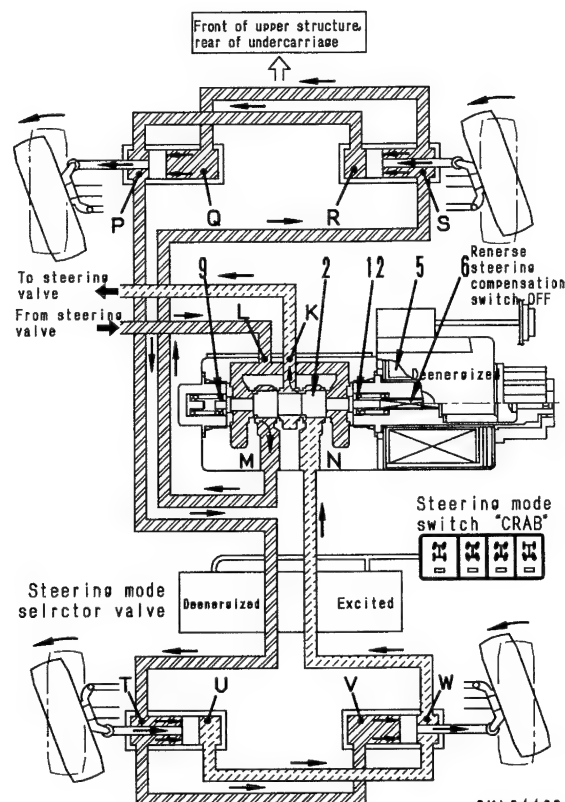


3. When reverse steering compensation switch is OFF (crab steering, normal travel)

When the upper structure is facing the front as normal, if the reverse steering compensation switch is OFF (the pilot lamp inside the switch is out), solenoid assembly (5) of the reverse steering compensation valve is not excited.

Therefore, spool (2) is held at the neutral position by the tension of springs (9) and (12), and the circuits between ports **L** and **N** and ports **K** and **M** are open.

In this condition, if the steering mode switch is set to "CRAB" and the steering wheel is turned to the left, the machine will turn left. (For details, see the explanation of operation of the steering mode selector valve.)

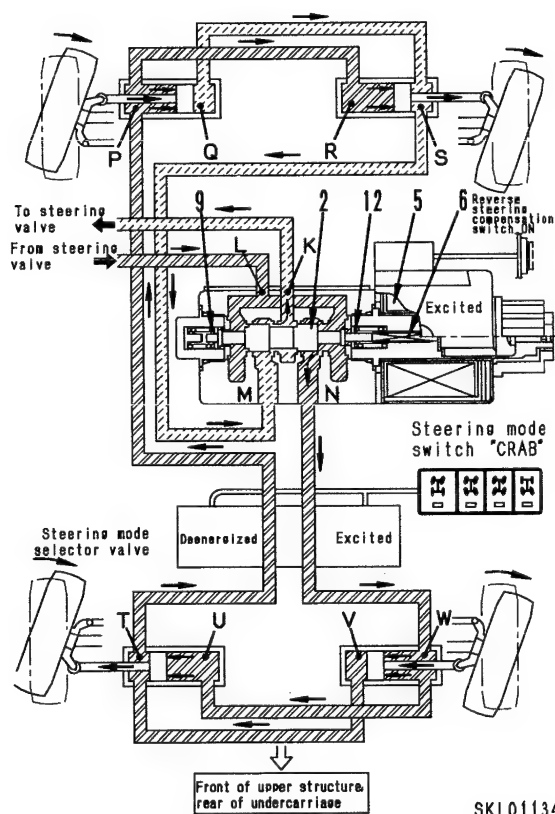


4. When reverse steering compensation switch is ON (crab steering, reverse travel)

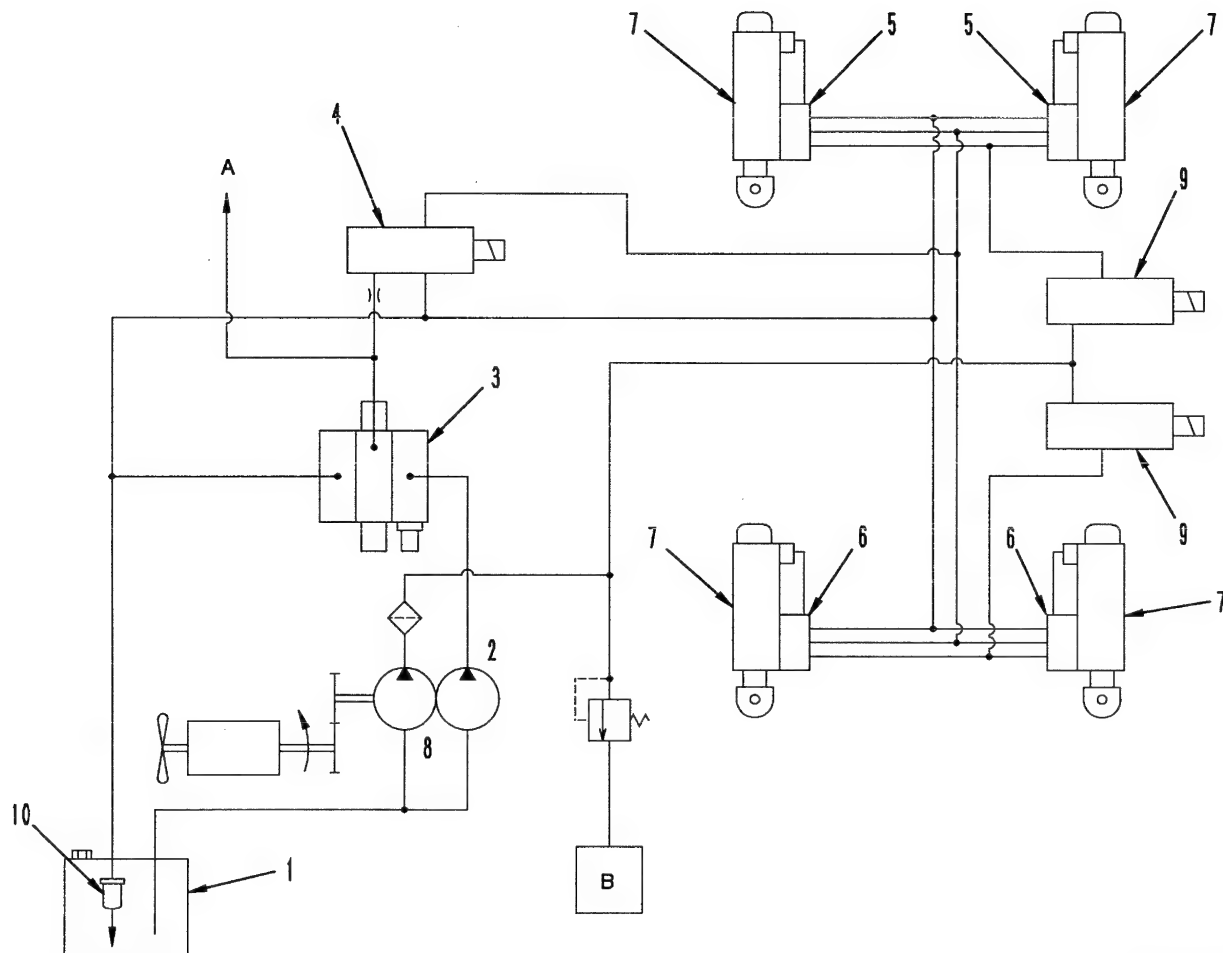
If the upper structure is turned from the condition in Item 3 and is swung to face the rear, and the reverse steering compensation switch is turned ON (the pilot lamp inside the switch lights up), solenoid assembly (5) of the reverse steering compensation valve is excited. When this happens, solenoid assembly (5) pushes out plunger (6) and moves spool (2) to the left.

As a result, the spool closes the circuit between ports **L** and **N** and opens the circuit between ports **L** and **M**. At the same time, it closes the circuit between ports **K** and **M** and opens the circuit between ports **K** and **N**, so the flow of oil to the four cylinder ports is the reverse of the condition in Item 3.

In this condition, if the steering mode switch is set to "CRAB" and the steering wheel is turned to the left, the machine will turn to the right, in the opposite direction from the direction of the steering wheel.



SUSPENSION HYDRAULIC SYSTEM



SKL00368

1. Hydraulic tank
2. Steering and outrigger pump
3. Outrigger selector valve
4. Suspension selector valve
5. Double pilot check valve (for front)
6. Single pilot check valve (for rear)
7. Suspension lock cylinder

8. Transmission pump
9. Suspension lock valve
10. Hydraulic filter
- A. To outrigger cylinder
- B. From power train hydraulic circuit

023S05

Outline

- The suspension hydraulic system consists of steering and outrigger pump (2), and the valves and cylinders operated by the suspension lock switch and brake controls in the operator's compartment.
- If the suspension lock switch in the operator's compartment is set to LIFT, outrigger selector valve (3), suspension selector valve (4), and suspension lock valve (9) are actuated. Steering and outrigger pump (2) sucks up oil from hydraulic tank (1), and sends it to pilot check valves (5) and (6) at the inlet port of suspension lock cylinder (7).

At the same time, suspension lock valve (9) sends the oil from transmission pump (8) to the pilot check valve to open the circuit to the suspension lock cylinder.

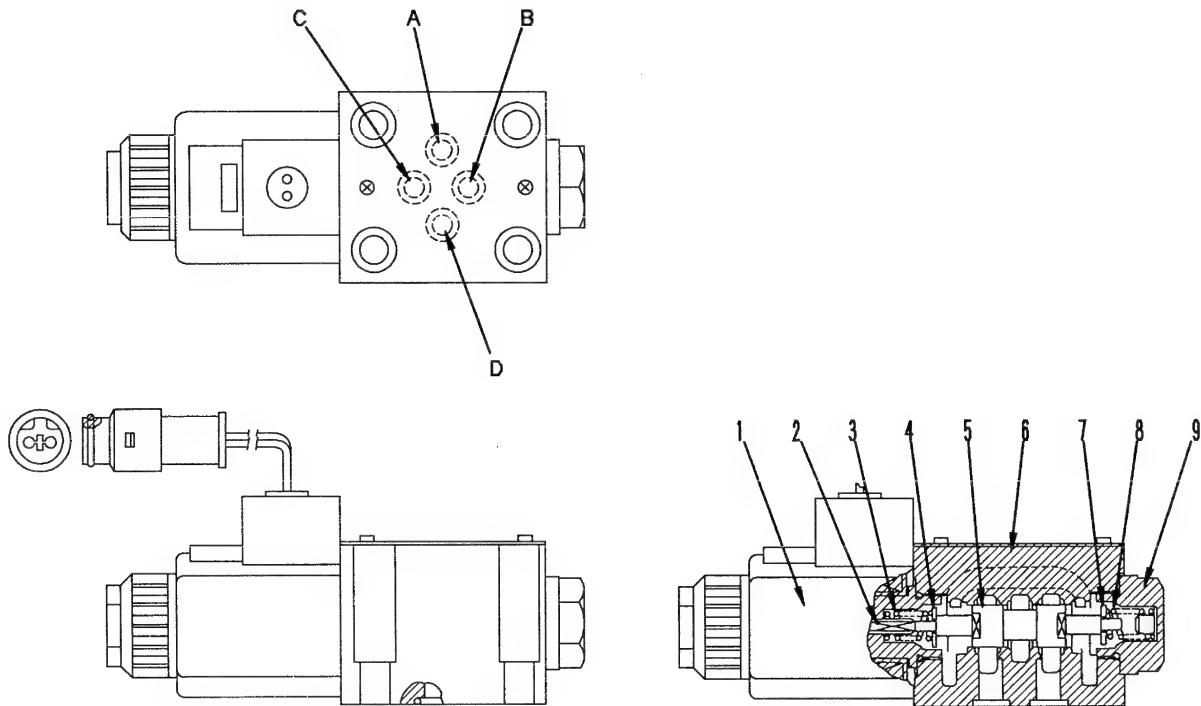
As a result, the oil from the steering and outrigger pump enters the suspension lock cylinder and retracts the cylinder.

When the cylinder is at the end of its stroke, if the suspension lock switch is set to LOCK, the suspension selector valve closes the circuit. Suspension lock valve (9) shuts off the oil from the transmission pump and drains the oil which was opening the pilot check valve, so the cylinder is locked at that position.

- When the machine is traveling, the switch is set to the FREE position, so the cylinder is able to extend and retract. However, when the brake is applied, the front wheel suspension lock valve is switched, and locks the pilot check valve to prevent the machine from nosediving.

023S05

SUSPENSION SELECTOR VALVE



SLL00369

023S05

1. Solenoid assembly
 2. Push pin
 3. Return spring
 4. Retainer
 5. Spool
 6. Valve body
 7. Retainer
 8. Return spring
 9. Plug
- A. From outrigger selector valve EXTEND
 - B. To suspension lock cylinder head end
 - C. Dead end at block
 - D. To hydraulic tank

Outline

- The suspension selector valve is in the circuit between the EXTEND circuit of the outrigger selector valve and the head end of the suspension lock cylinder. It uses a solenoid valve which switches the oil from the steering and outrigger pump when the suspension lock cylinder is operated.

The suspension lock is operated to ensure the safety of the machine during crane operations. When the suspension lock switch is set to the LIFT position, the suspension lock cylinder is retracted. It is then set quickly to the LOCK position, so the suspension lock valve is actuated and the suspension lock cylinder is locked.

OPERATION

1. When suspension lock switch is at FREE

When the suspension lock switch is at the FREE position, solenoid (1) of the suspension selector valve is not excited, so spool (5) is held by the tension of spring (8) at a position where the circuits between ports A and C and ports B and D are opened.

In addition, extension solenoid (12) of outrigger selector valve (11) is also not excited, so it is held at a position where it closes the circuit from the steering and outrigger pump to port A.

Therefore, if the outrigger is not being extended, no oil enters port A of the suspension selector valve and the oil at port B is drained to the hydraulic tank from port D to set the suspension lock cylinder in the free condition.

If the outrigger extension is being operated, extension solenoid (12) of outrigger selector valve (11) is excited, and the oil from the steering and outrigger pump enters port A of the suspension selector valve.

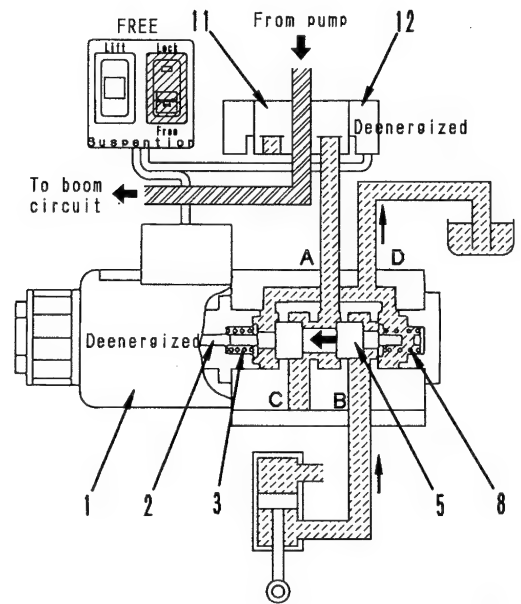
However, it flows from port A to port C and stops at the block, so there is no change in the free condition of the suspension lock cylinder.

2. When suspension lock switch is at LIFT

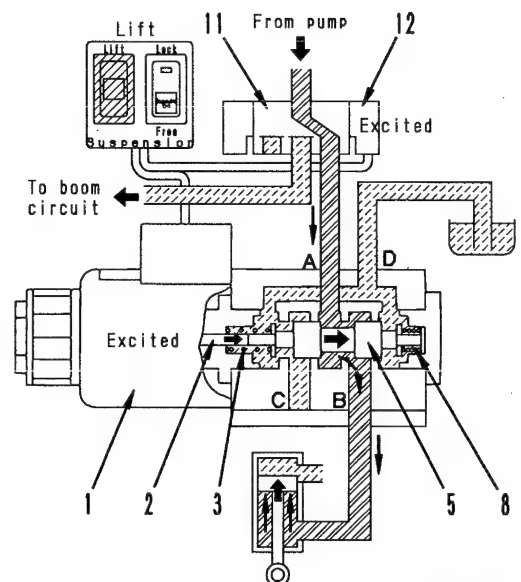
When the suspension lock switch is set to the LIFT position, solenoid (1) of the suspension selector valve is excited, and push pin (2) pushes spool (5) out to the right. This closes the circuit between ports A and C and opens the circuit between ports A and B, and at the same time, opens the circuit between ports C and D.

In addition, extension solenoid (12) of outrigger selector valve (11) is also excited, and opens the circuit from the steering and outrigger pump to port A of the suspension selector valve.

The oil from the steering and outrigger pump passes through the outrigger selector valve, enters port A of the suspension selector valve, and then enters port B from port A. From here, it flows to the head end of the suspension lock cylinder, waits for the pressure in the circuit to rise, and retracts the cylinder.

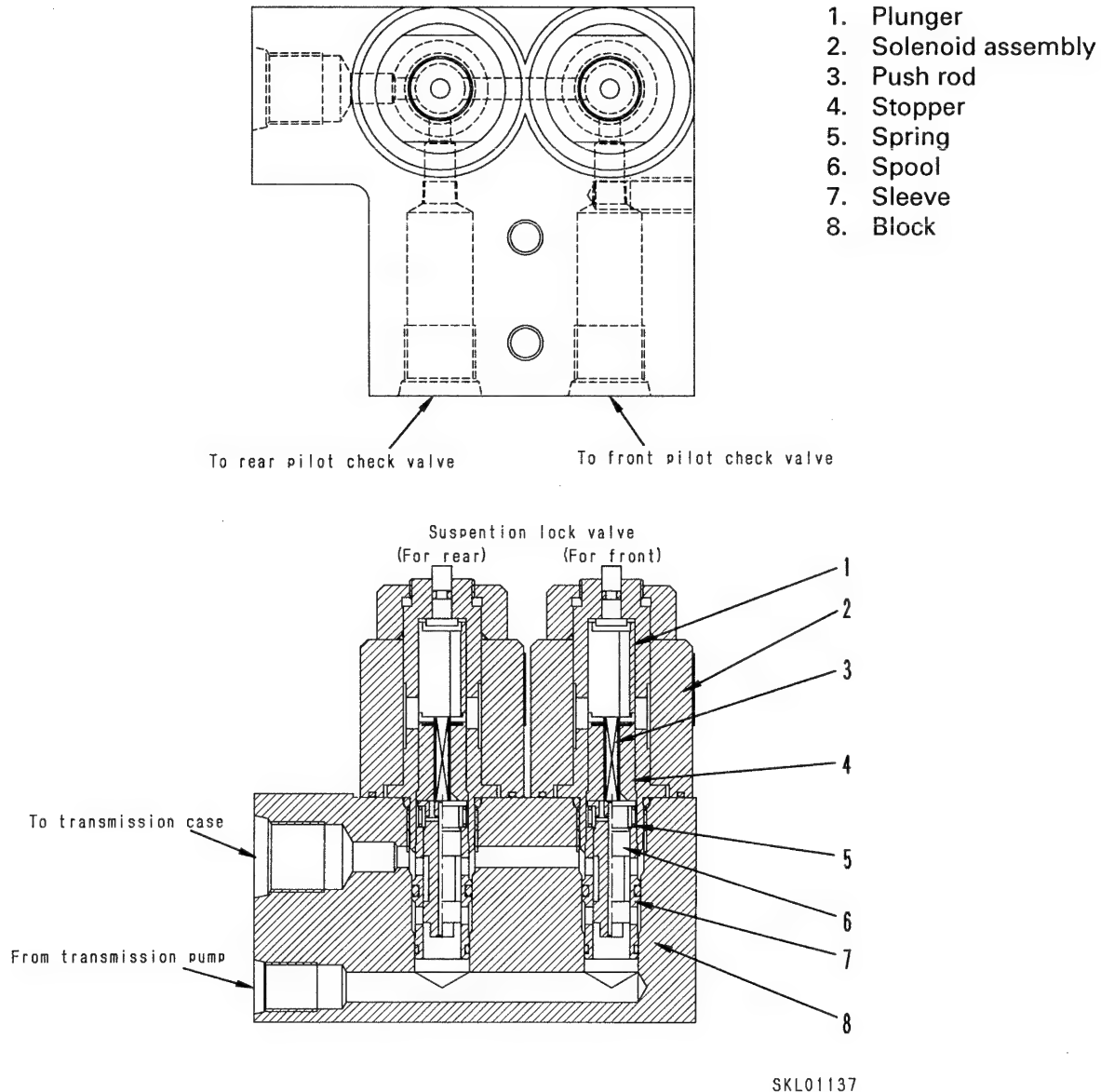


SLL01135



SLL01136

SUSPENSION LOCK VALVE



023S05

Outline

- There are two suspension lock valves in the circuit between the transmission pump and the pilot check valve. These switch the oil from the transmission pump and open or close the 4 pilot check valves. In addition, the suspension lock valve uses 2 solenoid valves (for the front and rear), and these are actuated when the suspension lock switch is set to the LOCK position.

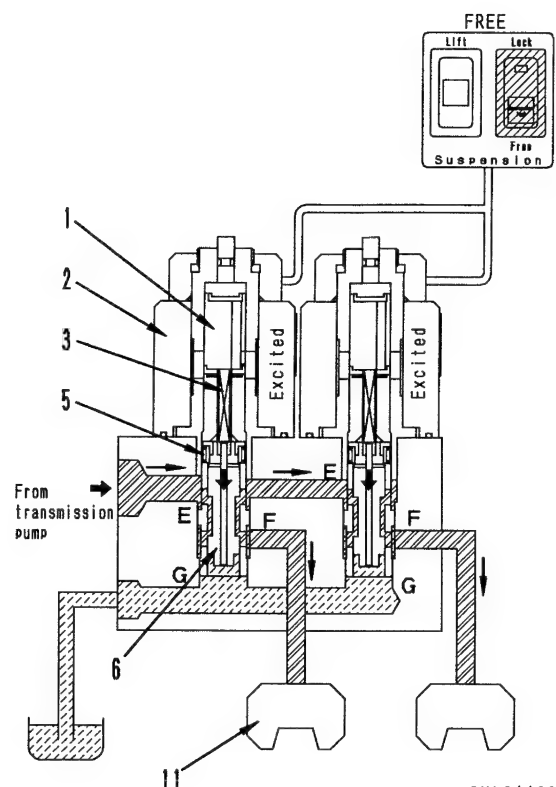
The front suspension lock valve is actuated when the suspension lock switch is operated, and it is also actuated when electricity is sent through it by the stop lamp switch actuated by the operation of the brake pedal. In other words, when the brakes are applied, it acts to prevent the machine from nosediving.

OPERATION

1. When suspension lock switch is at FREE

When the suspension lock switch is at the FREE position, solenoid (2) is excited. Plunger (1) and push rod (3) push spool (6) down, close the circuit between ports **G** and **F** and open the circuit between ports **E** and **F**.

When this happens, the oil from the transmission pump enters port **F** from port **E**, flows to the pilot port of pilot check valve (11), and sets the suspension lock cylinder in the free condition.



SKL01138

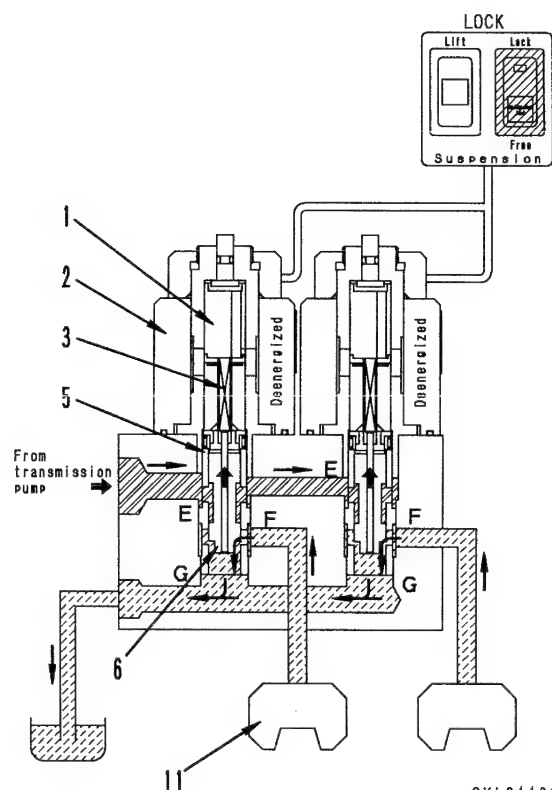
2. When suspension lock switch is at LOCK

If the suspension lock switch is set to the LOCK position, solenoid (2) is deenergized. Spool (6) is moved back up by the tension of spring (5), so the circuit between ports **E** and **F** is closed and the circuit between ports **F** and **G** is opened.

When this happens, the oil from the transmission pump enters port **E** and stops.

The oil from port **F**, in other words, the oil from the pilot port of pilot check valve (11), enters port **G** and is drained to the transmission case. As a result, the pilot pressure in the pilot check valve is lost, and the suspension lock cylinder is LOCKED.

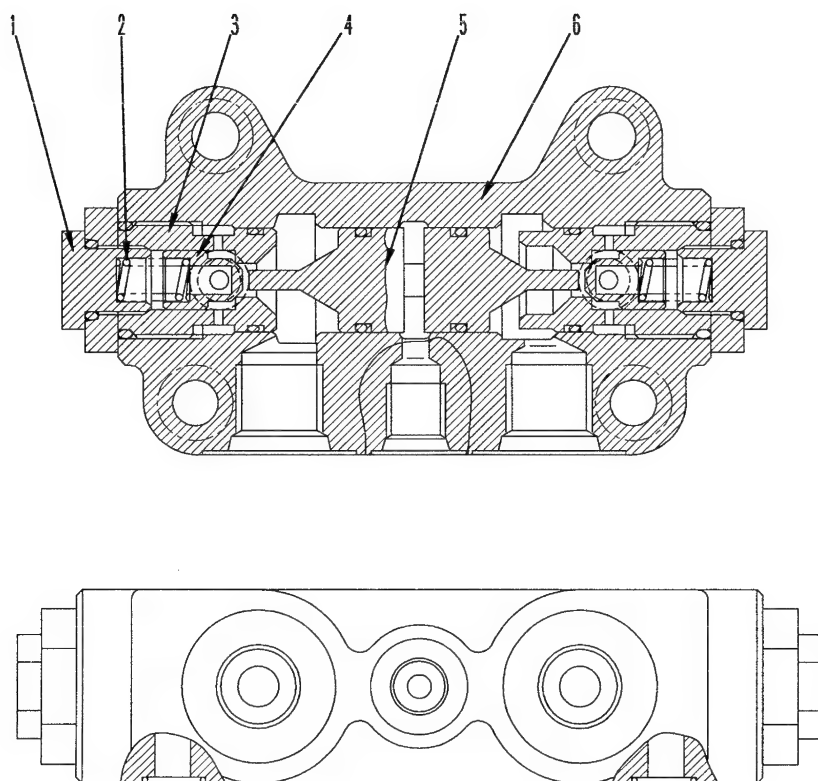
With the front suspension lock valve, the anti nose-dive relay is actuated by the stop lamp switch which is actuated by air pressure when the brake pedal is depressed, so solenoid (2) is deenergized, and the actuation is the same as given above even when the suspension lock switch is at the FREE position.



SKL01139

SUSPENSION PILOT CHECK VALVE

FOR FRONT SUSPENSION (DOUBLE)



SKL00375

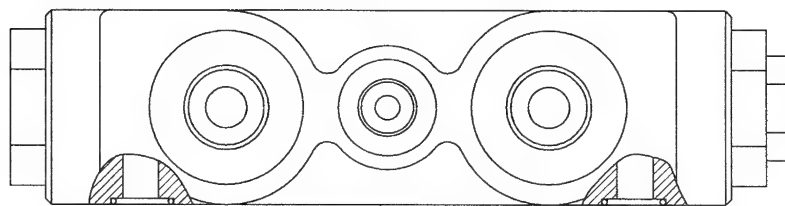
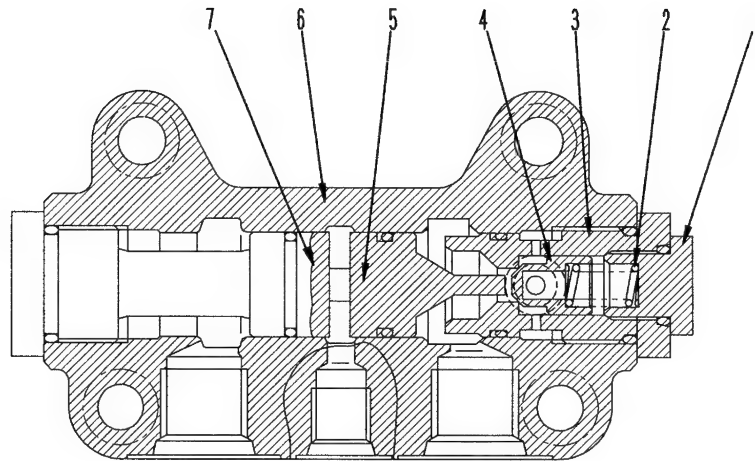
1. Cap
2. Check valve spring
3. Valve sleeve
4. Check valve
5. Piston
6. Valve body

Outline

- The front pilot check valve is in the circuit between the suspension selector valve and suspension lock valve and the front suspension lock cylinder. It acts to close the cylinder circuit when the suspension is locked. When the suspension lock switch is not being operated, the oil in the suspension lock valve enters the area between left and right pistons (5), pushes check valve (4), and connects the circuit between the suspension selector valve and the cylinder.

023S05

FOR REAR SUSPENSION (SINGLE)



SKL00376

1. Cap
2. Check valve spring
3. Valve sleeve
4. Check valve
5. Piston
6. Valve body
7. Plug

Outline

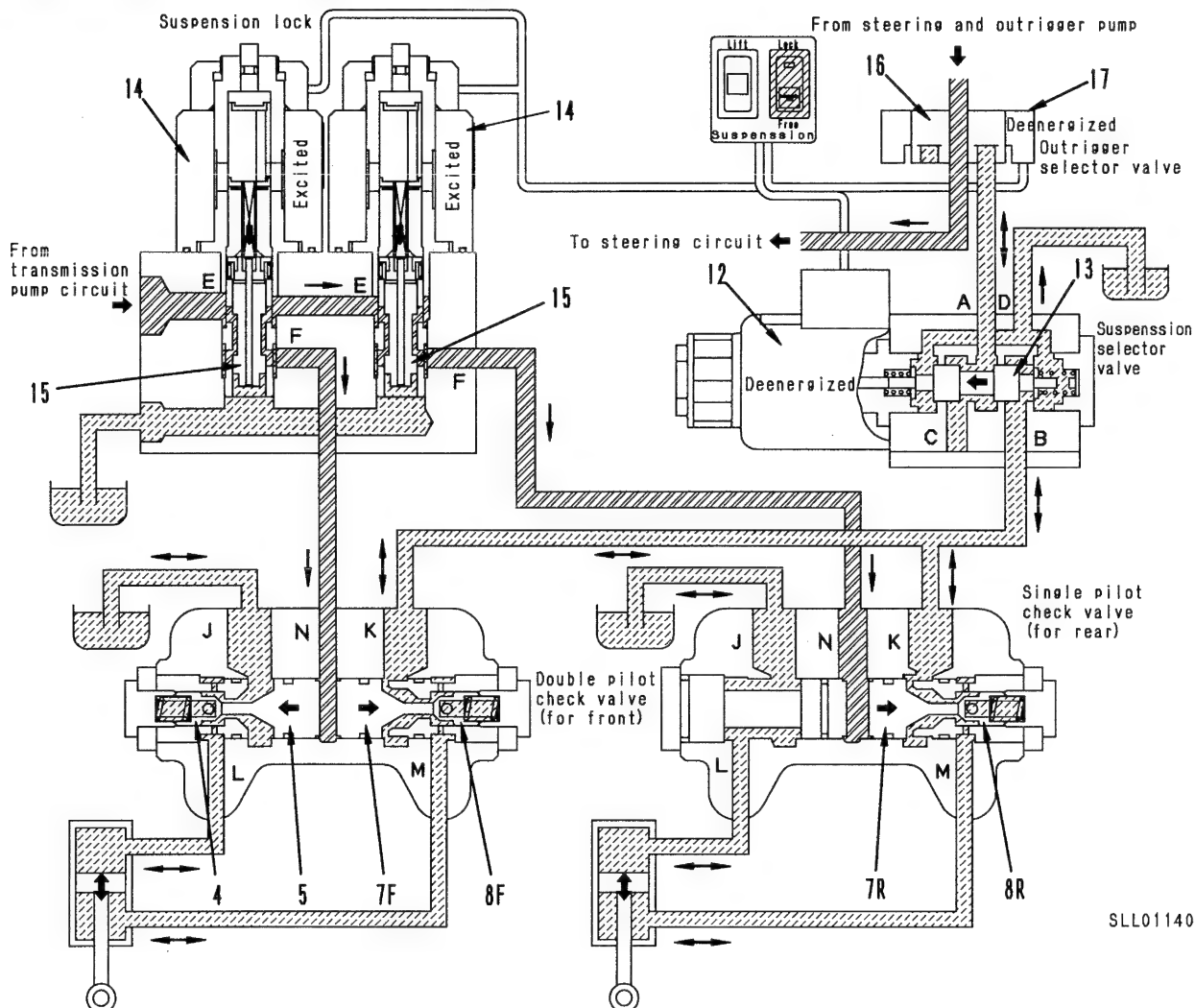
- The rear pilot check valve is in the same kind of circuit as the front pilot check valve, but it is different from the front pilot check valve because it is a single structure (check at head end).

When the suspension lock switch is not being operated, the oil in the suspension lock valve enters the area between piston (5) and plug (7), pushes check valve (4), and connects the circuit between the suspension selector valve and the cylinder.

023S05

OPERATION

1. When suspension lock switch is at FREE



- When the suspension lock switch is at the FREE position, solenoid (12) of the suspension selector valve is deenergized, so spool (13) is held in a position where the circuits between ports A and C and ports B and D are opened.

In addition, solenoid (14) of the suspension lock valve is excited, so spool (15) moves down, closes the circuit between ports F and G, and opens the circuit between ports E and F.

In this condition, if the outrigger extension is not being operated, extension solenoid (17) of outrigger selector valve (16) is deenergized, so the circuit from the steering and outrigger pump to port A of the suspension selector valve is closed.

Even if the steering and outrigger pump turns, the oil from the pump does not enter port A.

However, if the outrigger extension is being operated, extension solenoid (17) of outrigger selector valve (16) is excited. The circuit from the steering and outrigger pump to port A of the suspension selector valve is opened, and the oil from the steering and outrigger pump flows from port A of the suspension selector valve to port C, and stops at the block.

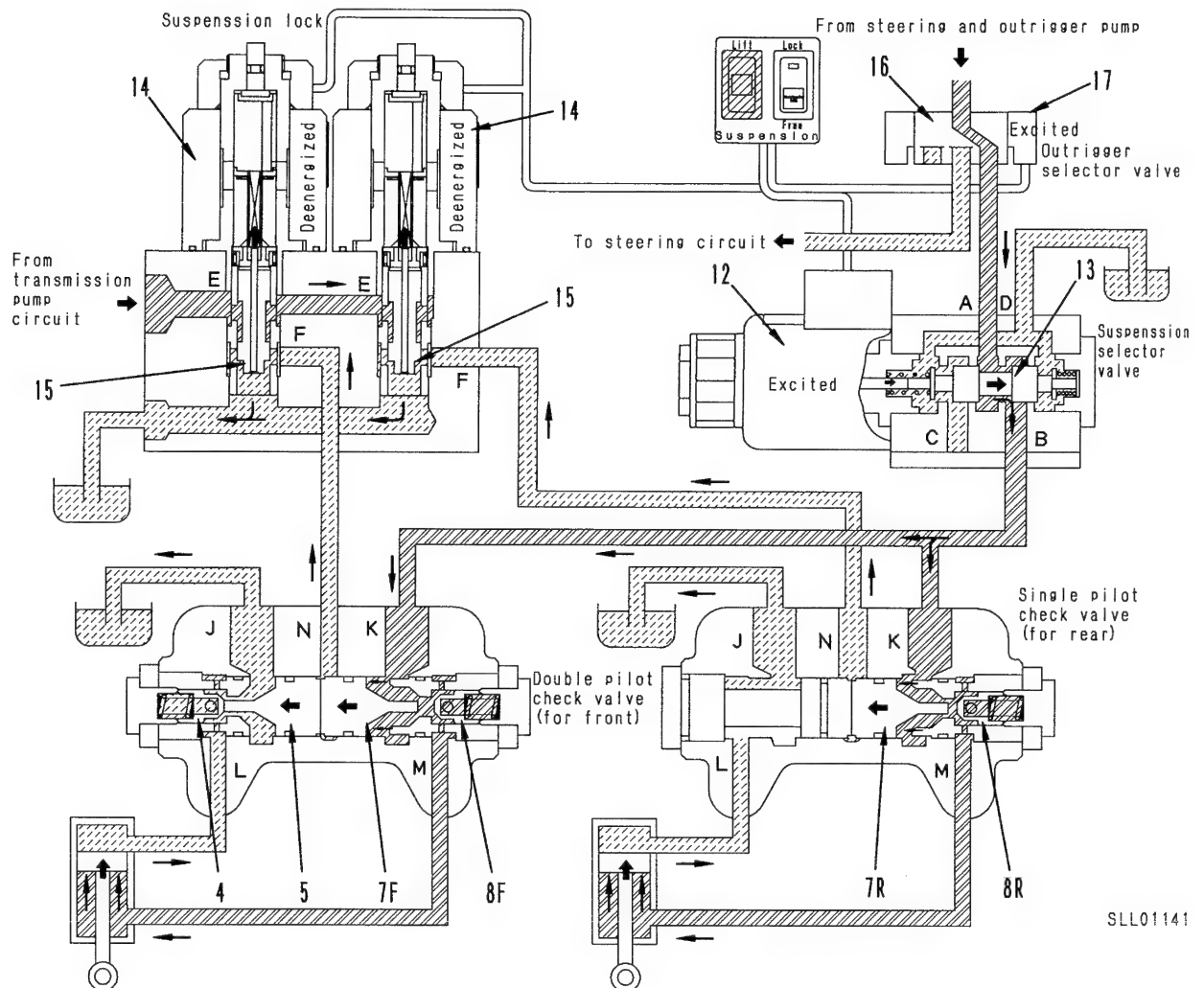
The oil from the transmission pump passes from port E of the suspension lock valve through port F, and enters port N of the pilot check valves. It pushes out left and right front pistons and rear piston (5) and (7), and pushes open check valves (4) and (8).

When this happens, the circuit between ports K and M and the circuit between ports J and L for the front are opened, and the suspension lock cylinder is set to the free condition.

023S05

SLL01140

2. When suspension lock switch is at LIFT



- When the suspension lock switch is moved from the FREE position to the LIFT position, solenoids (12) and (17) of selector valve (16) and the suspension selector valve are excited, and solenoid (14) of the suspension lock valve is deenergized.

When this happens, the selector valve opens the circuit from the steering and outrigger pump to port A of the suspension selector valve, and spool (13) of the suspension selector valve moves to the right and opens the circuit between ports A and B.

Spool (15) of the suspension lock valve is moved back up by the tension of the spring, closes the circuit between ports E and F, and opens the circuit between ports G and F.

When this happens, the oil at port N of the pilot check valve returns from port F of the suspension lock valve to port G, and is drained

to the tank. As a result, the pressure pushing pistons (5) and (7) to the left and right (only to the right for the rear piston) is lost.

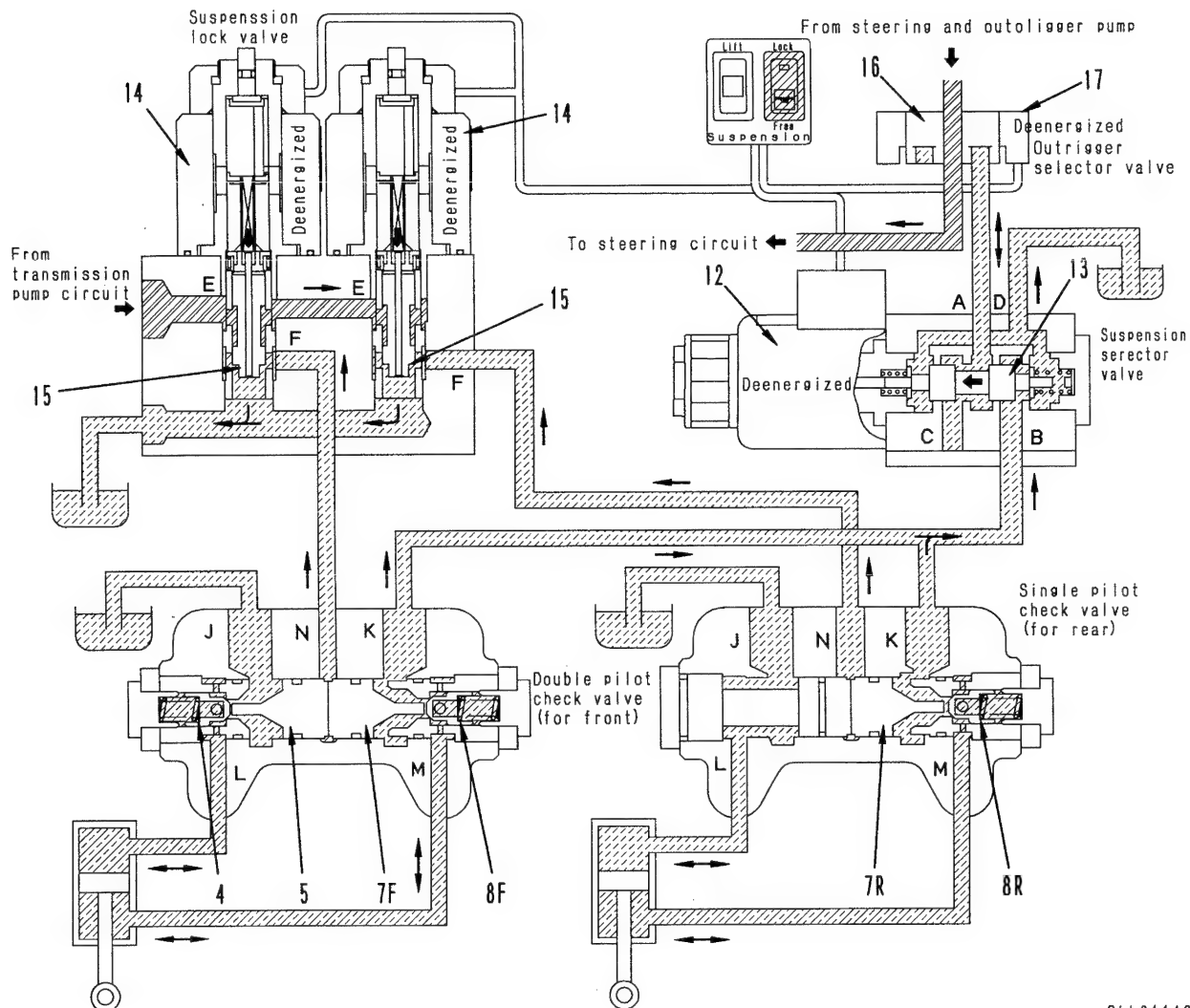
The oil from the steering and outrigger pump passes through the selector valve, and flows from ports A and B of the suspension selector valve to port K. When the pressure in the circuit goes above a certain pressure, some of the oil pushes open check valve (8), enters port M, and flows to the head end of the suspension lock cylinder to push the cylinder up. The rest of the oil pushes piston (5) (front piston only) to the left, and pushes open check valve (4). The oil at the bottom end of the suspension lock cylinder returns from port L to port J, and is drained to the hydraulic tank. (This is always the condition for the rear.)

Therefore, when the pressure in the circuit rises, the suspension lock cylinder is retracted.

023S05

SLL01141

3. When suspension lock switch is at LOCK



SLL01142

- When the suspension lock switch is moved from the LIFT position to the LOCK position, solenoids (12) and (17) of outrigger selector valve (16) and the suspension selector valve (16) are deenergized, and the deenergized condition of solenoid (14) of the suspension lock valve continues.

When this happens, the outrigger selector valve closes the circuit from the steering and outrigger pump to port A of the suspension selector valve. Spool (13) of the suspension selector valve is returned to the left by the tension of the spring, closes the circuit between ports A and B, and opens the circuits between ports A and C and ports B and D. The suspension lock valve closes the circuit between ports E and F in the same way as in Item 2, and keeps the circuit between ports G and F open.

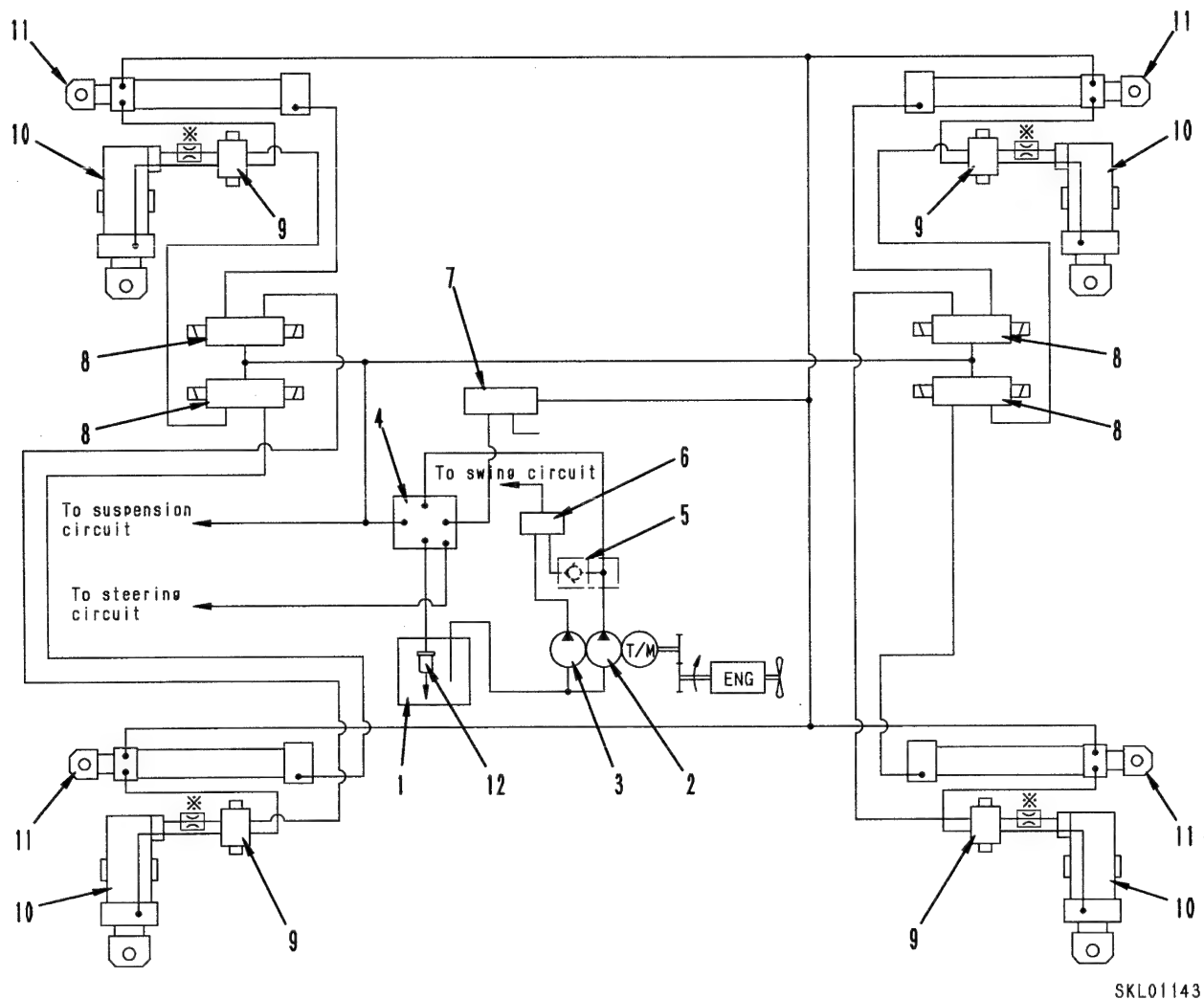
In this condition, there is no pilot pressure at port N of the pilot check valve, so the oil from port K returns from port B to port D and is drained to the hydraulic tank. When this happens, check valves (4) and (8) are returned by the tension of the spring, and close the circuit between ports K and M and the circuit between ports J and L for the front valve.

Therefore, the high-pressure circuits from the pilot check valve to the suspension lock cylinder are all closed, and the suspension lock cylinder is kept in the same position.

Ports J and L for the rear valve are always connected to the hydraulic tank, so the suspension lock is effective only when the cylinder reaches the end of its stroke at suspension lift. It cannot be locked at any other point on the cylinder stroke.

023S05

OUTRIGGER HYDRAULIC SYSTEM



- ※ Installed only to the H-shaped outrigger specification machine.

1. Hydraulic tank
2. Steering, outrigger pump
3. Swing pump
4. Outrigger selector valve
5. Check valve
6. Merge selector valve
7. Collection check valve
8. Outrigger individual valve
9. Jack pilot check valve
10. Jack cylinder
11. Slide cylinder
12. Hydraulic filter

Outline

- The outrigger hydraulic system consists of steering and outrigger pump (2), and the valves and cylinders actuated by the switches on the outrigger control panel in the operator's compartment.

- The oil in hydraulic tank (1) is sucked up by steering and outrigger pump (2) and enters outrigger selector valve (4).

When the switches on the outrigger control panel are operated, valves (4) and (8) are actuated, and jack cylinder (10) and slide cylinder (11) are extended or retracted to set or stow away the outriggers.

When selector valve (4) is at the NEUTRAL position, the oil from the pump flows to the steering circuit.

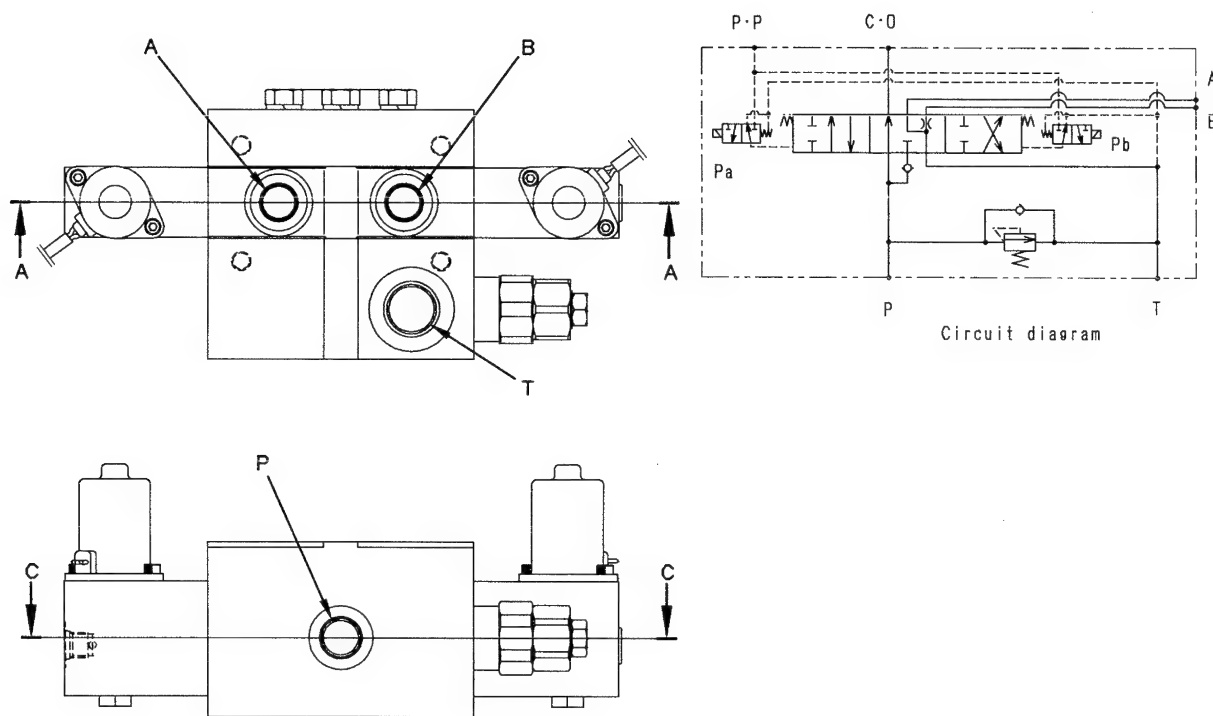
Pilot check valve (9) installed to jack cylinder (10) acts to prevent the cylinders from extending when the machine is traveling and from retracting when the outriggers have been set for crane operations.

Collection check valve (7) acts to prevent the slide cylinders from extending when the outriggers are stowed away.

- If the ALL switch on the control panel is operated, individual valve (8) and selector valve (4) are actuated and all four slide cylinders and jack cylinders can be operated at the same time in order. If the individual switches are operated, each cylinder can be operated independently.
- If the ALL switch is operated, merge selector valve (6) is actuated and the oil from swing pump (3) passes through check valve (5) and is sent to the outrigger circuit, so the amount of oil in the outrigger circuit increases and it becomes possible to increase the operating speed of the outrigger.
When individual valve (8) is operated, the merge selector valve is not actuated, so it is possible to carry out fine control.

023S05

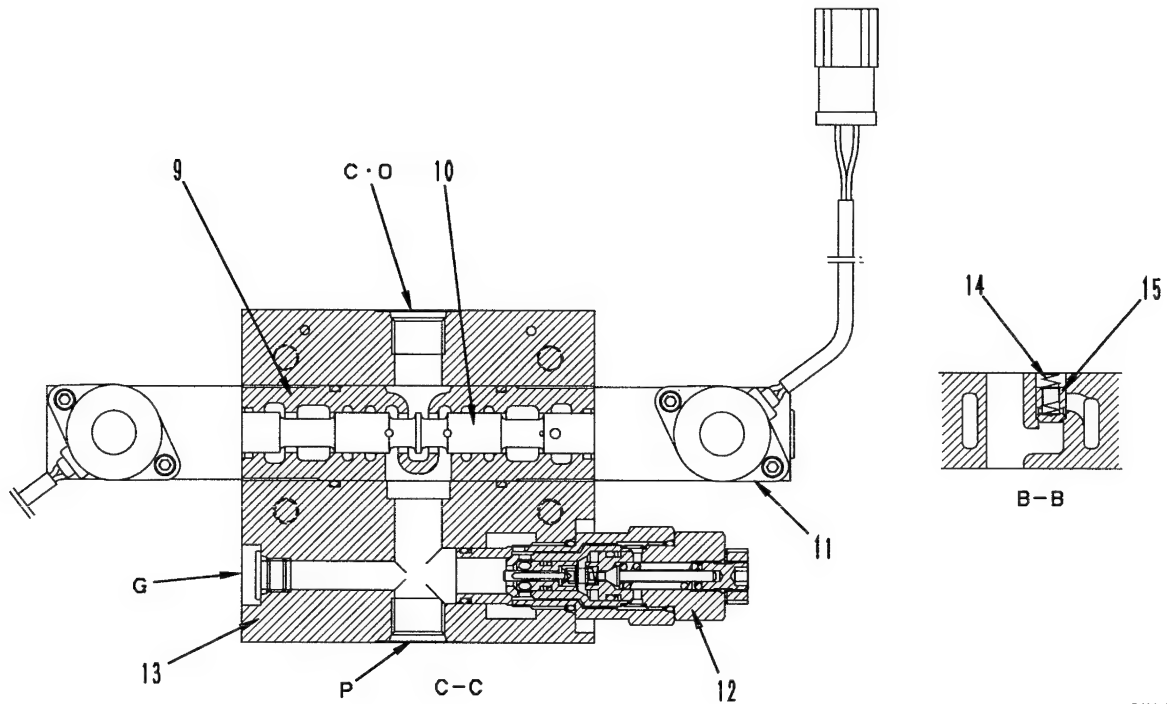
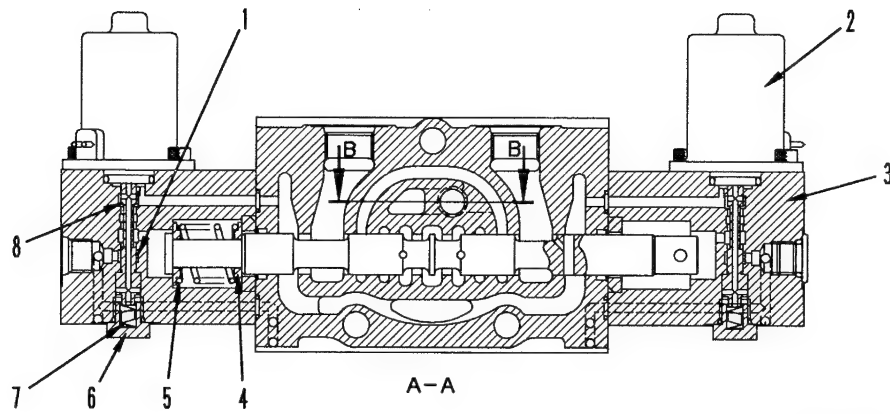
OUTRIGGER SELECTOR VALVE



SKL01144

- A. Port **A** (to slide cylinder, jack cylinder bottom)
- B. Port **B** (to slide cylinder, jack cylinder head)
- P. Port **P** (pump port)
- T. Port **T** (to tank)
- G. Port **G** (gauge port)
- P.P. Port **P.P.** (from PPC pump)
- C.O. Port **C.O.** (to steering circuit)

023S05

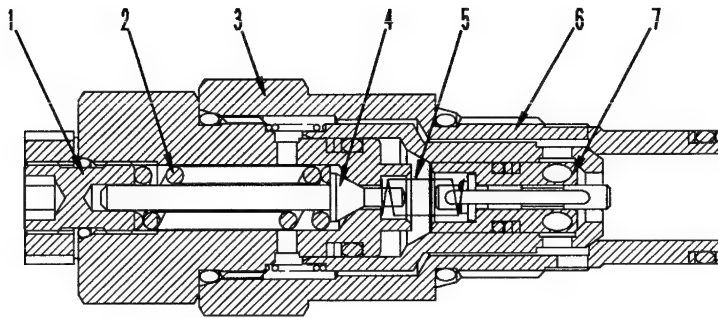


SKL00382

- | | |
|-------------------------|--------------------------------------|
| 1. Orifice | 9. Outrigger selector valve assembly |
| 2. Solenoid assembly | 10. Valve spool |
| 3. Solenoid valve body | 11. Solenoid valve assembly |
| 4. Retainer | 12. Main relief valve assembly |
| 5. Spool return spring | 13. Valve body |
| 6. Plug | 14. Spring |
| 7. Spool return spring | 15. Plunger |
| 8. Solenoid valve spool | |

023S05

MAIN RELIEF VALVE



SKL00389

1. Adjustment screw
2. Poppet spring
3. Valve body
4. Poppet
5. Valve spring
6. Valve body
7. Main relief valve

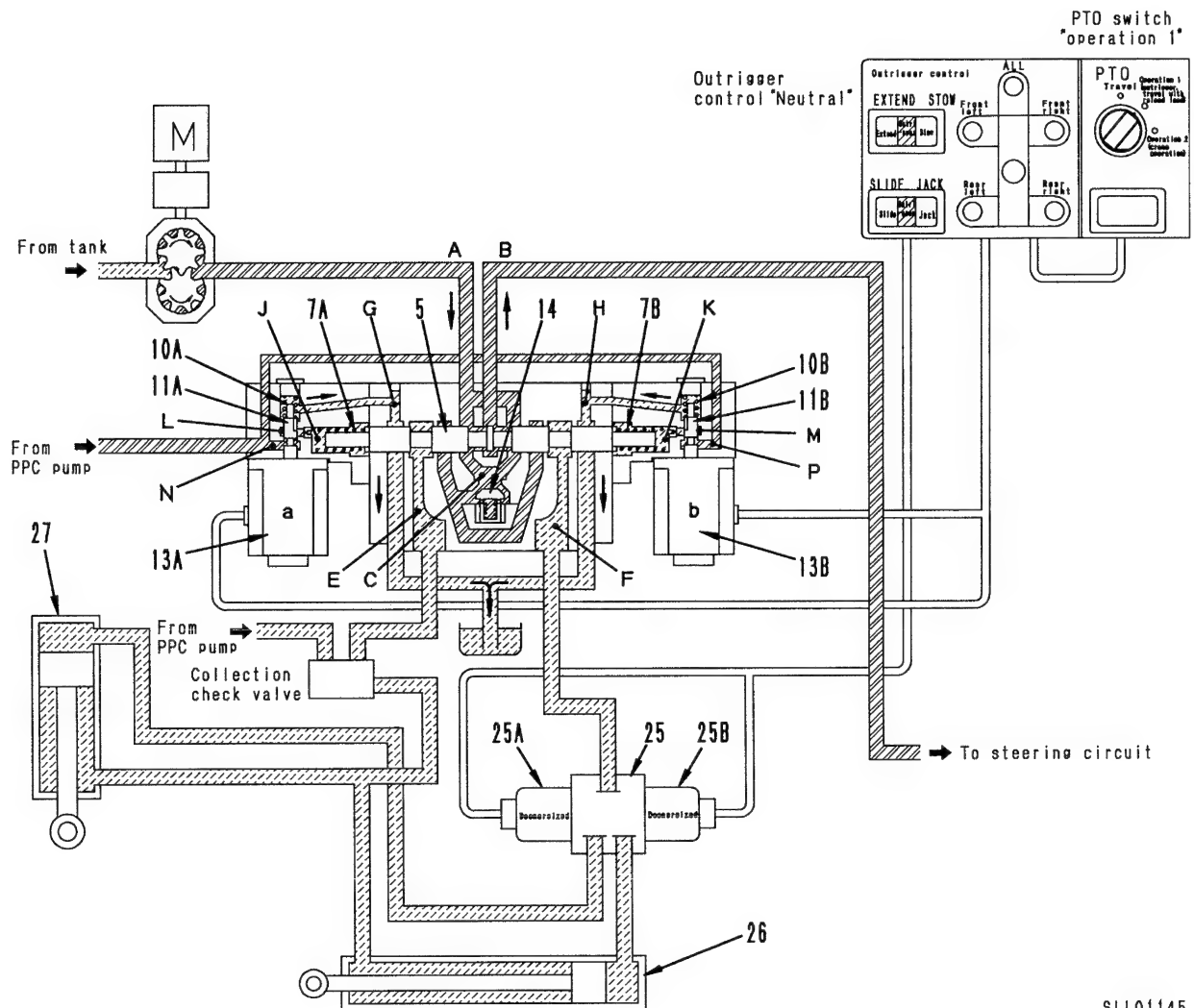
Outline

- The outrigger selector valve is in the circuit between the boom pump and the outrigger jack cylinder and slide cylinder. It consists of main relief valve (12), cylinder telescope selector valve (9), and two sets of solenoid valves (11). When the switch in the operator's compartment is operated, solenoid valve spool (8) is actuated and pilot pressure is applied to telescope selector valve (9) to actuate spool (10).
Set pressure: 20.6 MPa {210 kg/cm²}

023S05

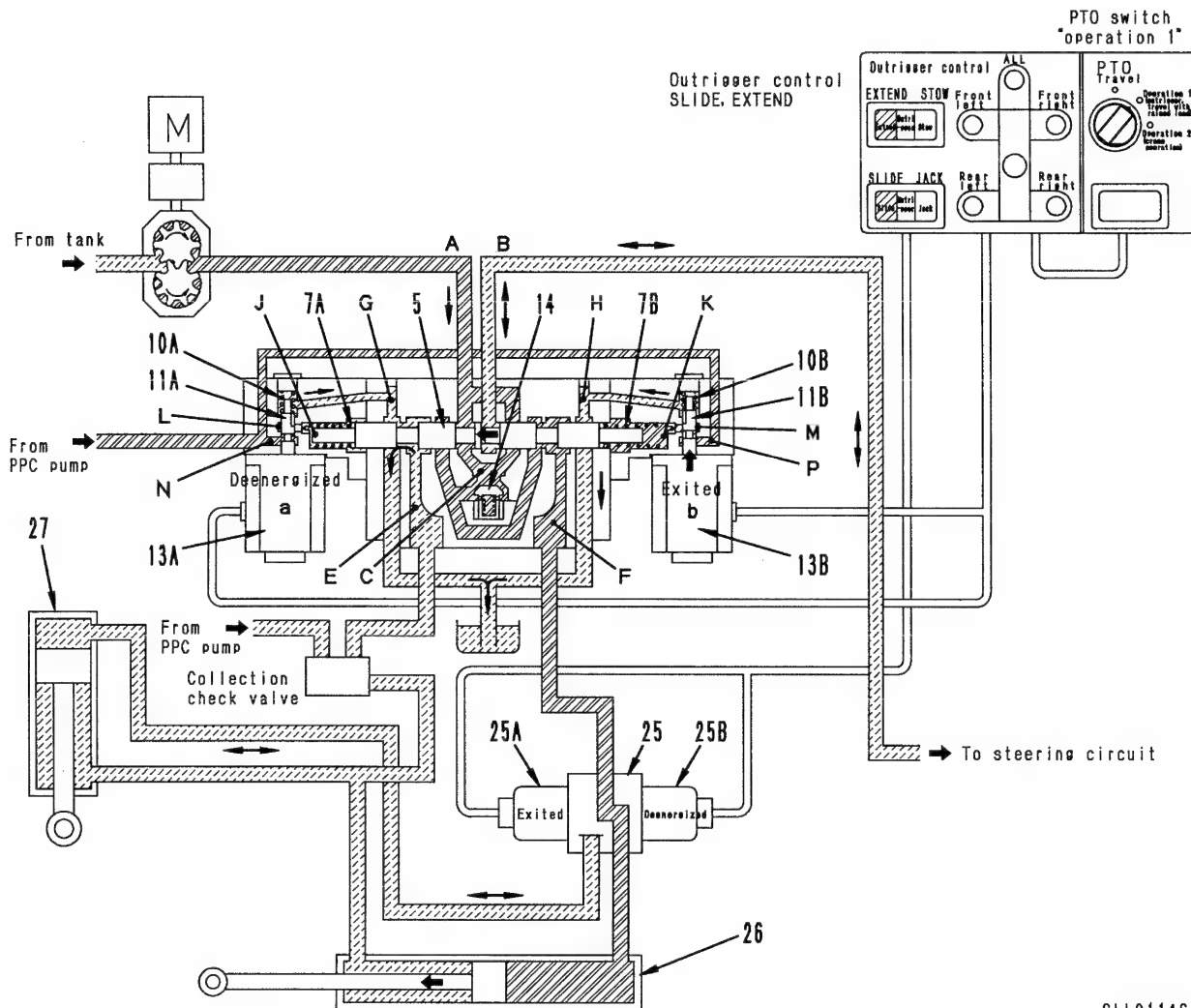
OPERATION

1. Extending outriggers



SLL01145

- ★ When extending the outriggers, carry out the operation in the following order. (For details, see the Operation and Maintenance Manual.)
 - 1) Set the PTO switch to "OPERATION 1".
 - 2) Set the JACK/SLIDE switch on the outrigger control panel to the SLIDE position.
 - 3) Set the EXTEND/STOW switch to the EXTEND position.
 - 4) Press the ALL switch.
 - 5) Check that the slide operation for the outrigger is completed, then set the JACK/SLIDE switch to the JACK position.
 - 6) Press the ALL switch.
- The engine runs, the steering and outrigger pump rotates, sucks up oil from the hydraulic tank, and sends it to port A of the selector valve. Some of the oil entering port A flows from port B to the steering circuit. The rest of the oil flows from port C, pushes open check valve (14), and enters port D. The circuit is shut off by spool (5).



• Extending slide

Next, set the JACK/SLIDE switch to the SLIDE position, and the EXTEND/STOW switch to the EXTEND position.

If the ALL switch is pressed, solenoid (25A) of individual valve (25) is excited, and the passage between port F and the bottom end of slide cylinder (26) is opened, solenoid (13B) is excited.

When this happens, the solenoid pushes spool (11B) up, closes the circuit between ports M and H, and opens the circuit between port M and P. The oil from the PPC pump always comes to port P, so it passes through the passage, through port M, and flows to port K. When the pressure in the circuit becomes greater than the load of spring (7A), spool (5) is pushed out to the left.

When this happens, spool (5) closes the circuit between ports A and B, and opens the circuit between ports D and F, so the oil from the pump all enters port F and flows to the bottom end of front and rear, left and right slide cylinders (26), which have been opened by individual valve (25).

At the same time, the circuit between ports E and G opens, so the oil at the head end of each slide cylinder is drained to the hydraulic tank.

When the pressure in the circuit rises, the slide cylinders are extended, and the slide extension operation of the outriggers is completed. When the ALL switch is released, it returns automatically to the neutral position, and solenoids (13B) and (25A) are deenergized.

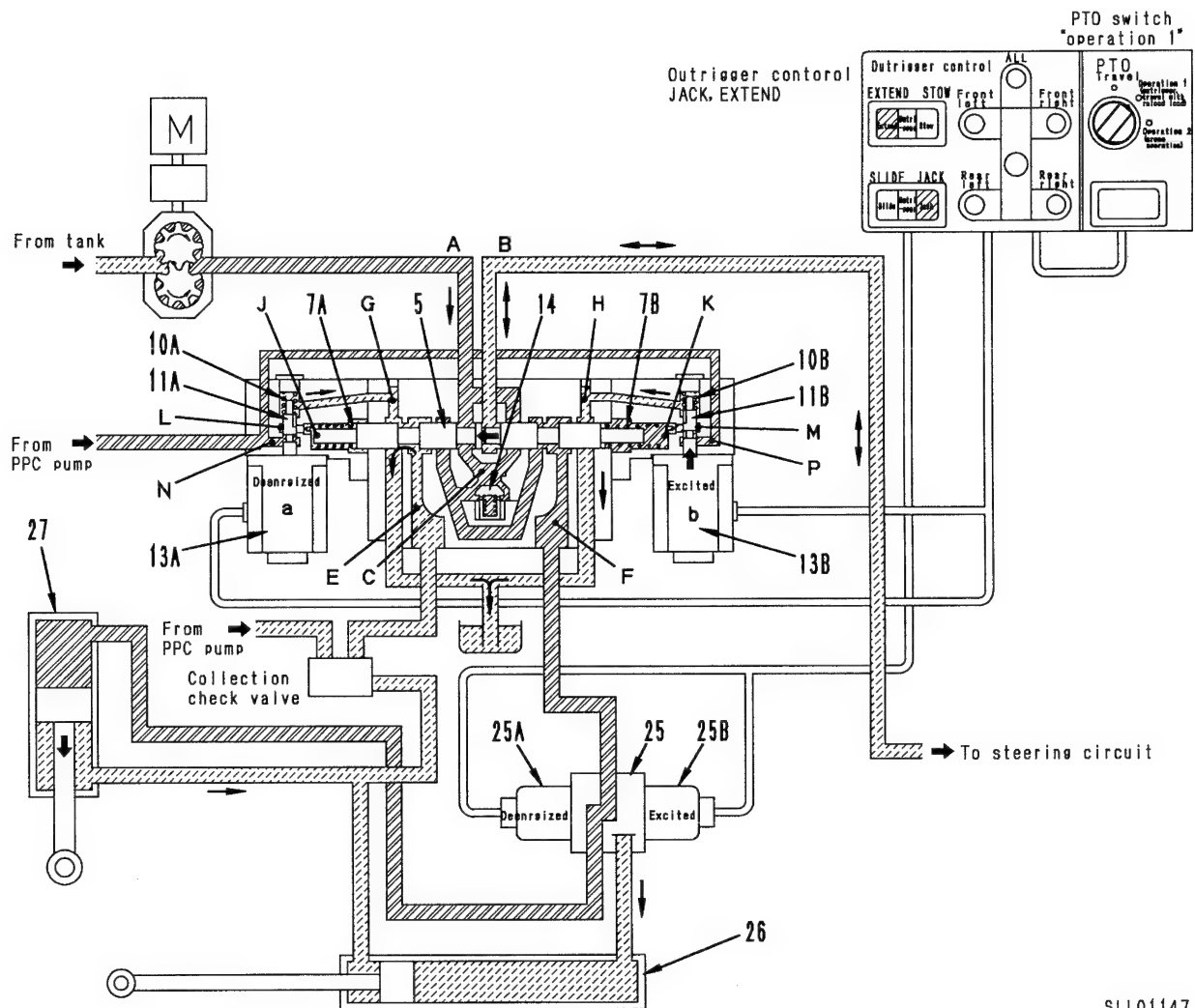
When this happens, spool (11B) is moved back down by the tension of spring (10B), closes the circuit between ports M and P, and opens the circuit between ports M and H, so the oil at port K flows from drain port H and returns to the hydraulic tank.

When the pilot pressure at port K is lost, spool (5) is pushed back to the right by the tension of spring (7A), and returns to the NEUTRAL position.

Solenoid (25A) of individual valve (25) is deenergized, so the circuit at the bottom end of the slide cylinder is closed, and the slide cylinders are held in position.

023S05

SLL01146



SLL01147

- Extending jack**

When the extension of the slide is completed, turn the JACK/SLIDE switch from the SLIDE position to the JACK position and press the ALL switch.

When this happens, solenoid (25B) of individual valve (25) is excited, so the passage between port F and the bottom end of jack cylinder (27) is opened. In addition, solenoid (13B) is excited, and spool (5) is actuated in the same way as when operating the slide. The oil from the pump all enters port F, and flows to the bottom end of front and rear, left and right jack cylinders (27), which have been opened by individual valve (25).

At the same time, the oil at the head of each jack cylinder returns to port E and is drained to the hydraulic tank. When the pressure in the circuit rises, the jack cylinders are extended, and the EXTENSION operation of the

outriggers is completed.

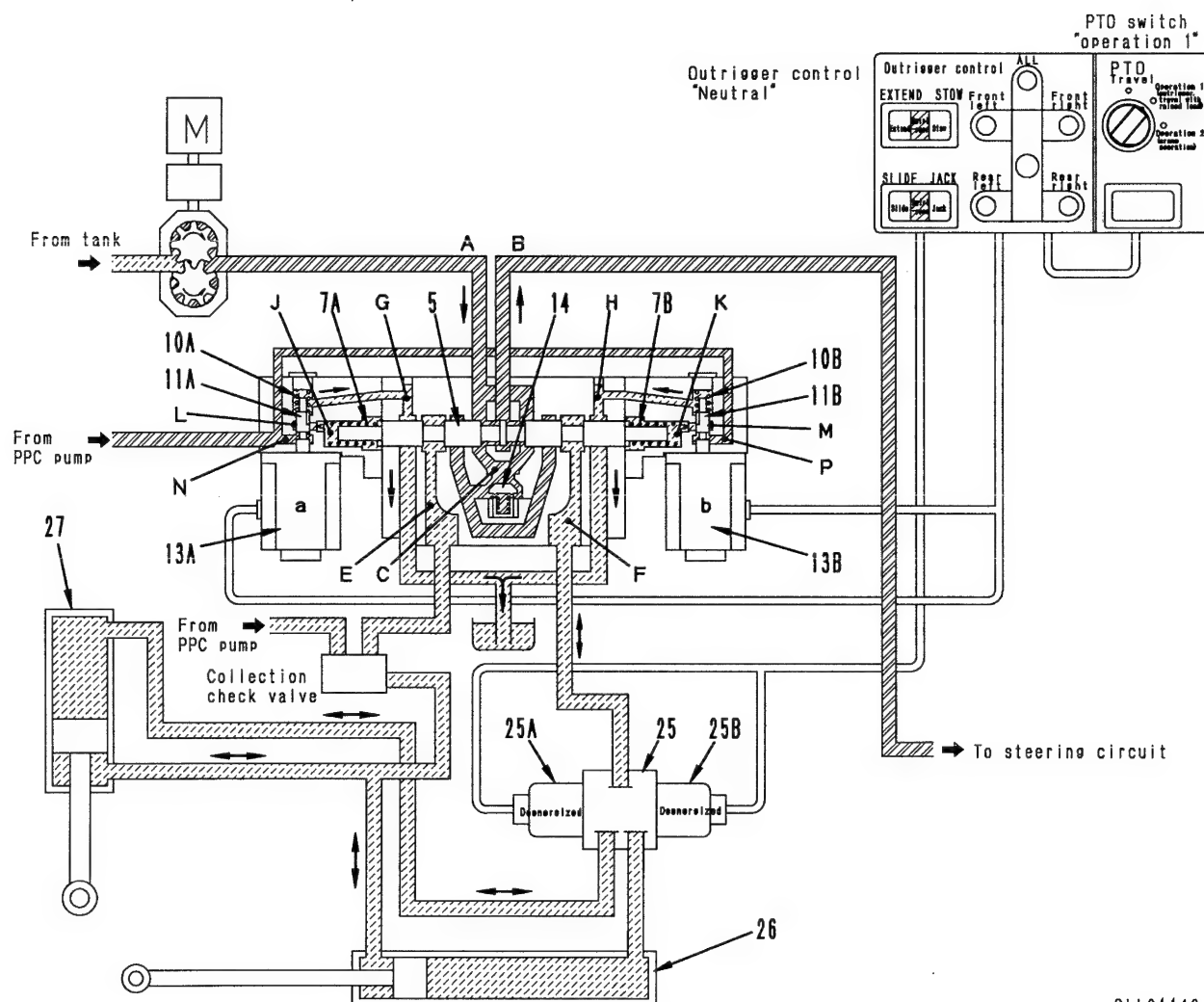
When the ALL switch is released, it returns automatically to the NEUTRAL position, and solenoids (13B) and (25B) are deenergized.

When this happens, spool (11B) is moved back down by the tension of spring (10B), closes the circuit between ports M and P, and opens the circuit between ports M and H, so the oil at port K flows from drain port H and returns to the hydraulic tank.

When the pilot pressure at port K is lost, spool (5) is pushed back to the right by the tension of spring (7A), and returns to the NEUTRAL position.

Solenoid (25G) of individual valve (25) is deenergized, so the circuit at the bottom end of the jack cylinder is closed, and the jack cylinders are held in position.

2. Stowing outriggers



023S05

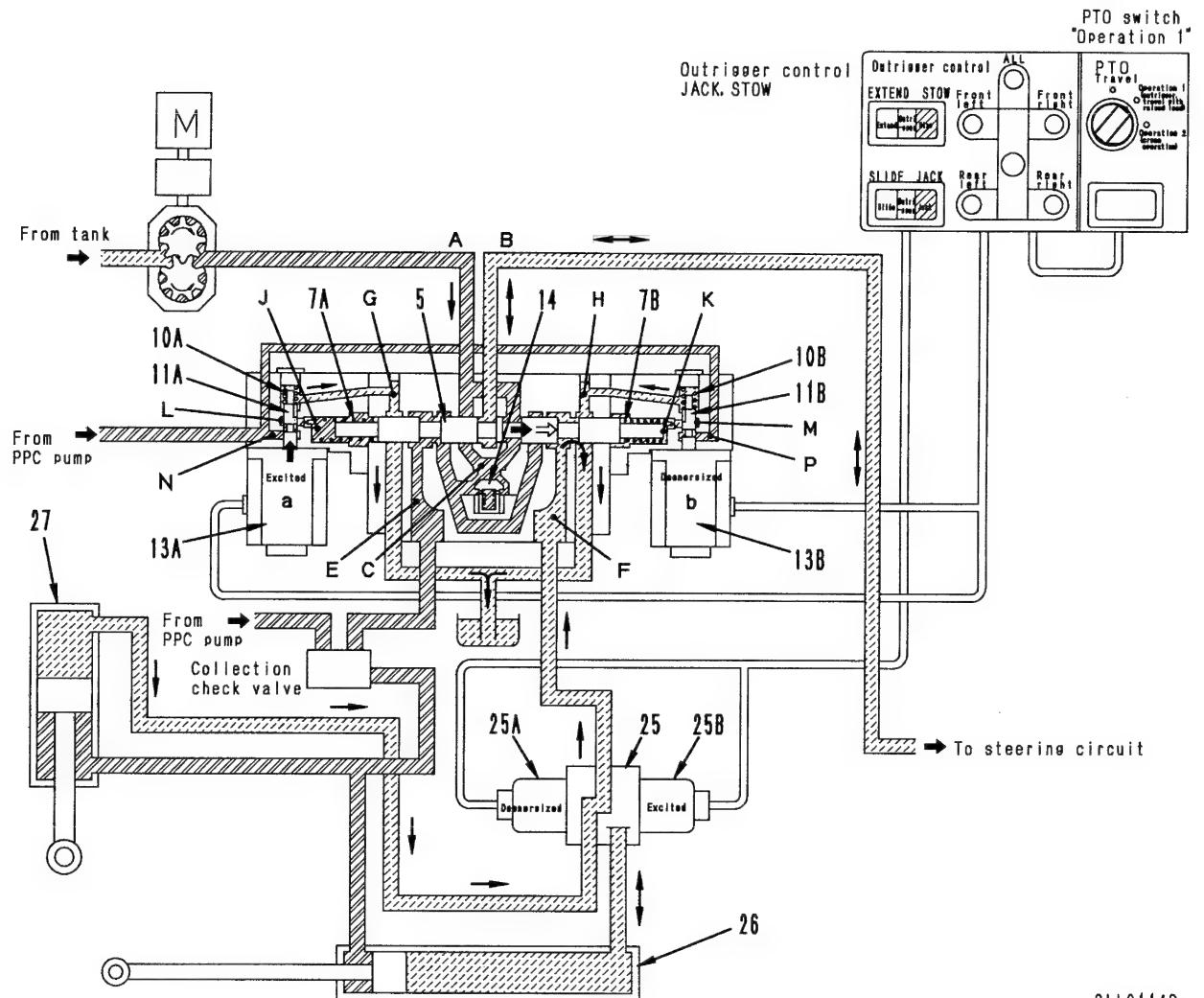
SLL01148

★ When stowing the outriggers, carry out the operation in the following order. (For details, see the Operation and Maintenance Manual.)

- 1) Set the PTO switch to "OPERATION 1".
- 2) Set the JACK/SLIDE switch on the outrigger control panel to the JACK position.
- 3) Set the EXTEND/STOW switch to the STOW position.
- 4) Press the ALL switch.
- 5) Check that the stowing operation for the outrigger jacks is completed, then set the JACK/SLIDE switch to the SLIDE position.
- 6) Press the ALL switch.

- The engine runs, the steering and outrigger pump rotates, sucks up oil from the hydraulic tank, and sends it to port A of the selector valve.

Some of the oil entering port A flows from port B to the steering circuit. The rest of the oil flows from port C, pushes open check valve (14), enters port D, then flows to ports N and P of the solenoid valves, and stops.



SLL01149

- Stowing jack**

Set the JACK/SLIDE switch to the JACK position, and the EXTEND/STOW switch to the STOW position.

If the ALL switch is pressed, solenoid (25B) of individual valve (25) is excited, and the passage between port F and the bottom end of jack cylinder (27) is opened. At the same time, solenoid (13A) is excited.

When this happens, solenoid (13A) pushes spool (11A) up, closes the circuit between ports L and G, and opens the circuit between ports L and N.

The oil from the PPC pump always comes to port N, so it passes through the passage, through port L, and flows to port J. When the pressure in the circuit becomes greater than the load of spring (7B), spool (5) is pushed out to the right.

When this happens, spool (5) closes the circuit between ports A and B, and opens the circuit between ports D and F, so the oil from the pump all enters port E and flows to the head end of front and rear, left and right jack cylinders (27).

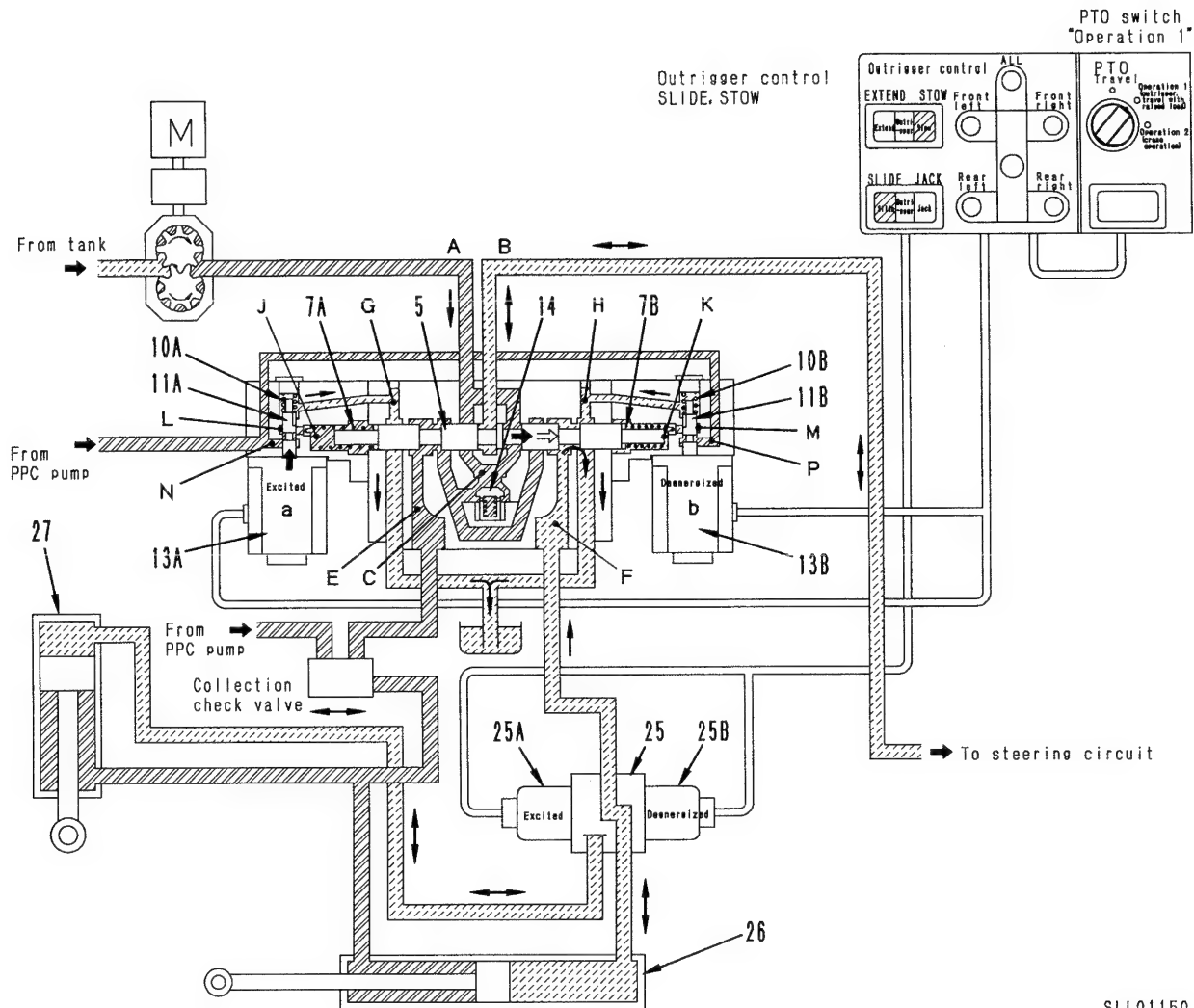
At the same time, the circuit between ports F and H opens, so the oil at the head end of each jack cylinder is drained to the hydraulic tank. When the pressure in the circuit rises, the jack cylinders are retracted, and the stowing operation of the outrigger jacks is completed. When the ALL switch is released, it returns automatically to the NEUTRAL position, and solenoid (13A) and (25B) are deenergized.

When this happens, spool (11A) is moved back down by the tension of spring (10A), closes the circuit between ports L and N, and opens the circuit between ports L and G, so the oil at port J flows from drain port G and returns to the hydraulic tank.

When the pilot pressure at port J is lost, spool (5) is returned to the left by the tension of spring (7B), and returns to the NEUTRAL position.

Solenoid (25G) of individual valve (25) is deenergized, so the circuit at the bottom end of the jack cylinder is closed, and the jack cylinders are held in position.

023S05



SLL01150

• Stowing slide

- When the stowing of the jack is completed, turn the JACK/SLIDE switch from the JACK position to the SLIDE position and press the ALL switch.

When this happens, solenoid (25A) of individual valve (25) is excited, so the passage between port F and the bottom end of jack cylinder (27) is closed, and the passage between port F and the bottom end of slide cylinder (26) is opened. At the same time, solenoid (13A) is excited, and spool (5) is actuated in the same way as when operating the jack. The oil from the PPC pump all enters port E, and flows to the head end of front and rear, left and right slide cylinders (26).

At the same time, the oil at the bottom of each slide cylinder returns to port F and is drained to the hydraulic tank. When the pressure in the circuit rises, the slide cylinders are re-

tracted, and the stowing operation of the outriggers is completed.

When the ALL switch is released, it returns automatically to the neutral position, and solenoids (13A) and (25A) are deenergized.

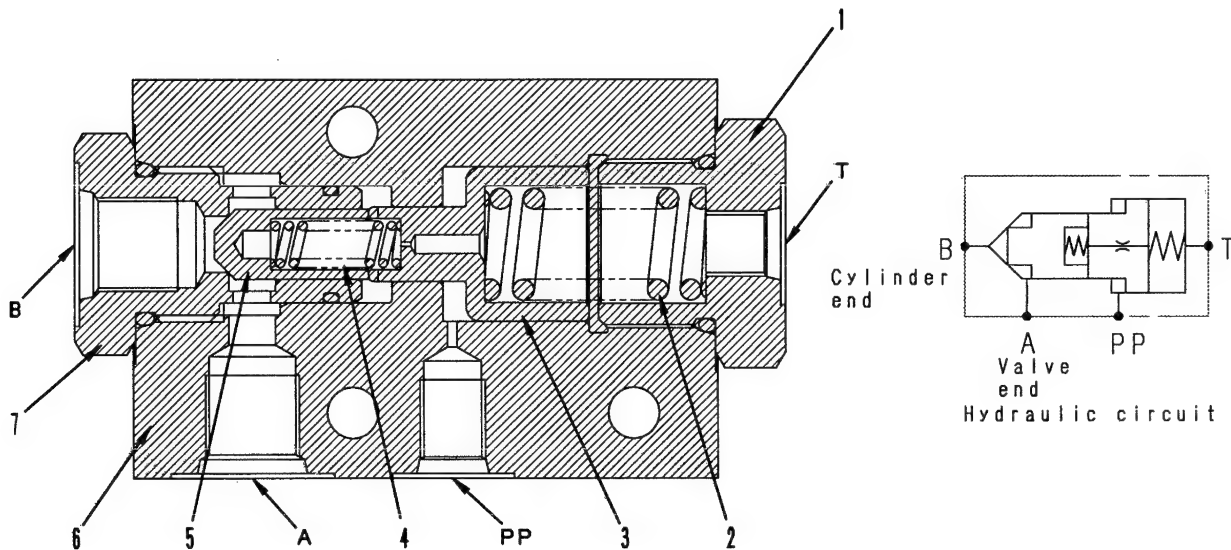
When this happens, spool (11A) is moved back down by the tension of spring (10A), closes the circuit between ports L and N and opens the circuit between ports L and G, so the oil at port J returns from drain port G to the hydraulic tank.

When the pilot pressure at port J is lost, spool (5) is pushed back to the left by the tension of spring (7B), and returns to the NEUTRAL position.

Solenoid (25A) of individual valve (25) is deenergized, so the circuit at the bottom end of the slide cylinder is closed, and the slide cylinders are held in position.

023S05

COLLECTION CHECK VALVE (FOR H-SHAPED OUTRIGGER)



SKL01151

- | | |
|---------------|--------------------------------------|
| 1. Plug | A. Port A (valve end) |
| 2. Spring | B. Port B (cylinder end) |
| 3. Piston | T. Port T (to tank) |
| 4. Spring | P.P. Port P.P (from PPC pump) |
| 5. Check | |
| 6. Valve body | |
| 7. Sleeve | |

Outline

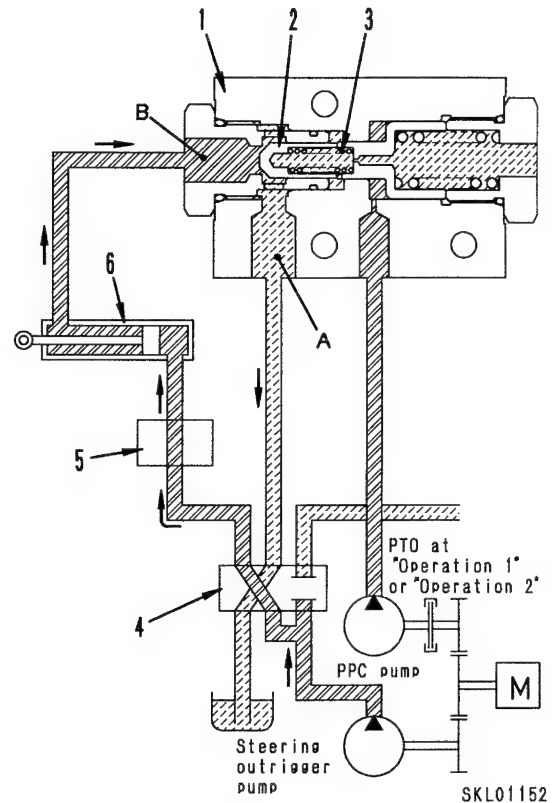
- The collection check valve is in the circuit between the outrigger selector valve and the outrigger slide and jack cylinder rod circuit. It prevents the rise of abnormal pressure during operations, and prevents damage to the cylinders and abnormal operation of the outriggers.
- With the collection check valve, when the PTO switch is set to "OPERATION 1" or "OPERATION 2", the PTO clutch is engaged and oil from the PPC pump goes to port **PP**. It moves piston (3), which is held in position by powerful spring (2), so piston (3) and check (5) are separated.

As a result, the force pushing spring (2) is lost, and the holding pressure of check (5) becomes lower.

In this way, the pressure is relieved when abnormal pressure is generated in the cylinder.

OPERATION**1. When slide cylinder is at SLIDE**

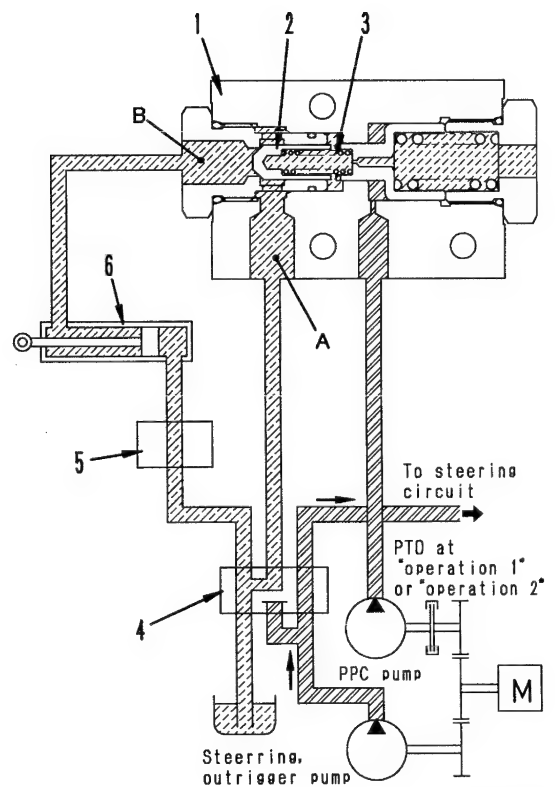
- Set the PTO switch to "OPERATION 1" and the JACK/SLIDE switch to SLIDE and the EXTEND/STOW switch to the EXTEND position. When the outrigger ALL switch or INDIVIDUAL switch is pressed, oil from the steering and outrigger pump passes through outrigger selector valve (4) and outrigger individual valve (5), enters the port at the bottom end of slide cylinder (6) and extends the slide cylinder.
- The oil at the rod end of slide cylinder (6) is pushed out, enters port B of collection check valve (1), and pushes up check (2), which is held in position by spring (3), so the oil passes from port A through selector valve (4) and returns to the hydraulic tank.



SKL01152

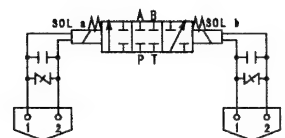
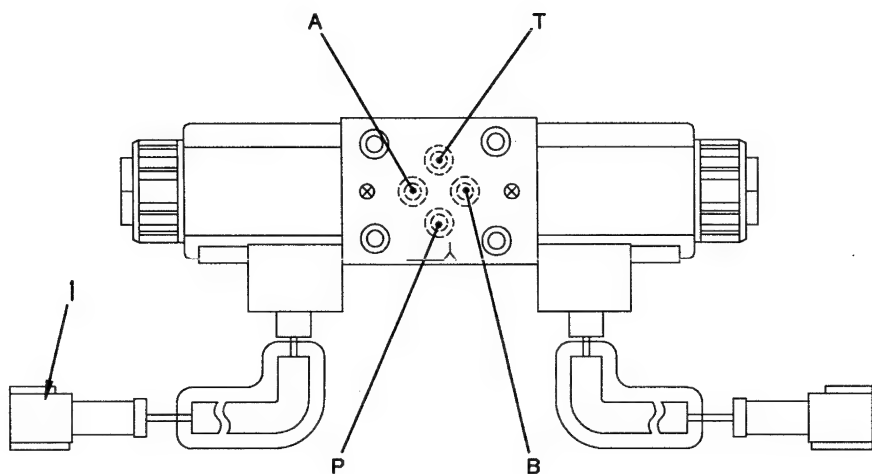
2. When slide cylinder is at HOLD

- If the outrigger ALL switch or individual switch is released, or if the EXTEND/STOW switch is set to OUTRIGGER (neutral), the oil from the steering and outrigger pump all flows to the steering circuit and the extension of the slide cylinder stops.
- The oil at the rod end of slide cylinder (6) is held by check (2) and spring (3) inside the collection check valve, so the oil at the slide cylinder rod end does not flow. In this way, the cylinder is held in position.

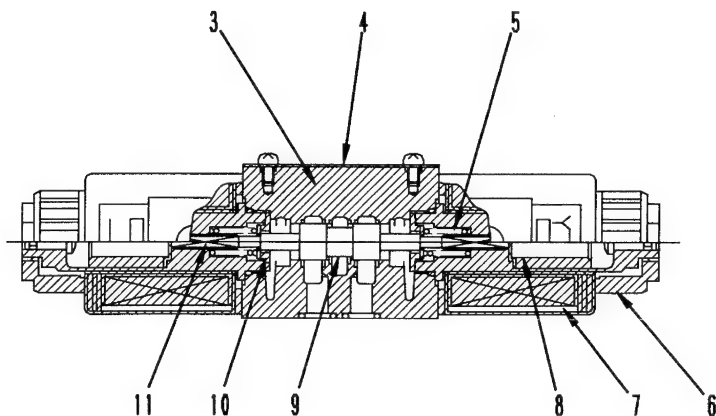
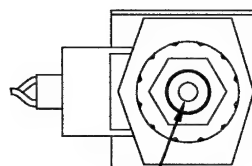
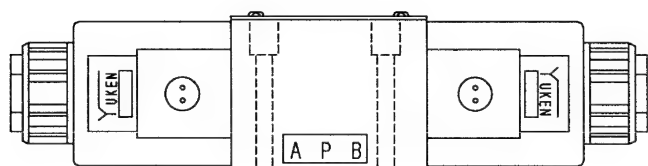


SKL01153

OUTRIGGER INDIVIDUAL VALVE



Hydraulic circuit diagram



023S05

1. Connector
2. Manual push pin
3. Valve body
4. Cover
5. Spring
6. Nut

7. Coil assembly
8. Core assembly
9. Spool
10. Spacer
11. Push pin

- A. Port A (pump port)
- B. Port B (cylinder port)
- C. Port C (cylinder port)
- T. Port T (tank port)

SKL01154

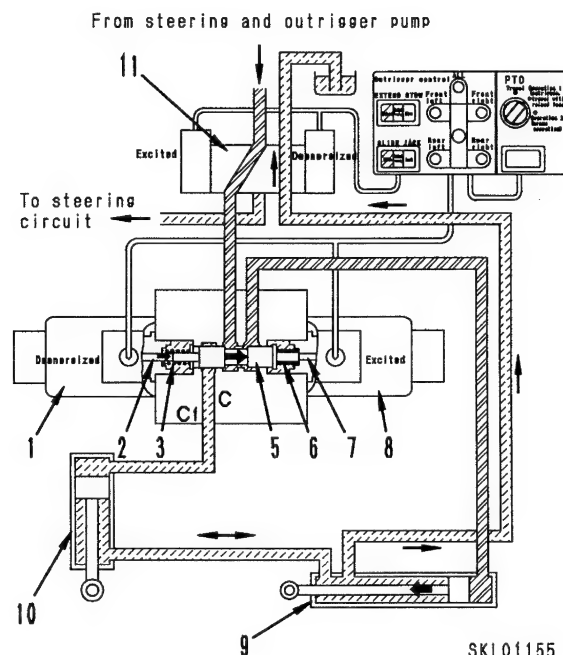
OPERATION

1. When JACK/SLIDE switch is at SLIDE

Set the JACK/SLIDE switch to the SLIDE position and the EXTEND/STOW switch to the EXTEND position.

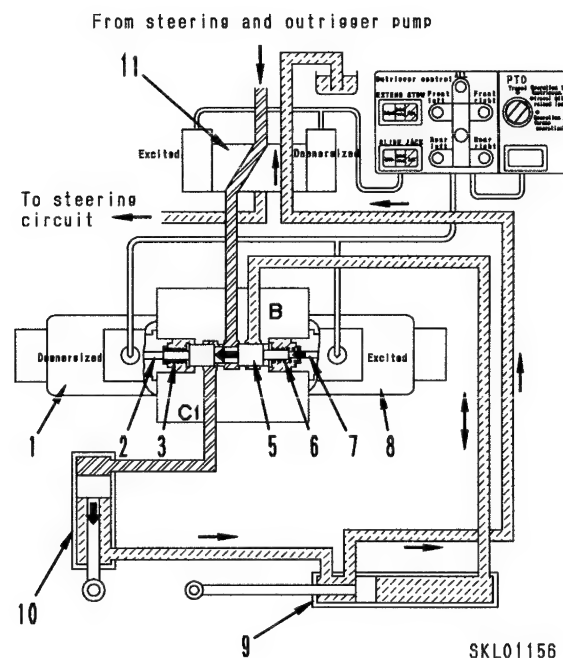
If the INDIVIDUAL switch is pressed, solenoid (1) of the individual valve is excited, pushes out push pin (2), and moves spool (5) to the right. This opens the passage between ports **A** and **B**, and opens the circuit between the bottom end of slide cylinder (9) and selector valve (11).

In addition, the solenoid of selector valve (11) is excited and switches the spool, so the circuit at the head end of slide cylinder (9) is connected to the drain port. At the same time, the oil from the steering and outrigger pump enters the bottom end of the slide cylinder. Therefore, when the pressure in the circuit at the bottom end of the slide cylinder rises, the cylinder extends.

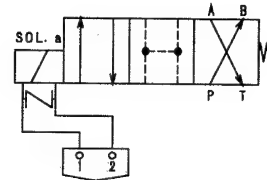
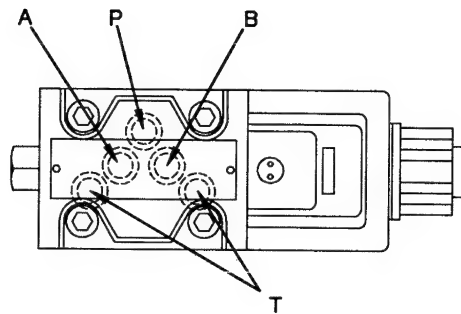


2. When JACK/SLIDE switch is at JACK

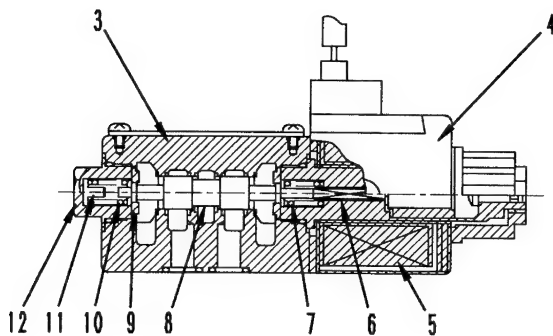
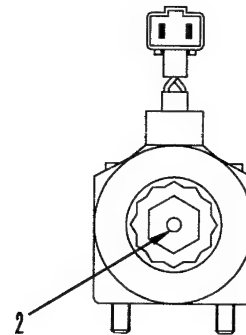
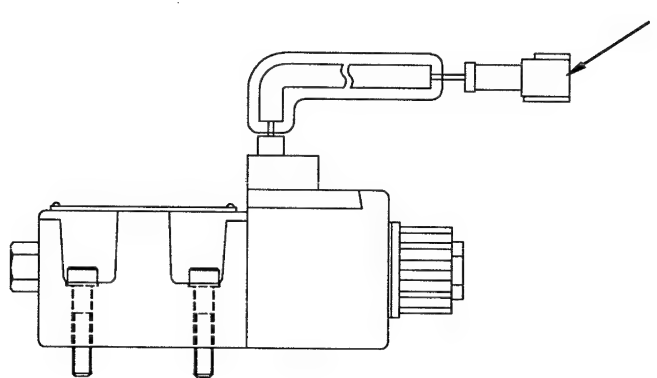
When the JACK/SLIDE switch is set to the JACK position and the INDIVIDUAL switch is pressed, solenoid (8) of the individual valve is excited, and spool (5) moves in the opposite direction from Item 1 to extend jack cylinder (10).



OUTRIGGER MERGE SELECTOR VALVE



Hydraulic, electrical circuit diagram



- | | |
|----------------------|------------|
| 1. Connector | 7. Spring |
| 2. Manual push pin | 8. Spool |
| 3. Valve body | 9. Spacer |
| 4. Solenoid assembly | 10. Spring |
| 5. Coil assembly | 11. Spacer |
| 6. Push pin | 12. Plug |

SKL01157

- A. Port A (to outrigger selector valve circuit)
 B. Port B (to swing motor circuit)
 P. Port P (from swing pump)
 T. Port T (tank port)

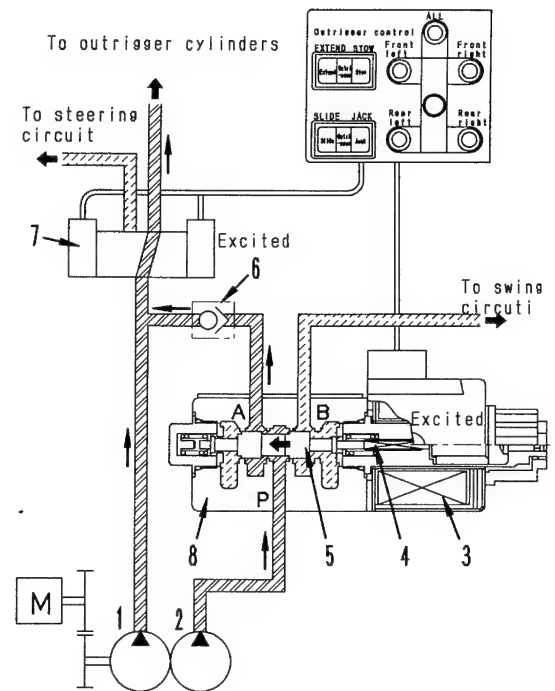
Outline

- The outrigger merge selector valve is in the circuit between the swing pump and the swing hydraulic circuit (swivel joint). When the outrigger ALL switch is operated, the solenoid of the merge selector valve is excited and switches the circuit. The oil from the swing pump merges with the steering and outrigger pump circuit, and the merged oil is sent to the outrigger to increase the operating speed.

OPERATION

1. When outrigger ALL is operated

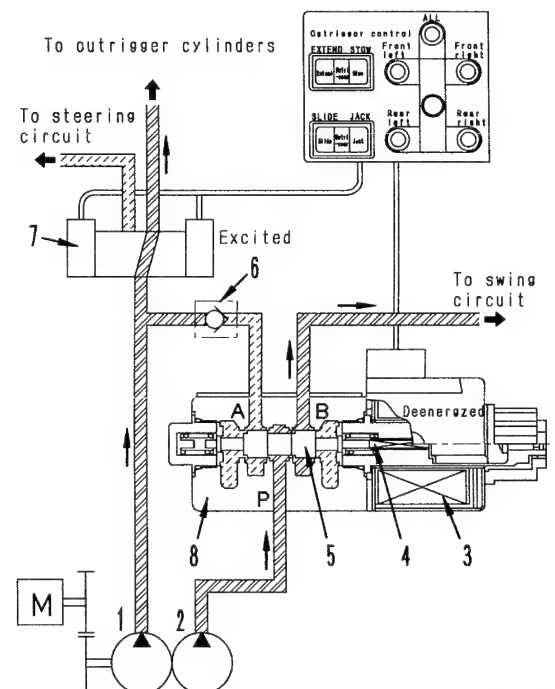
- Set the JACK/SLIDE switch and EXTEND/STOW switch on the outrigger control panel to the specified positions.
 - When the outrigger ALL control switch is pressed, solenoid (3) of outrigger merge selector valve (8) is excited, pushes push pin (4) out, so spool (5) is actuated and opens the circuit between port **P** and port **A**.
- Oil from swing pump (2) is coming to port **P**, so the valve at ports **P** and **A** opens. The oil passes through check (6), merges with the steering and outrigger pump circuit, and flows to selector valve (7).
- At the same time, the solenoid of outrigger selector valve (7) is excited, switches the spool, and sends the merged pump circuit oil to the jack or slide cylinder.
- This merged oil flow increases the operating speed.



SKL01158

2. When outrigger INDIVIDUAL is operated

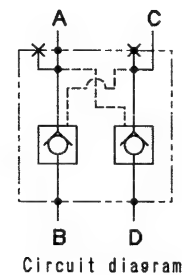
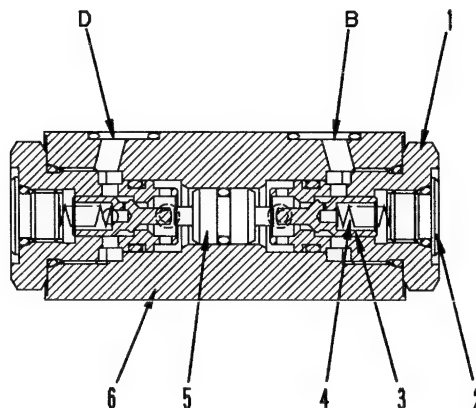
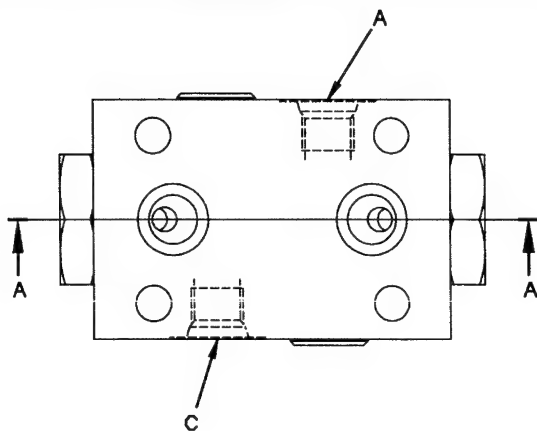
- When the outrigger INDIVIDUAL switch is operated, the solenoid of outrigger merge selector valve (8) is not excited, so the oil from swing pump (2) passes through port **B** of merge selector valve (8) and is sent to the swing hydraulic circuit.
- Only the oil from steering and outrigger pump (1) flows to the outrigger cylinders, so the amount of oil is reduced, and it is possible to obtain fine control of the outrigger movement with the individual control.
- During INDIVIDUAL operation, check (6) prevents the oil from steering and outrigger pump (1) from passing through merge selector valve (8) and flowing to the hydraulic tank.



SKL01159

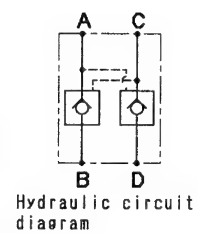
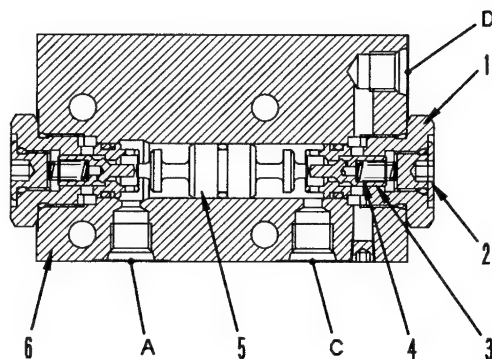
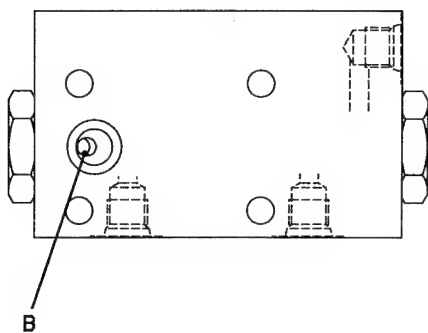
OUTRIGGER JACK PILOT CHECK VALVE

X-SHAPED OUTRIGGER SPECIFICATION



SKL01160

H-SHAPED OUTRIGGER SPECIFICATION



SKL01161

1. Valve sleeve
2. Plug
3. Check valve
4. Check valve spring
5. Piston
6. Valve body

- A. Port A
- B. Port B
- C. Port C
- D. Port D

Outline

- The pilot check valves are installed to each jack cylinder to stop the movement of oil inside the cylinder and prevent the cylinder from extending or retracting.

OPERATION

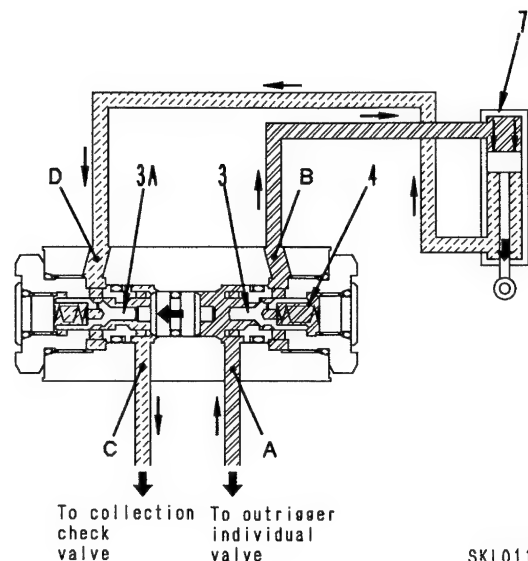
1. When jack cylinder is at EXTEND (explanation for X-shape outrigger valve)

If the JACK/SLIDE switch is set to JACK, the EXTEND/STOW switch is set to EXTEND, and the ALL switch is pressed, the oil from the steering and outrigger pump enters port **A** from the outrigger individual valve.

When the pressure at port **A** rises, the oil pushes check valve (3) to the right, compresses spring (4), opens the circuit between ports **A** and **B**, and enters the bottom of cylinder (7).

The oil entering port **A** moves piston (5) to the left, pushes check valve (3A), and opens the circuit between ports **D** and **C**.

The oil entering the bottom end of cylinder (7) pushes the cylinder, and this pushes out the oil at the rod end. The oil passes through ports **D** and **C**, and returns to the hydraulic tank, so the cylinder extends.



SKL01162

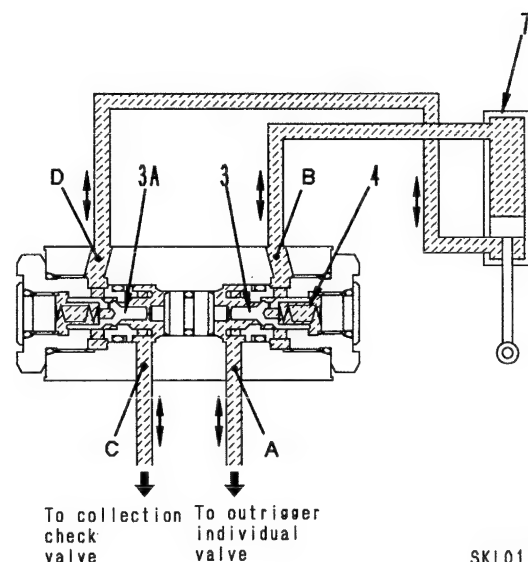
2. When jack cylinder is at HOLD (explanation for X-shape outrigger valve)

If the EXTEND/STOW switch is set to the NEUTRAL position, the oil from the steering and outrigger pump all flows to the steering circuit, and the supply of oil to port **A** from the outrigger individual valve stops.

When the pressure at port **A** drops, check valve (3) is returned to the left by the tension of spring (4). This closes the circuit between ports **A** and **B**.

The oil at the head end of cylinder (7) passes through ports **C** and **D**, and goes to the port of the collection check valve. When it is at HOLD, the port of the collection check valve is kept at HOLD by the check.

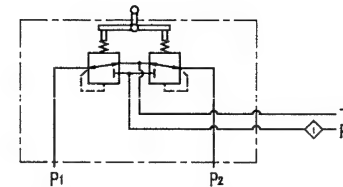
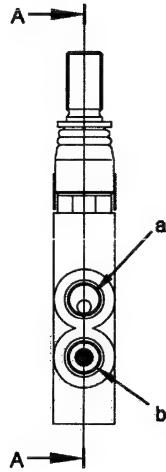
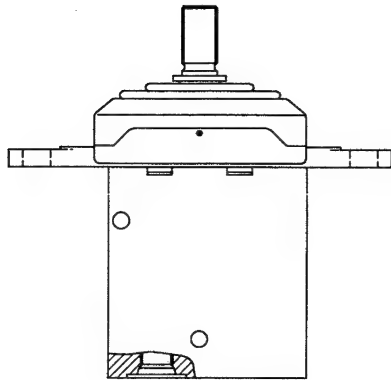
As a result, the oil in cylinder (7) does not return to the selector valve, and the cylinder is held in position.



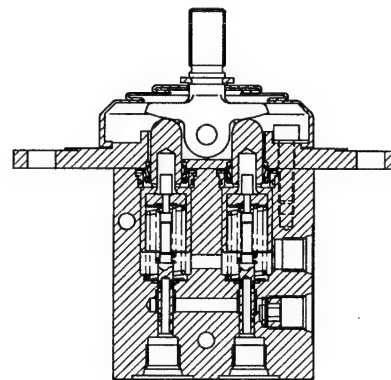
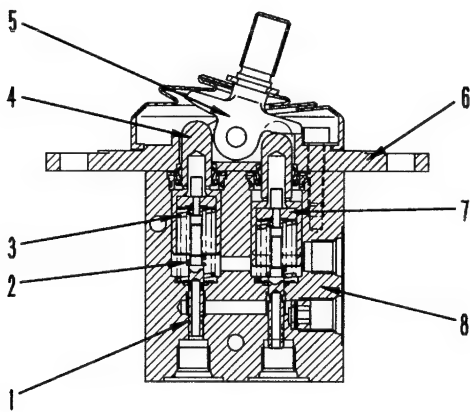
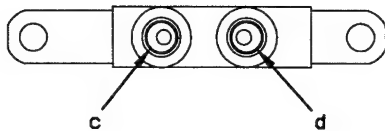
SKL01163

PEDAL PPC VALVE

(AUXILIARY WINCH & TELESCOPE)



Hydraulic circuit diagram



A - A

SKL01164

- a. Port **T** (to tank)
- b. Port **P** (from control pump)
- c. Port **P1**
- d. Port **P2**

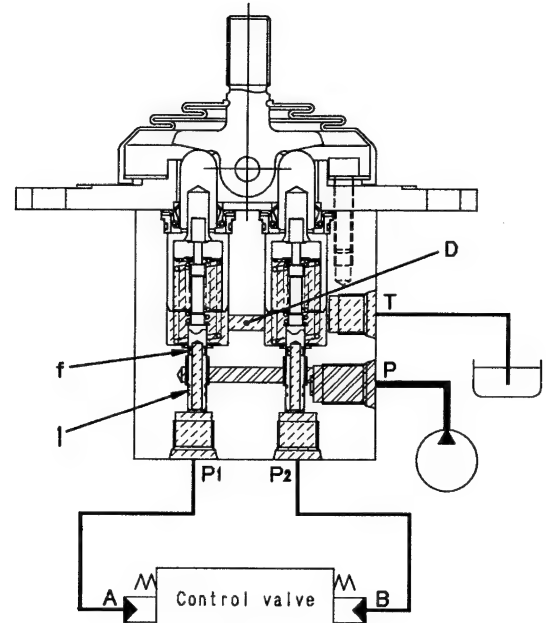
- 1. Spool
- 2. Metering spring
- 3. Centering spring
- 4. Piston
- 5. Lever
- 6. Plate
- 7. Retainer
- 8. Body

023S05

OPERATION

1. At neutral

Ports **A** and **B** of the main control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine control hole **f** in spool (1). (Fig. 1)



(Fig. 1)

SKL01165

2. At fine control (neutral → fine control)

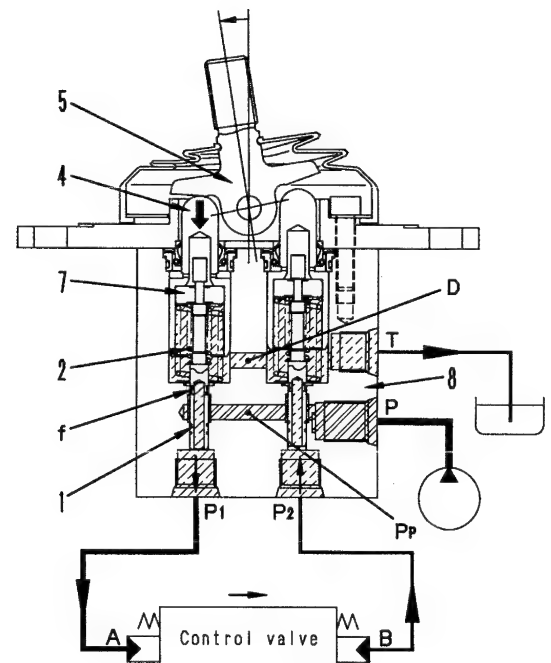
When piston (4) starts to be pushed by lever (5), retainer (7) is pushed, spool (1) is also pushed by metering spring (2), and moves down.

As a result, fine control hole **f** is shut off from drain chamber **D**, and at almost the same time, it is connected to pump pressure chamber **PP**, so the control pump pilot pressure oil through fine control hole **f** goes from port **P1** to port **A**.

When the pressure at port **P1** becomes higher, spool (1) is pushed back and fine control hole **f** is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D**, so the pressure at port **P1** is relieved.

As a result, spool (1) moves up and down until it reaches a point where the force of metering spring (2) is balanced with the pressure at port **P1**. The relationship of the position of spool (1) and body (8) (fine control hole **f** is at a position midway between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (7) contacts spool (1). Therefore, metering spring (2) is compressed in proportion to the amount that the control lever is operated, so the pressure at port **P1** also rises in proportion to the amount that the control lever is operated.

As a result, the control valve spool moves to a point where the pressure in chamber **A** (the same as the pressure at port **P1**) is balanced with the force of the control valve spool return spring. (Fig. 2)



(Fig. 2)

SKL01166

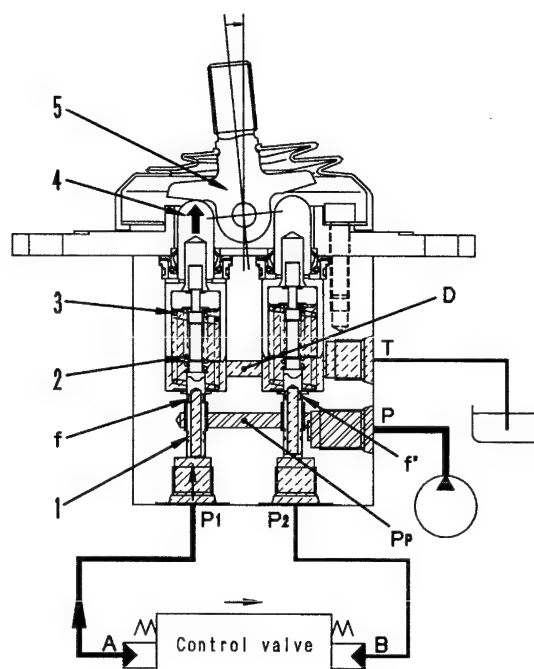
3. At fine control (control lever returned)

When lever (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.

As a result, fine control hole **f** is connected to drain chamber **D** and the pressure at port **P1** is relieved.

If the pressure at port **P1** becomes too low, spool (1) is pushed down by metering spring (2), so fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and pump pressure is supplied until the pressure at port **P1** recovers to a pressure equivalent to the position of the lever.

When the control valve spool returns, the oil from fine control hole **f'** of the valve that is not moving flows into drain chamber **D**, and from drain chamber **D** it passes through port **P2** to chamber **B** to fill the chamber. (Fig. 3)



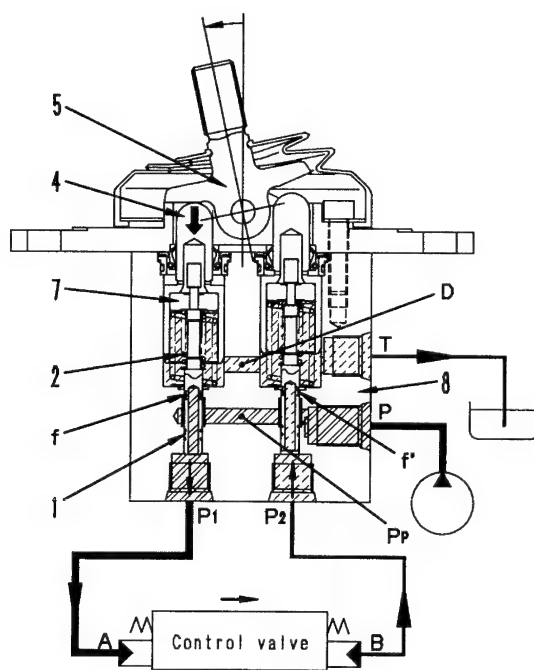
(Fig. 3)

SKL01167

4. Lever fully operated

When lever (5) pushes down piston (4) and retainer (7) pushes down spool (1), fine control hole **f** is shut off from drain chamber **D** and is connected with pump pressure chamber **PP**. Therefore, the pilot pressure oil from the control pump passes through fine control hole **f**, flows from port **P1** to chamber **A**, and pushes the control valve spool.

The return oil from chamber **B** passes from port **P2** through fine control hole **f'** and flows to drain chamber **D**. (Fig. 4)



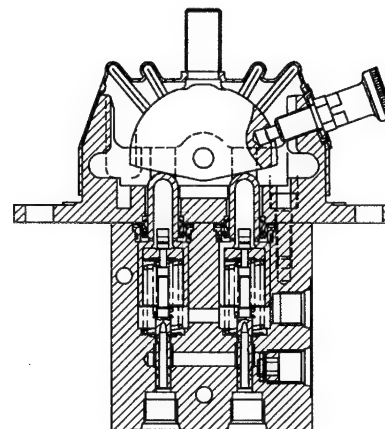
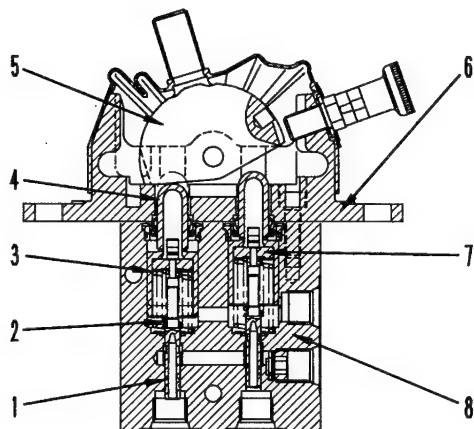
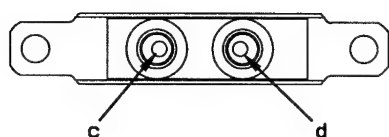
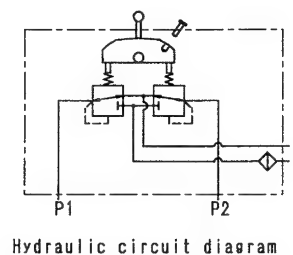
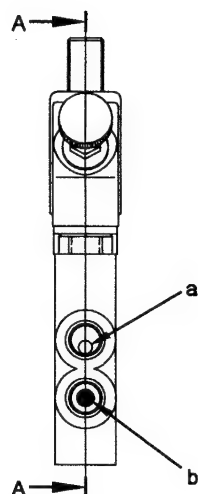
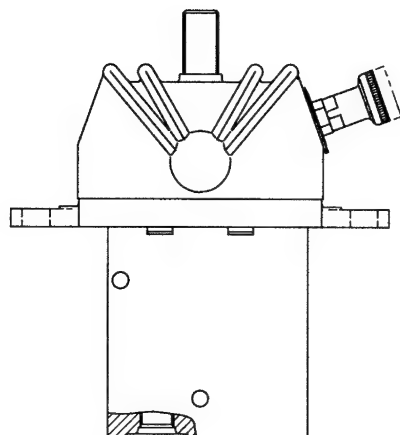
(Fig. 4)

SKL01168

023S05

LEVER PPC VALVE

(FOR TELESCOPE)



A-A

- a. Port T (to tank)
- b. Port P (from control pump)
- c. Port P1
- d. Port P2

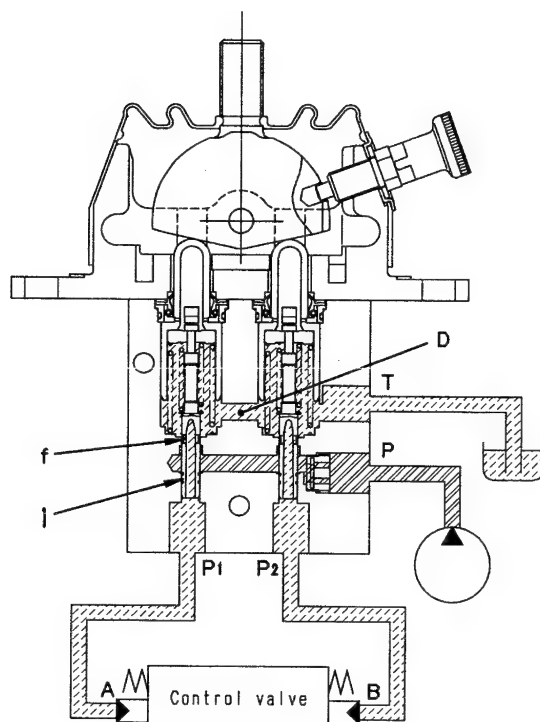
- 1. Spool
- 2. Metering spring
- 3. Centering spring
- 4. Piston
- 5. Lever
- 6. Plate
- 7. Retainer
- 8. Body

SKL01169

OPERATION

1. At neutral

Ports **A** and **B** of the main control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine control hole **f** in spool (1).



SKL01170

2. At fine control (neutral → fine control)

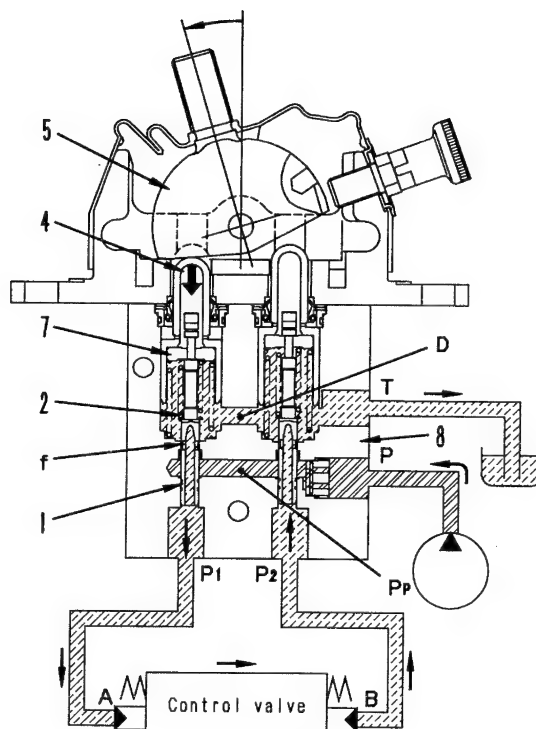
When piston (4) starts to be pushed by lever (5), retainer (7) is pushed, spool (1) is also pushed by metering spring (2), and moves down.

As a result, fine control hole **f** is shut off from drain chamber **D**, and at almost the same time, it is connected to pump pressure chamber **PP**, so the control pump pilot pressure oil through fine control hole **f** goes from port **P1** to port **A**.

When the pressure at port **P1** becomes higher, spool (1) is pushed back and fine control hole **f** is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D**, so the pressure at port **P1** is relieved.

As a result, spool (1) moves up and down until it reaches a point where the force of metering spring (2) is balanced with the pressure at port **P1**. The relationship of the position of spool (1) and body (8) (fine control hole **f** is at a position midway between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (7) contacts spool (1). Therefore, metering spring (2) is compressed in proportion to the amount that the control lever is operated, so the pressure at port **P1** also rises in proportion to the amount that the control lever is operated.

As a result, the control valve spool moves to a point where the pressure in chamber **A** (the same as the pressure at port **P1**) is balanced with the force of the control valve spool return spring.



SKL01171

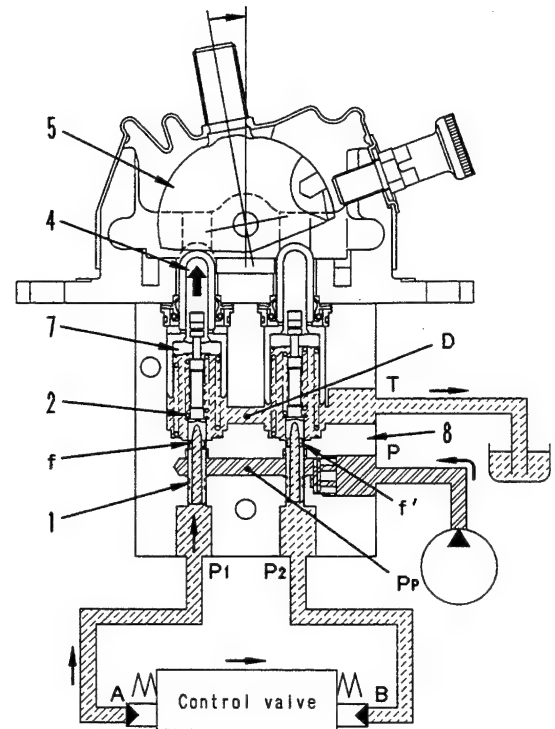
3. At fine control (control lever returned)

When lever (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.

As a result, fine control hole **f** is connected to drain chamber **D** and the pressure at port **P1** is relieved.

If the pressure at port **P1** becomes too low, spool (1) is pushed down by metering spring (2), so fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and pump pressure is supplied until the pressure at port **P1** recovers to a pressure equivalent to the position of the lever.

When the control valve spool returns, the oil from fine control hole **f'** of the valve that is not moving flows into drain chamber **D**, and from drain chamber **D** it passes through port **P2** to chamber **B** to fill the chamber.

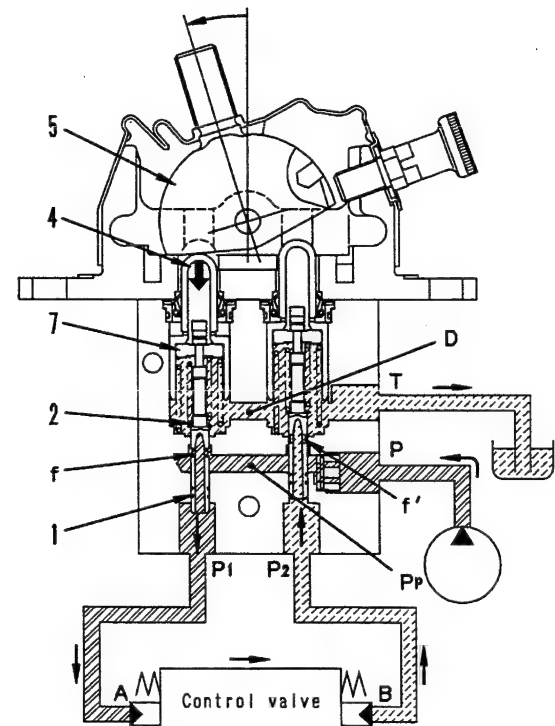


SKL01172

4. Lever fully operated

When lever (5) pushes down piston (4) and retainer (7) pushes down spool (1), fine control hole **f** is shut off from drain chamber **D** and is connected with pump pressure chamber **PP**. Therefore, the pilot pressure oil from the control pump passes through fine control hole **f**, flows from port **P1** to chamber **A**, and pushes the control valve spool.

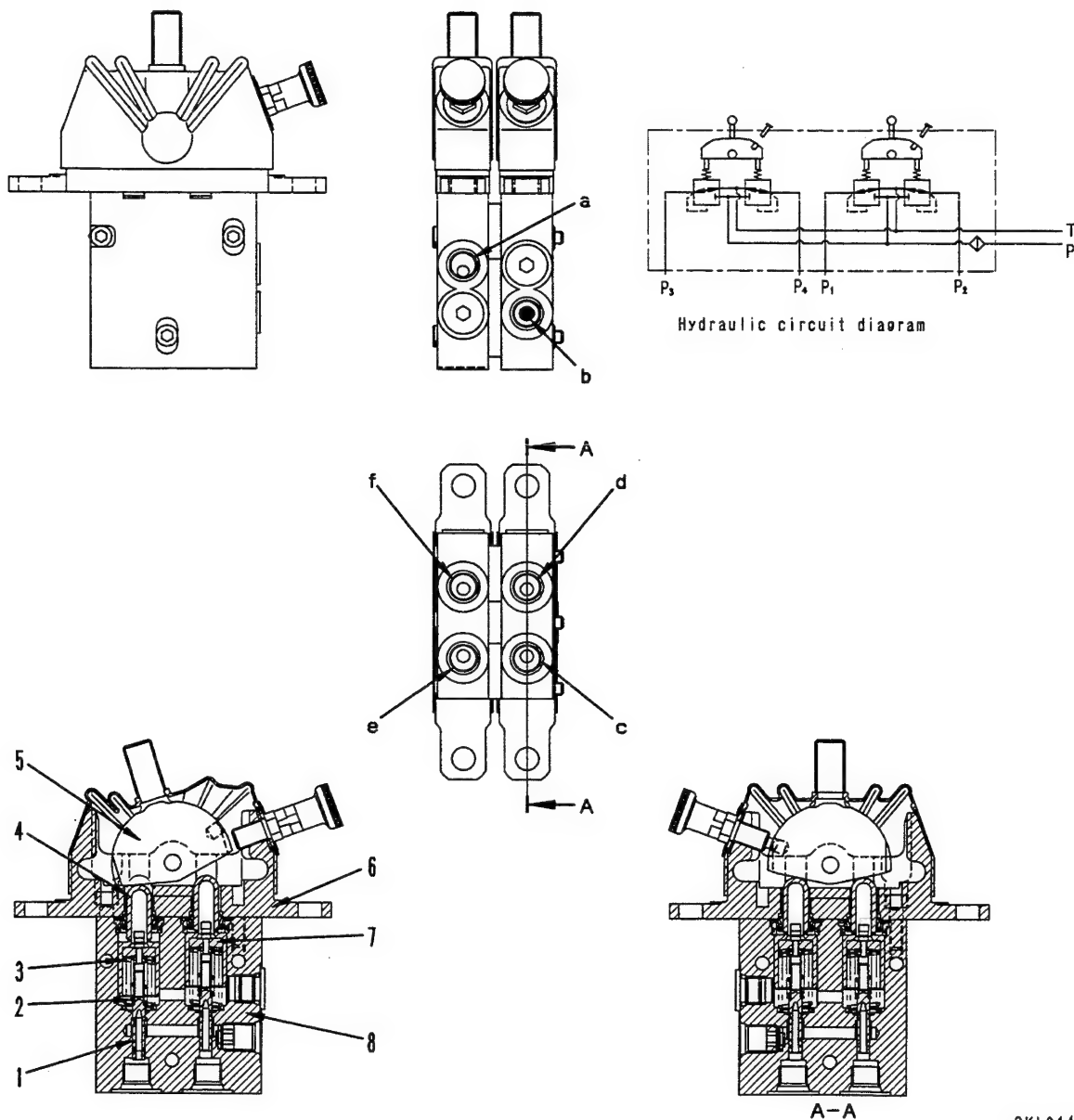
The return oil from chamber **B** passes from port **P2** through fine control hole **f'** and flows to drain chamber **D**.



SKL01173

(FOR TILT, SWING)

Tilt control PPC valve is used only machine with power tilt jib, and is blocked with plug for machine with manual tilt jib.



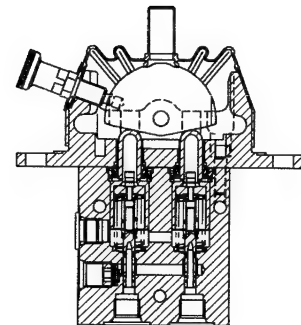
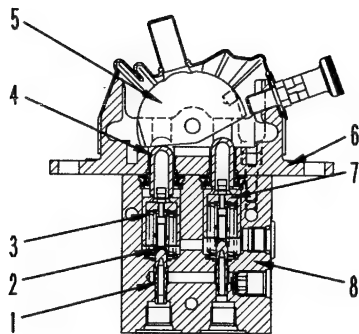
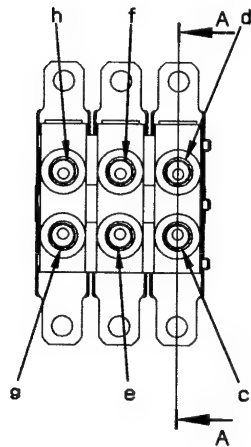
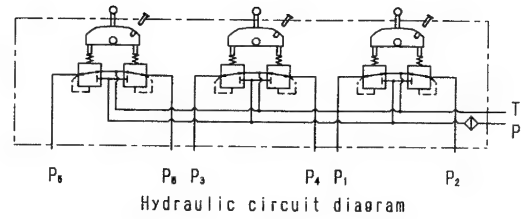
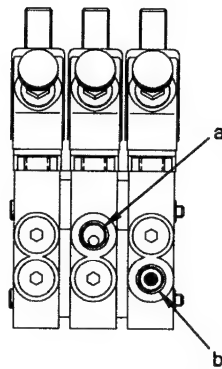
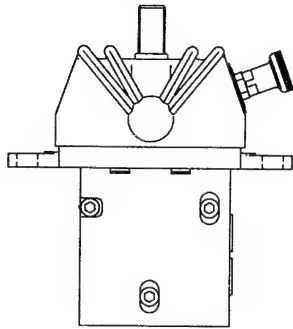
- a. Port T (to tank)
- b. Port P (from control pump)
- c. Port P1
- d. Port P2
- e. Port P3
- f. Port P4

- 1. Spool
- 2. Metering spring
- 3. Centering spring
- 4. Piston
- 5. Lever
- 6. Plate
- 7. Retainer
- 8. Body

SKL01174

023S05

(FOR HOIST, MAIN WINCH, AUXILIARY WINCH)



A-A

SKL01175

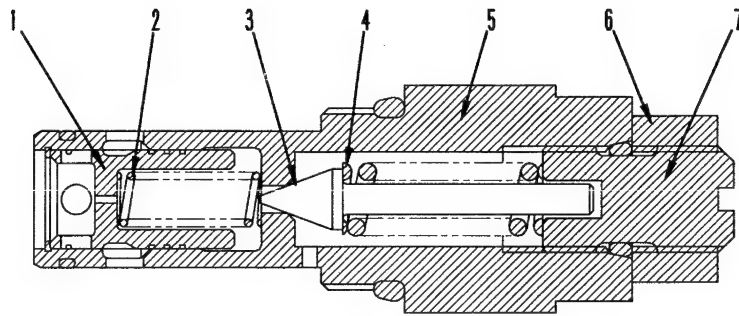
- a. Port **T** (to tank)
- b. Port **P** (from control pump)
- c. Port **P1**
- d. Port **P2**
- e. Port **P3**
- f. Port **P4**
- g. Port **P5**
- h. Port **P6**

- 1. Spool
- 2. Metering spring
- 3. Centering spring
- 4. Piston
- 5. Lever
- 6. Plate
- 7. Retainer
- 8. Body

023S05

RELIEF VALVE

RELIEF VALVE FOR PPC PILOT CIRCUIT PRESSURE

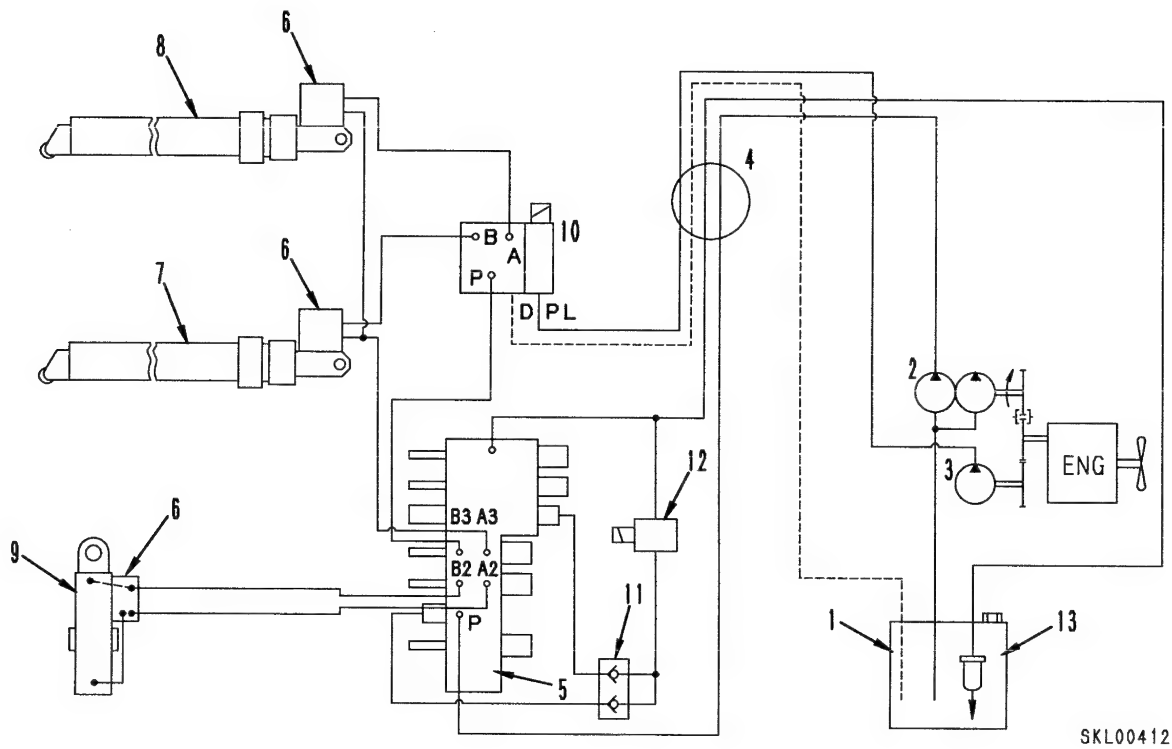


1. Main valve
2. Main valve spring
3. Poppet
4. Poppet spring
5. Sleeve
6. Locknut
7. Adjustment screw

SKL00411

023S05

BOOM HYDRAULIC SYSTEM



1. Hydraulic tank
2. Boom pump
3. PPC pump
4. Center swivel joint
5. Main control valve
6. Counterbalance valve
7. Boom telescope No. 1 cylinder
8. Boom telescope No. 2 cylinder
9. Boom hoist cylinder
10. Boom telescope selector valve
11. Check valve
12. Unload pilot valve
13. Hydraulic filter

023S05

SKL00412

Outline

- The boom hydraulic system consists of boom pump (2), and control valve (5) and cylinders (7), (8), and (9) which are actuated by the boom hoist lever and telescope lever in the operator's compartment.
- The oil in hydraulic tank (1) is sucked up by boom pump (2), passes through swivel joint (4) and enters control valve (5).

When the boom hoist lever or boom telescope lever are operated, control valve (5) is actuated and boom hoist cylinder (9) or telescope cylinders (7) and (8) are extended or retracted to raise, lower, extend or retract the boom.

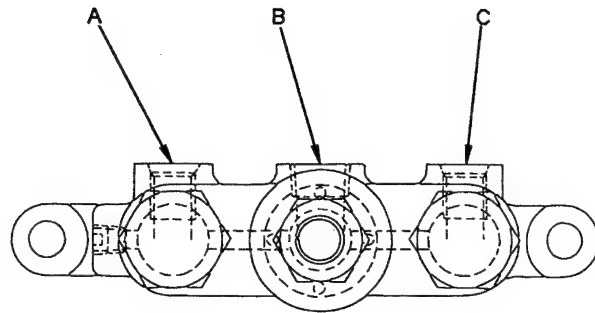
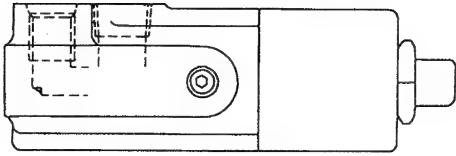
Boom telescope selector valve (10), which switches the oil from the inlet port of control valve (5), is installed to the inlet and outlet ports of telescope cylinders (7) and (8). The solenoid of this boom telescope selector valve (10) opens or closes to make it impossible to extend and retract two cylinders at the same time.

Counterbalance valve (6), which is installed to the hoist and telescope cylinders, prevents the boom from suddenly moving down.

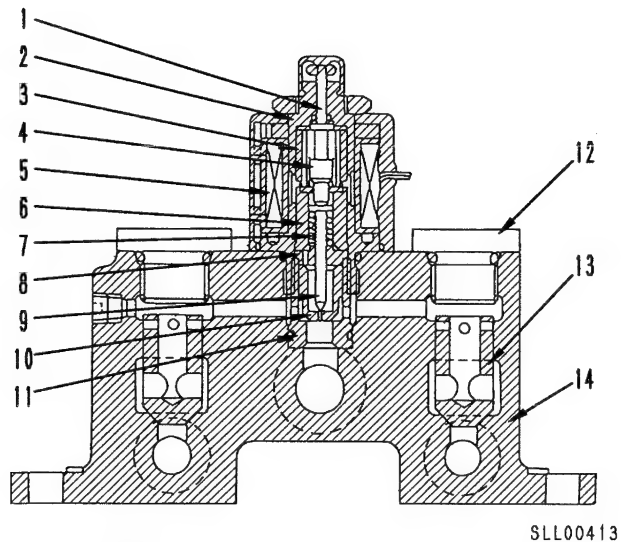
Unload pilot valve (12) which is related with the electrical circuit for the moment limiter automatic stop, is installed as a safety device in the pump inlet port circuit of the boom control valve.

- If the boom is not being operated, but the main or auxiliary winches are operated, the oil from boom pump (2) merges with the oil from the winch pump inside control valve (5) and acts to boost the speed of the main or auxiliary winch.
- The oil from PPC pump (3) enters boom telescope selector valve (10). Boom telescope selector valve (10) opens or closes to switch the pilot pressure from the PPC pump to extend or retract one of the two cylinders.

UNLOAD PILOT VALVE



1. Pin
2. Valve body
3. Plunger
4. Rod
5. Solenoid assembly
6. Stopper
7. Spring
8. Bushing
9. Needle valve
10. Check valve
11. Valve seat
12. Plug
13. Check valve
14. Valve body



SLL00413

- A. From boom unload valve
- B. To hydraulic tank
- C. From winch unload valve

Outline

- The check valves for the boom and winch unload circuits are in the circuit between the boom unload valve and winch unload valve inside the main control valve and the unload pilot valve. They act to prevent the oil in the unload pilot valve from flowing back to the boom or winch circuit.
- The unload pilot valve is in the circuit between the drain circuit and the boom unload valve and relief valve with winch unload valve through the check valve. It is a solenoid valve that is connected with the automatic stop circuit for the overload safety system.
- When the overload safety system is not being actuated, the solenoid valve is excited and closes the passage to the drain circuit. If the crane load reaches 100% of the rated

load, the overload safety system is actuated, so the solenoid is deenergized and the passage to the drain circuit is opened. This removes the back pressure of the boom and winch relief valve and makes it impossible for the pressure to rise in the boom circuit and winch motor circuit.

As a result, the boom and winch cannot be operated, thereby ensuring safety when there is overloading.

However, there are four limit switches installed to the valve spool. The signals from these switches excite the solenoid to close the passage to the drain circuit and make it possible to operate the boom RAISE and RETRACT and winch WIND OUT.

023S05

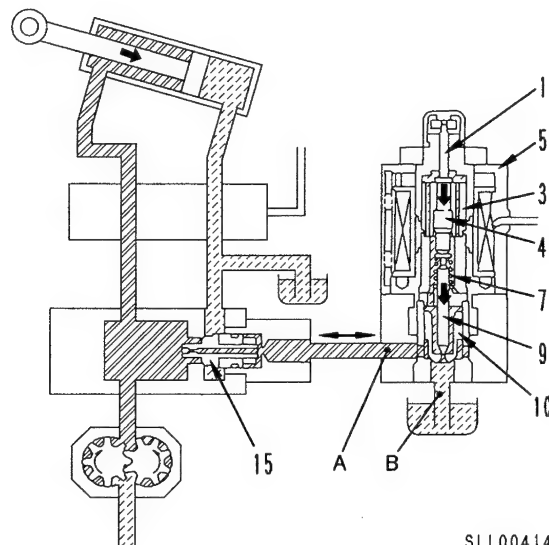
OPERATION

1. When normal (overload safety system not actuated)

When the overload safety system is not being actuated, solenoid (5) is excited.

Therefore, pin (1), plunger (3), rod (4), and needle valve (9) compress spring (7), and push check valve (10) down to close the circuit between ports **A** and **B**.

As a result, the oil from the pump makes the pressure in the circuit up to the cylinder rise, and also raises the pressure at the back pressure port of unload valve (15), so the boom circuit extends and retracts the cylinders under the normal oil pressure condition.



SLL00414

2. When abnormal (overload safety system actuated)

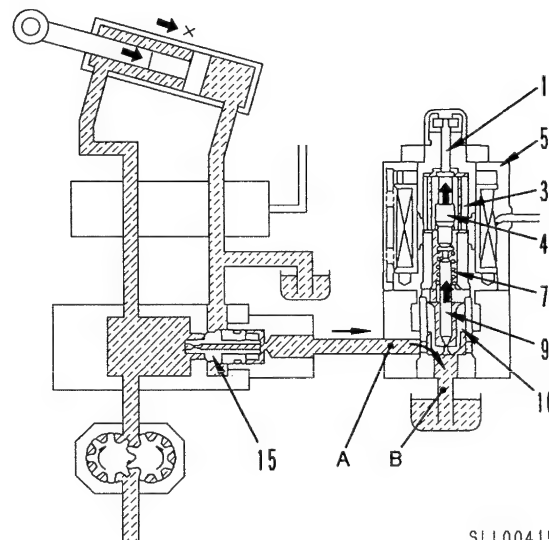
When the crane load reaches 100% of the rated load, solenoid (5) is deenergized.

Therefore, pin (1), plunger (3), rod (4), and needle valve (9) are moved back up by the tension of spring (7), and check valve (10) becomes free.

As a result, the oil from the pump enters port **A** of the pilot valve, pushes check valve (10) up, and is drained from port **B**.

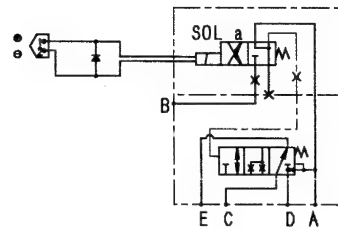
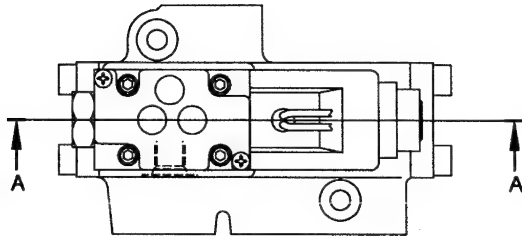
The pressure at port **A** becomes lower than the pump discharge pressure, so unload valve (15) moves to the right and the oil from the pump is returned to the hydraulic tank.

For this reason, the oil pressure in the whole circuit does not rise, and the boom cannot be operated.

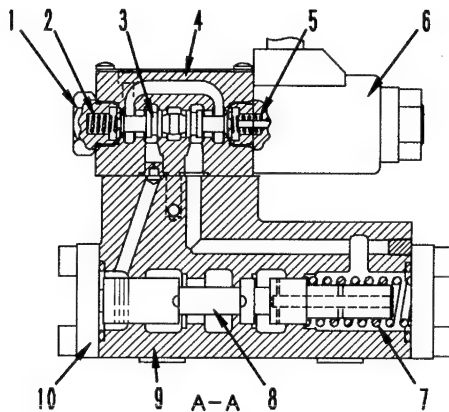
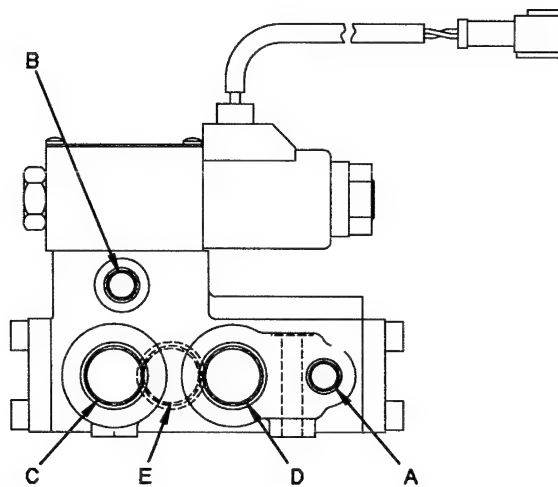


SLL00415

BOOM TELESCOPE SELECTOR VALVE



Hydraulic circuit diagram



SKL01176

1. Plug
2. Spring
3. Spool
4. Body
5. Spring
6. Solenoid coil
7. Spring
8. Spool
9. Body
10. Flange

Outline

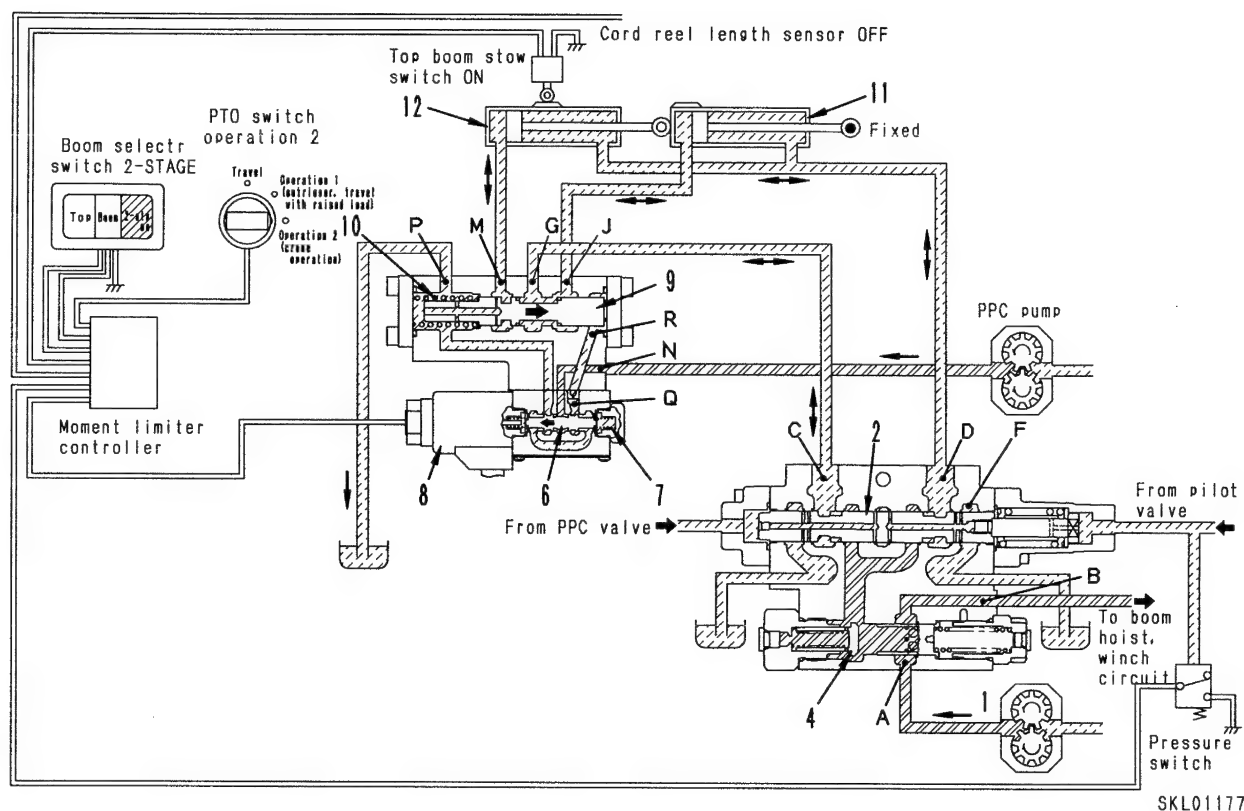
- The boom telescope selector valve is in the circuit between the boom control valve and the bottom end of the two boom telescope cylinders. It switches the pilot pressure from the PPC pump to actuate one of the telescope cylinders.

- A. To drain
- B. From PPC pump
- C. To boom telescope No. 1 cylinder
- D. To boom telescope No. 2 cylinder
- E. From main control valve (boom telescope valve)

023S05

OPERATION

1. Boom telescope lever at neutral (boom fully retracted)



- When the telescope lever is at the NEUTRAL position, telescope valve spool (2) is also at the neutral position. The circuits between port A and ports C and D are closed and the circuit between ports A and B is open.

Therefore, some of the oil from boom pump (1) pushes open check valve (4) and stops, while the rest of the oil enters port B from port A, and flows to the boom hoist and winch circuit.

In addition, if the telescope lever is at the NEUTRAL position, the boom selector switch is at the 2 STAGE position, and the No. 1 and No. 2 telescope cylinders (11) and (12) are fully retracted, the extension pressure switch and cord reel length sensor signal are OFF and the top boom stow is switched ON. The moment limiter controller is actuated by these

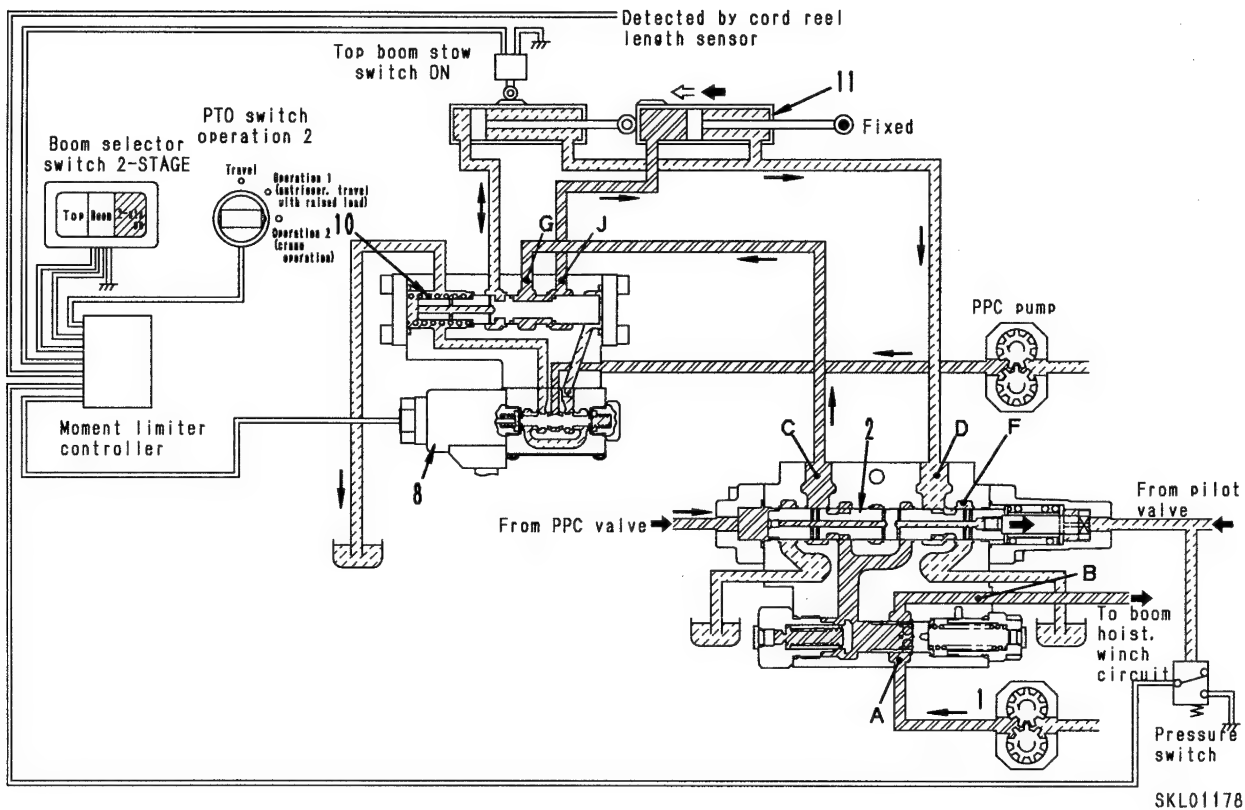
signals and deenergizes solenoid (8) of the telescope selector valve.

When this happens, spool (6) is moved to the left by the tension of spring (7), and closes the circuit between ports N and Q and opens the circuit between ports Q and P.

At this point, the oil from boom pump (1) enters port N and stops. The oil at port R enters port P from port Q and returns to the tank. Spool (9) is moved to the right by the force of spring (10), so the circuit between ports G and J opens and the circuit between ports G and M closes.

In other words, the circuit between the port at the bottom end of No. 1 telescope cylinder (11) and port C of the telescope valve is connected, and waits for the operation of the telescope valve.

2. Boom telescope lever at EXTEND (2nd boom extended)



- When the telescope lever is set to the EXTEND position, the extension pressure switch is turned ON, and the moment limiter controller is actuated by this signal. However, no electricity flows to solenoid (8) of the telescope selector valve, so the telescope selector valve continues to remain in the condition in Item 1. When the telescope lever is moved to the EXTEND position, telescope valve spool (2) moves to the right, and opens the circuit between ports A and C and the circuit between ports D and F.

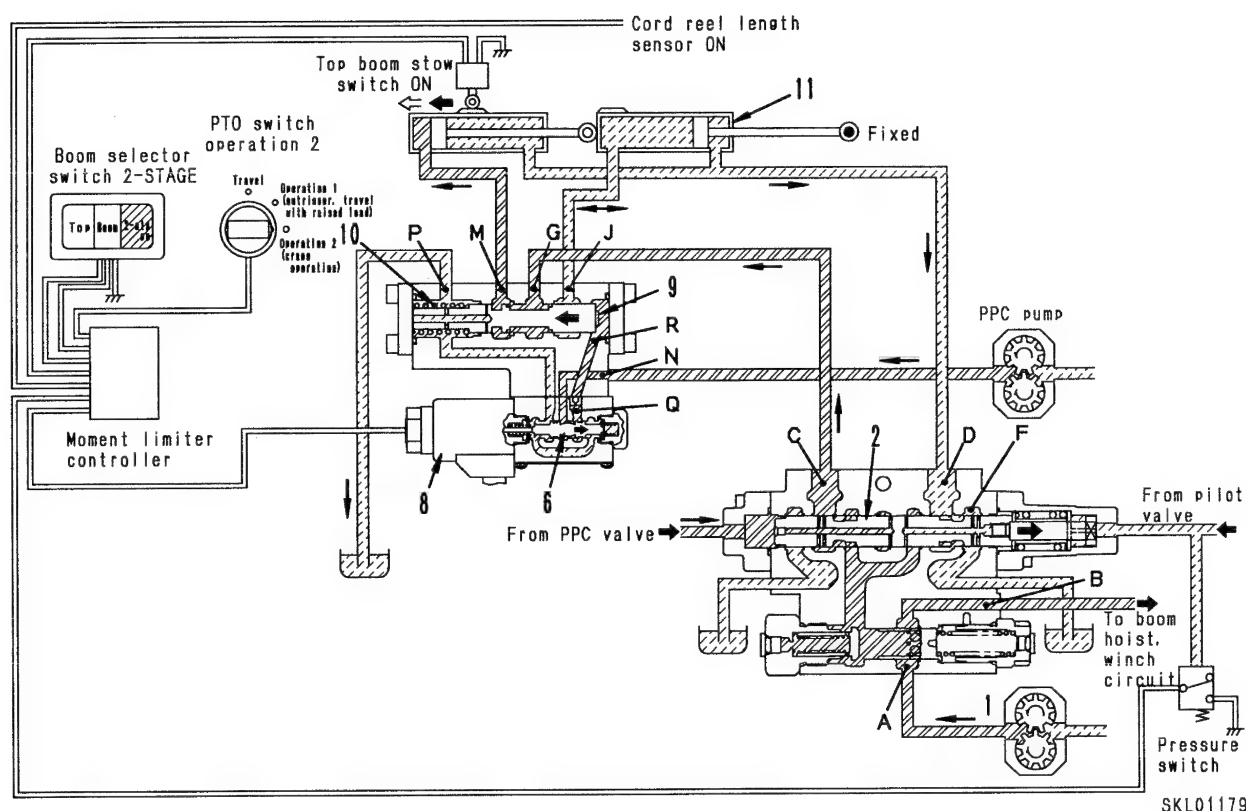
When this happens, the oil from boom pump (1) enters port C from port A, then goes from port G of the telescope selector valve to port J, and flows to the bottom end of No. 1 telescope cylinder (11).

In addition, the oil at the head end of No. 1 telescope cylinder is drained from port D of the telescope valve to port F.

Therefore, the No. 1 telescope cylinder waits for the pressure in the circuit to rise, then it extends and also extends the 2nd boom.

023S05

3. Boom telescope lever at EXTEND (top, 4th, 3rd boom extended)



- In the condition in Item 2, if No. 1 telescope cylinder (11) reaches the end of its stroke and the extension of the 2nd boom is completed, the cord reel length sensor signal is turned ON. The moment limiter controller is actuated by the signal and excites solenoid (8) of the telescope selector valve. When this happens, spool (6) moves to the right, closes the circuit between ports Q and P and opens the circuit between ports N and Q.

The oil from boom pump (1) enters port Q from port N, and flows to port R. It then waits for the pressure in the circuit to rise, pushes spool (9) to the left, closes the circuit between ports G and J, and opens the circuit between ports G and M.

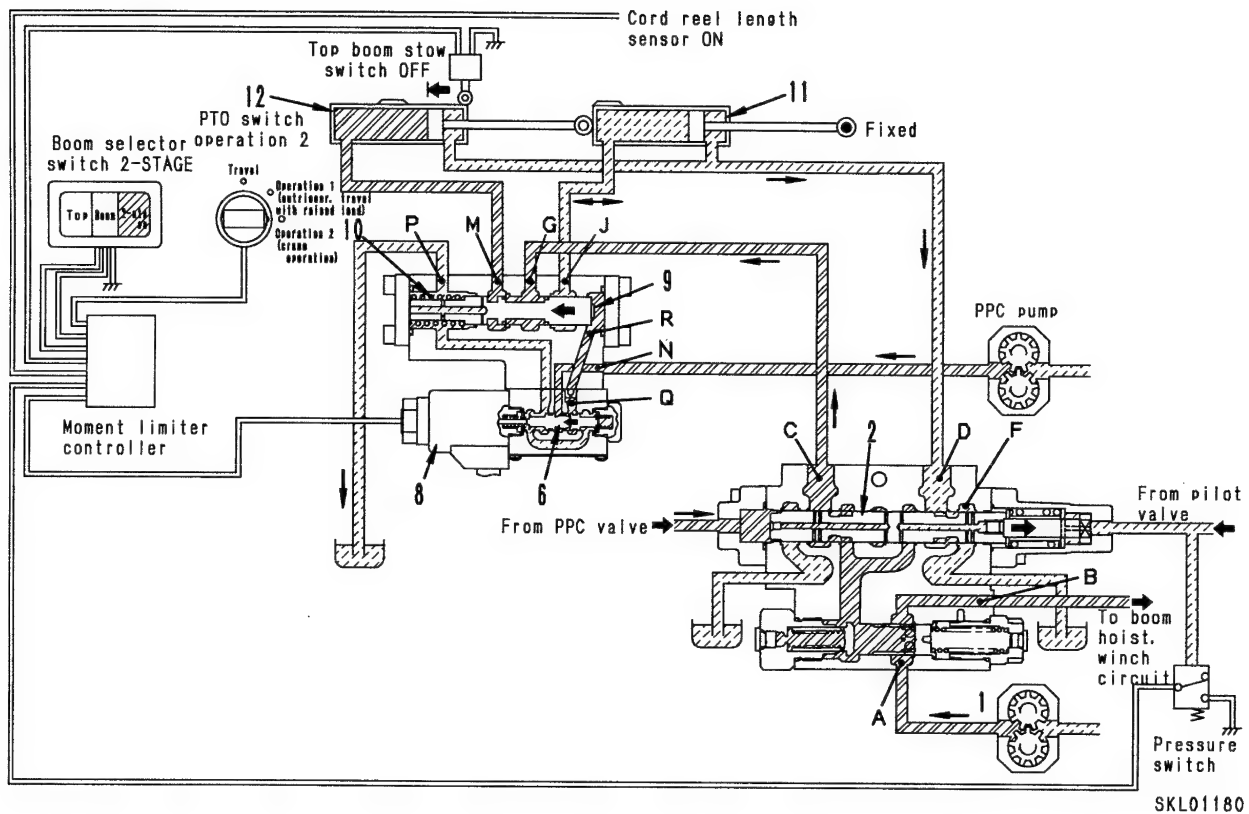
In other words, the circuit between the port

at the bottom end of the No. 1 telescope cylinder and port C of the telescope valve is closed, and the circuit between the port at the bottom end of No. 2 telescope cylinder (12) and port C of the telescope valve is connected.

When this condition is reached, the oil from port C of the telescope valve flows from port G to port M, and enters the bottom end of the No. 2 telescope cylinder.

The oil at the head end of the No. 2 telescope cylinder is drained from port D of the telescope valve to port F.

Therefore, the No. 2 telescope cylinder waits for the pressure in the circuit to rise, then it extends and also extends the top, 4th, and 3rd booms.

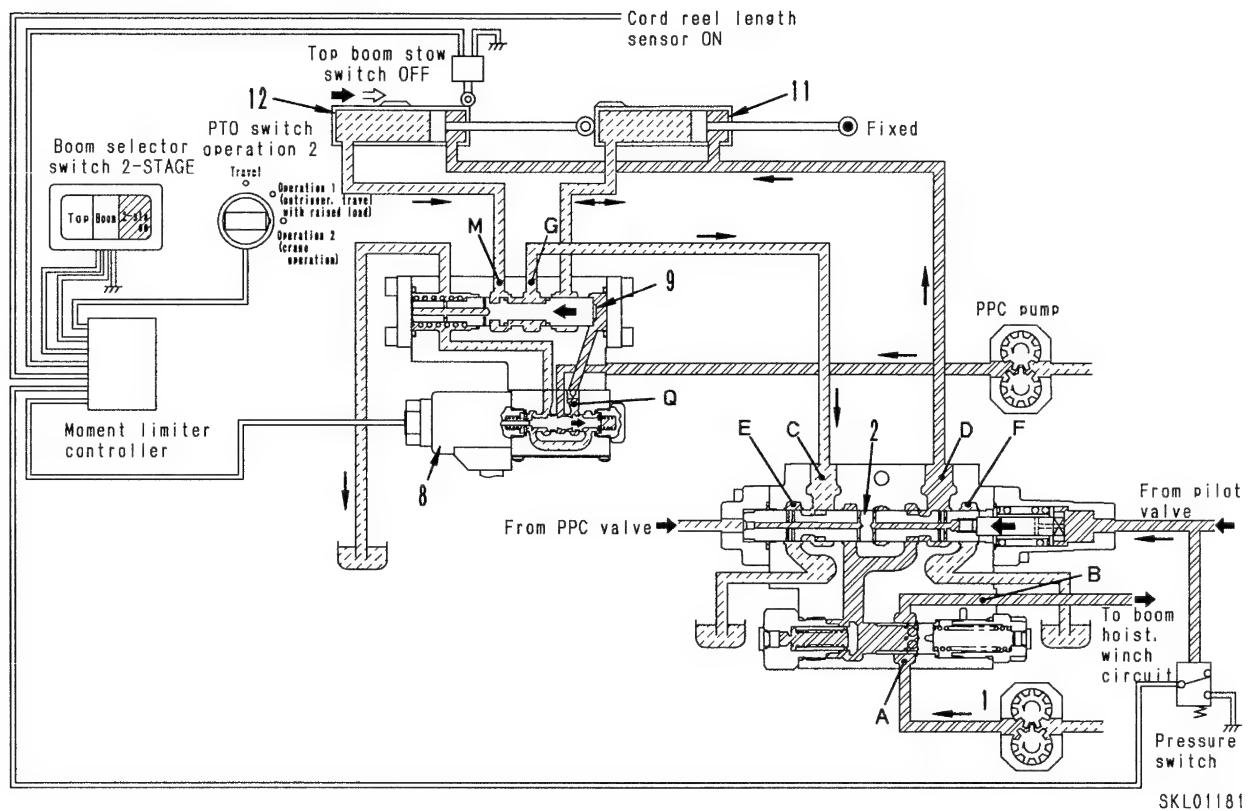


023S05

- When the extension of the top, 4th, and 3rd booms is completed, the top boom stow switch is turned OFF. The signal is sent to the moment limiter controller, actuates it, and forms the electrical circuit for when the boom is retracted.

When the No. 2 telescope cylinder is at the EXTEND position, the oil at the bottom end of the No. 1 telescope cylinder returns to port J of the pilot check valve, but it is held by the action of the spool.

4. Boom telescope lever at RETRACT (top, 4th, 3rd boom retracted)

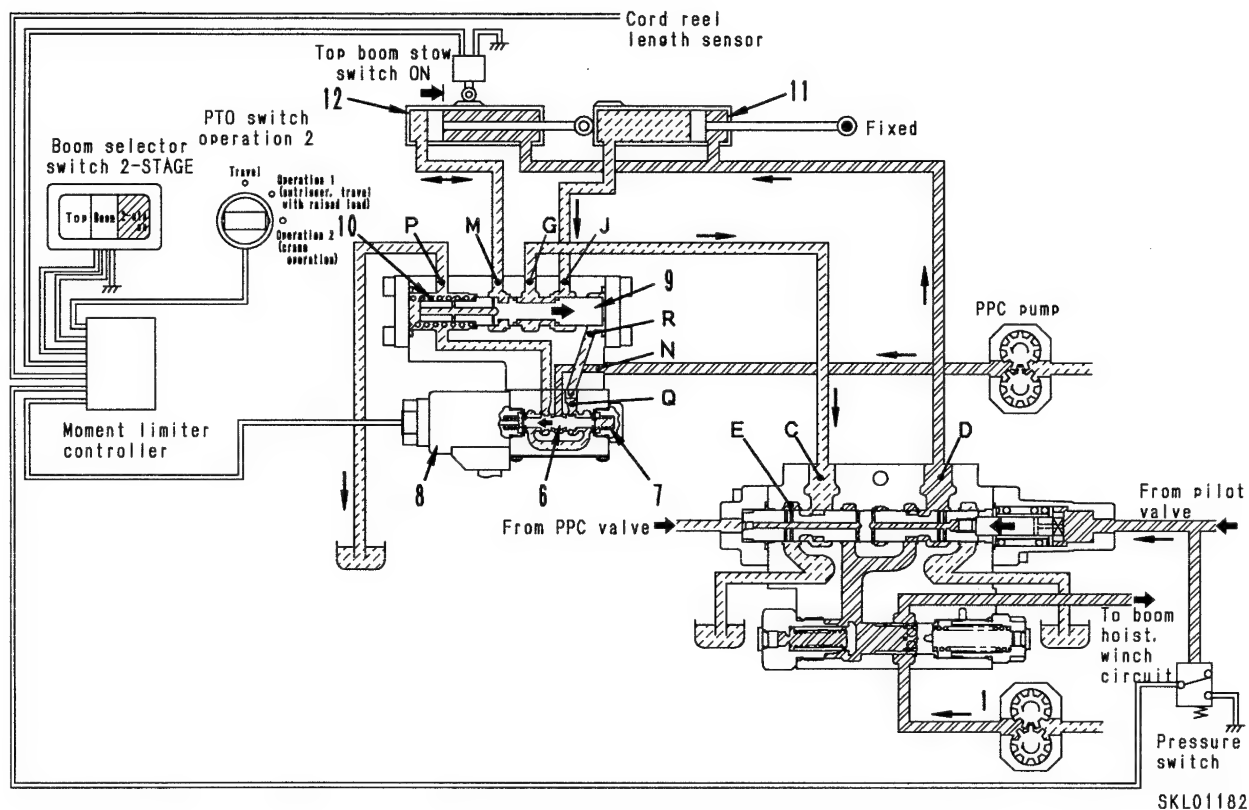


SKL01181

- If the telescope lever is moved to the RETRACT position from the condition in Item 3, the extension pressure switch is turned OFF. The top boom stow switch is OFF and the cord reel length sensor signal is ON, so the moment limiter controller is actuated by these signals, excites solenoid (8) of the telescope selector valve, and puts the telescope selector valve in the same condition as in item 3. In other words, the circuit between the port at the bottom end of No. 2 telescope cylinder (12) and port C of the telescope valve is connected. If the telescope lever is set to the RETRACT position, telescope valve spool (2) moves to

the left, closes the circuit between ports A and C, and opens the circuit between ports A and D and the circuit between ports C and E. When this happens, the oil from boom pump (1) enters port D from port A, and flows to the head end of the No. 2 telescope cylinder. The oil at the bottom end of the No. 2 telescope cylinder returns to port G from port M of the telescope selector valve, and is drained from port C of the telescope valve to port E. Therefore, the No. 2 telescope cylinder waits for the pressure in the circuit to rise, then it retracts, and retracts the top, 4th, and 3rd boom.

5. Boom telescope lever at RETRACT (2nd boom retracted)



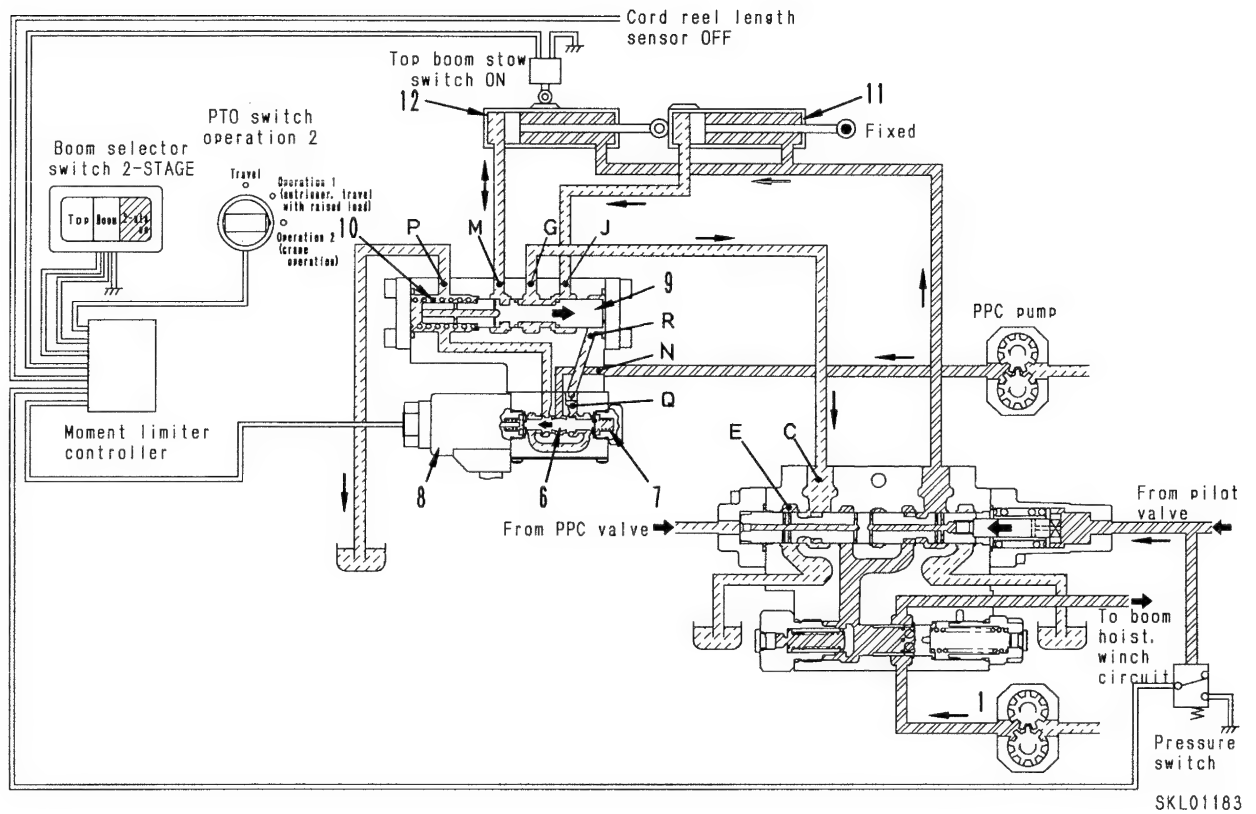
023S05

- In the condition in Item 4, if No. 2 telescope cylinder (12) is at the end of its stroke, and the retraction of the top, 4th, and 3rd boom is completed, the top boom stow switch is turned ON. The moment limiter controller is actuated by this signal, and deenergizes solenoid (8) of the telescope selector valve. When this happens, spool (6) is moved to the left by the tension of spring (7), closes the circuit between ports **N** and **Q**, and opens the circuit between ports **Q** and **P**. At this point, the oil entering port **R** of the pilot check valve returns to port **Q** and is drained from port **P**. Therefore, spool (9) is returned to the right by the tension of spring (10), closes the circuit between port **M** and **G** and opens the circuit between ports **G** and **J**.

In other words, the circuit between the port at the bottom end of the No. 2 telescope cylinder and port **C** of the telescope valve is closed, and the circuit between the port at the bottom end of No. 1 telescope cylinder (11) and port **C** of the telescope valve is connected. When this condition is reached, the oil from port **D** of the telescope valve flows to the head end of the No. 1 telescope cylinder.

In addition, the oil at the bottom end of the No. 1 telescope cylinder returns to port **G** from port **J** of the telescope selector valve, and is drained to port **E** from port **C** of the telescope valve.

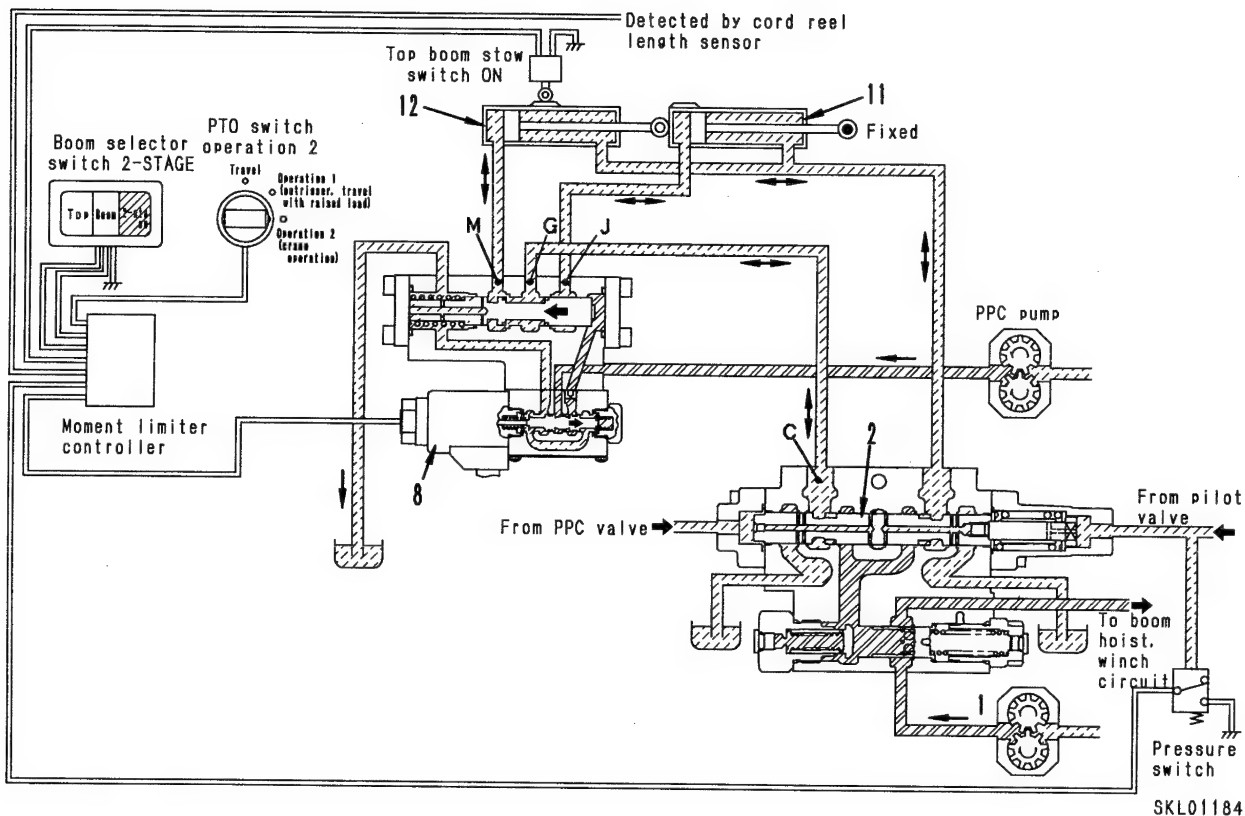
Therefore, the No. 1 telescope cylinder waits for the pressure in the circuit to rise, then it retracts, and retracts the 2nd boom.



- When the 2nd boom is retracted, cord reel length sensor signal is turned OFF. This signal is sent to the moment limiter controller, actuates it, and forms the electric circuit for when the boom is extended. When the No. 1 telescope cylinder is at the RETRACT position, the oil at the bottom end of the No. 2 telescope cylinder returns to port **M**, but it is held by the action of the spool.

023S05

6. Boom selector switch at TOP (possible to extend or retract top, 4th, 3rd boom)



023S05

- When the boom selector switch is set to the TOP position, the moment limiter controller is actuated and excites the telescope selector valve regardless of the condition of the No. 1 and No. 2 telescope cylinders or the three switches.

When this happens, the the telescope selector valve opens the circuit between ports **G** and **M**, and the circuit between the port at the bottom end of No. 2 telescope cylinder (12) and port **C** of the telescope valve is connected. When this condition is reached, telescope valve spool (2), which is actuated by the pilot pressure of the telescope lever PPC valve, switches the oil from boom pump (1), and makes it possible to freely extend or retract the No. 2 telescope cylinder, in other words, the top, 4th, and 3rd boom.

★ For details of the operation of each valve, see Items 3 and 4.

7. Boom selector switch at 2 STAGE (possible to extend or retract 2nd boom)

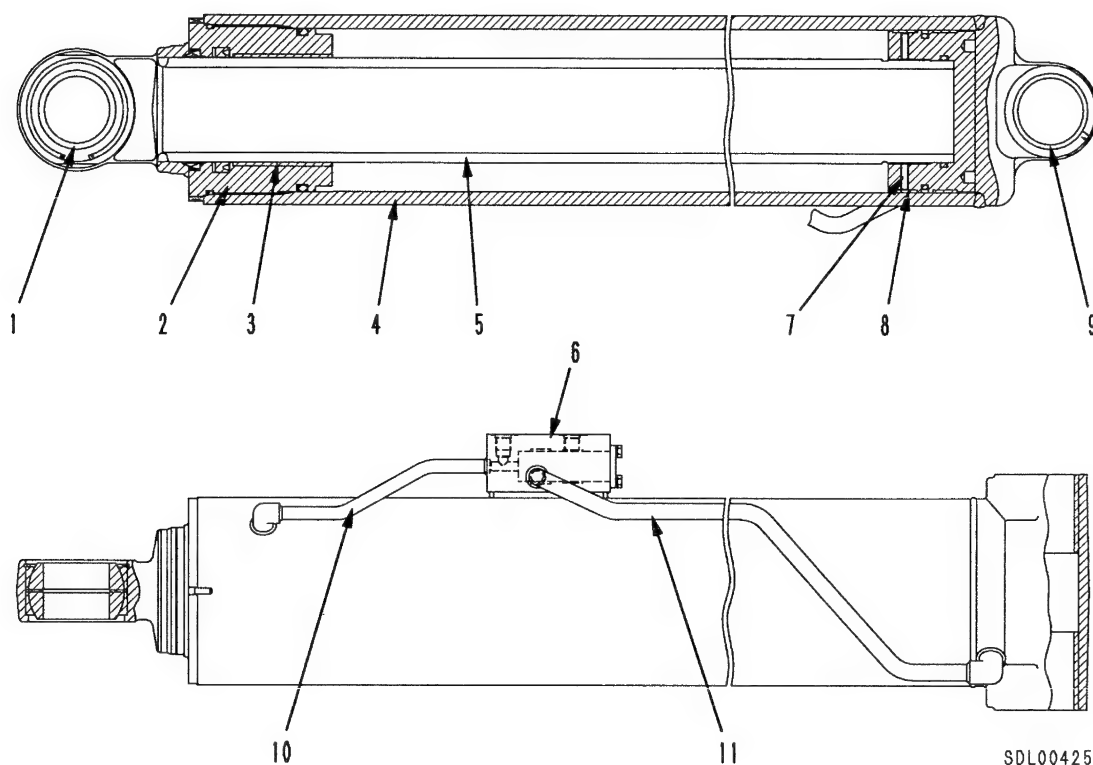
- When the boom selector switch is set to the 2 STAGE position, the moment limiter controller is actuated and deenergizes the telescope selector valve regardless of the condition of the No. 1 and No. 2 telescope cylinders or the three switches.

When this happens, the telescope selector valve opens the circuit between ports **G** and **J**, and the circuit between the port at the bottom end of No. 1 telescope cylinder (11) and port **C** of the telescope valve is connected. When this condition is reached, telescope valve spool (2), which is actuated by the pilot pressure of the telescope lever, switches the oil from boom pump (1), and makes it possible to freely extend or retract the No. 1 telescope cylinder, in other words, the 2nd boom.

★ For details of the operation of each valve, see Items 2 and 5.

BOOM CYLINDER

BOOM HOIST CYLINDER



1. Bushing
2. Cylinder head
3. Bushing
4. Cylinder
5. Piston rod
6. Counterbalance valve assembly
7. Piston
8. Wear ring
9. Bushing
10. Tube
11. Tube

Outline

- The boom hoist cylinder is a double-acting piston type. It is installed to the revolving frame and carries out the hoist operations for the boom.

Counterbalance valve (6) acts to prevent the boom from falling suddenly if there should be a failure in the cylinder circuit.

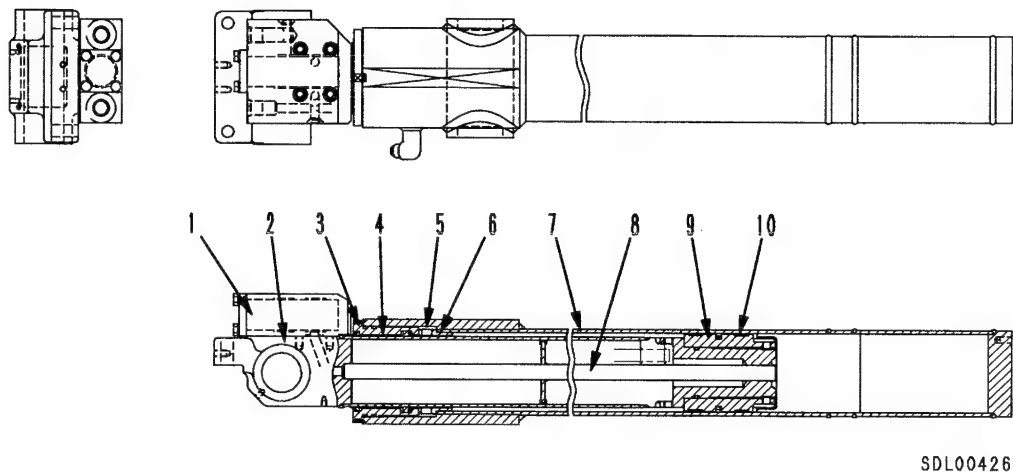
The stroke and dimensions of the cylinder are as shown in the table below.

Unit: mm

Item	Standard value
Outside diameter of piston rod	210
Cylinder bore	280
Piston stroke	1,998
Max. distance between pins	4,551
Min. distance between pins	2,553

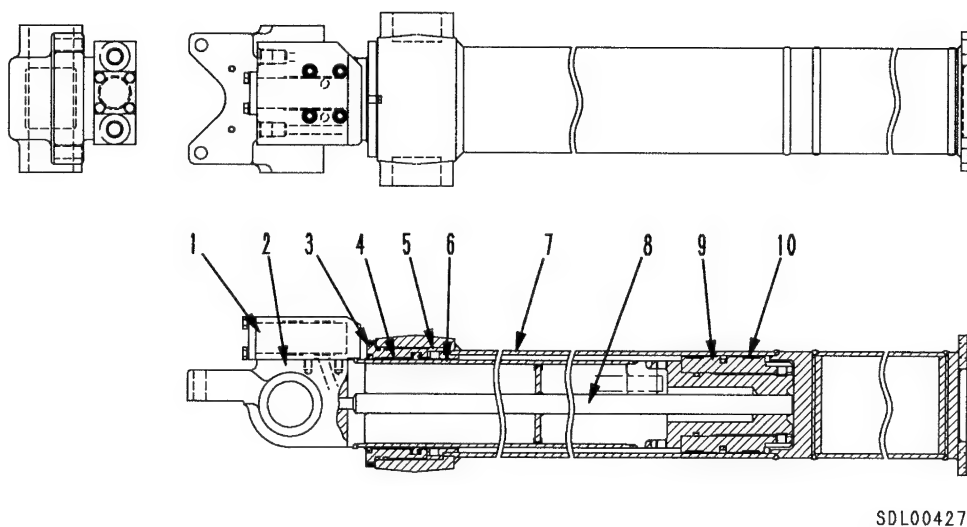
BOOM TELESCOPE NO. 1, NO. 2 CYLINDERS

NO. 1 CYLINDER



SDL00426

NO. 2 CYLINDER



SDL00427

023S05

1. Counterbalance valve assembly
2. Piston rod
3. Cylinder head
4. Bushing
5. Retainer
6. Bushing
7. Cylinder
8. Tube
9. Piston
10. Wear ring

Outline

- The boom telescope cylinder is a double-acting piston type, and it consists of two cylinders: the No. 1 and No. 2 cylinders.

The head end of the No. 1 cylinder is installed to the base boom, and the cylinder itself is installed to the 2nd boom. It extends and retracts the 2nd boom.

The head end of the No. 2 cylinder is installed to the 2nd boom, and the cylinder itself extends and retracts the 3rd boom.

There is a roller installed to the bottom end of the No. 2 cylinder. This rotates inside the top boom and supports the weight of the cylinder as it extends or retracts.

Counterbalance valve (1) acts to prevent the boom from falling suddenly if there should be a failure in the cylinder circuit.

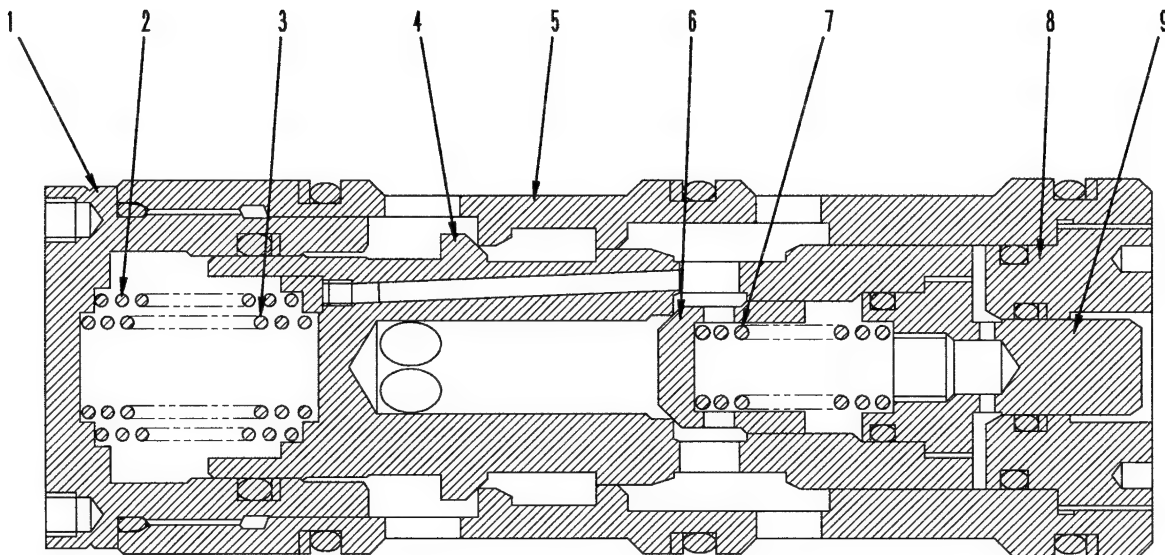
Cylinder tube (8) is assembled inside piston rod (2) and makes it possible for the cylinder to be stowed inside the boom.

The stroke and dimensions of the cylinder are as shown in the table below.

Unit: mm

Item	Standard value	
	No.1 cylinder	No.2 cylinder
Outside diameter of piston rod	110	135
Cylinder bore	130	160
Piston stroke	6,114	6,114
Max. distance between pins	6,440	6,319
Min. distance between pins	326	205

COUNTERBALANCE VALVE



SKD00428

023S05

1. Cap
2. Spring (large)
3. Spring (small)
4. Spool
5. Valve body
6. Check valve
7. Spring
8. Bushing
9. Piston

Outline

- The counterbalance valves are in the circuits between the boom control valve and the boom hoist cylinder, and boom telescope No. 1 and No. 2 cylinders. If the oil pressure at the cylinder head is not the set pressure, the counterbalance valve acts to prevent the oil at the cylinder bottom from returning to the drain circuit.

As a result, if there should be any failure or damage to the engine, pump, or piping while the boom is being operated, the oil at the cylinder bottom is not drained, so the cylinder is held, and the boom is prevented from falling suddenly.

Set pressure: 2.0 MPa {20 kg/cm²}

OPERATION

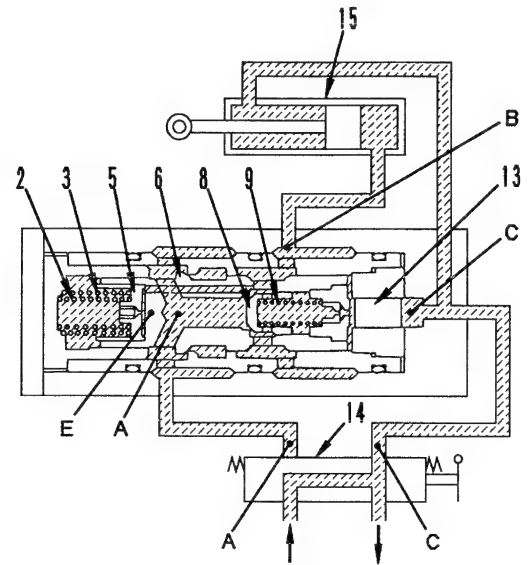
- ★ The explanation of the operation uses the boom hoist circuit as the example.

1. When boom hoist lever is at neutral

When the boom hoist lever is at the NEUTRAL position, boom valve (14) is also at the NEUTRAL position, so the oil at the cylinder head returns from the boom valve to the tank.

The oil at the bottom end of the cylinder returns to port **B**, but the passage to port **A** is closed by check valve (8). Because of this, the oil does not return to the boom valve, and the cylinder is held at that position.

Therefore, even if the engine or pump should fail during operations, the circuit at the cylinder bottom is at HOLD, and this prevents the boom from moving down suddenly.

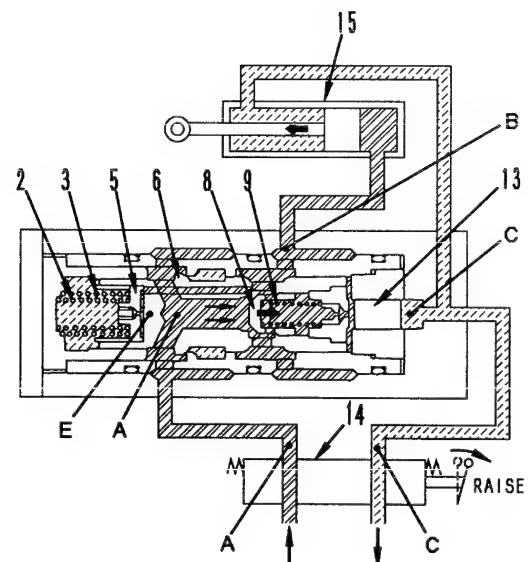


SLL00429

2. When boom hoist lever is at RAISE

If the boom hoist lever is set to the RAISE position, boom valve (14) is switched, and the circuit between the pump port and port **A** is connected.

When this happens, the oil from the pump enters port **A**, pushes open check valve (8), and flows from port **B** to the bottom end of the cylinder. It waits for the pressure in the circuit to rise, then the cylinder extends and raises the boom.



SLL01185

3. When boom hoist lever is at LOWER

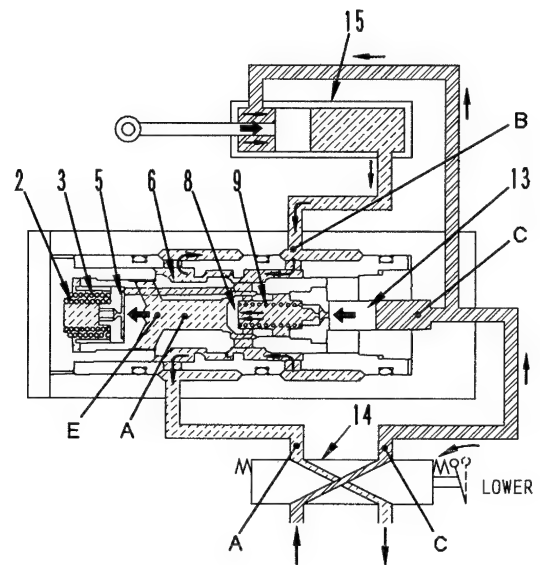
If the boom hoist lever is set to the LOWER position, boom valve (14) is switched, and the circuit between the pump port and port **C** is connected.

When this happens, the oil from the pump passes through port **C** and flows to the cylinder head.

However, the oil at the cylinder bottom returns to port **B**, but it is prevented from flowing out to the port by check valve (8), so the pressure at the cylinder head (port **C**) rises.

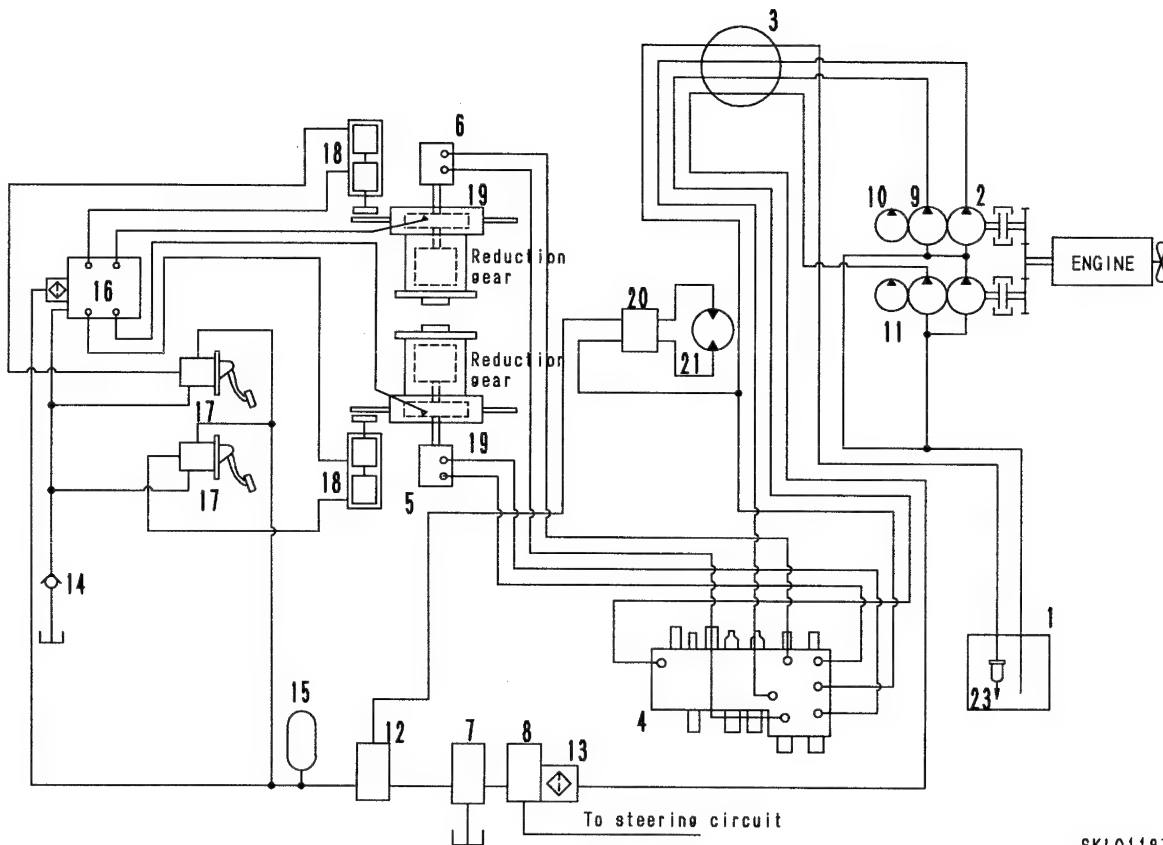
When the pressure rises to more than 2.0 MPa (20 kg/cm²), the oil at port **C** pushes piston (13) to the left, compresses springs (2) and (3), and moves spool (6) to the left. When this happens, the circuit between port **A** and port **B** through port **D** is connected.

As a result, the oil at the cylinder bottom is connected to the tank port, so when the pressure in the circuit rises, the cylinder is retracted and the boom is lowered.



SLL01186

WINCH HYDRAULIC SYSTEM



SKL01187

- | | | |
|------------------------------|------------------------------|--|
| 1. Hydraulic tank | 9. Boom pump | 17. Winch brake master cylinder |
| 2. Winch pump | 10. Pilot pump (PPC) | 18. Winch brake cylinder |
| 3. Swivel joint | 11. Outrigger, steering pump | 19. Winch clutch cylinder |
| 4. Boom, winch control valve | 12. Charge valve | 20. Overrun prevention valve |
| 5. Auxiliary winch motor | 13. Line filter | 21. Air conditioner compressor drive motor |
| 6. Main winch motor | 14. Check valve | 22. Hydraulic filter |
| 7. Flow priority valve | 15. Accumulator | |
| 8. Steering valve | 16. Winch clutch valve | |

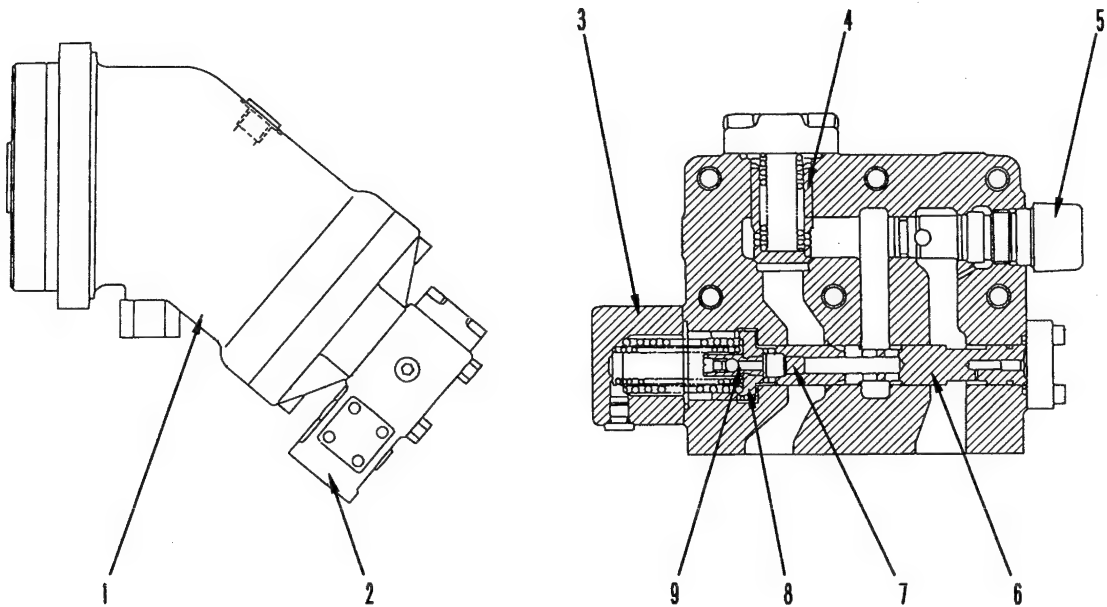
023S05

Outline

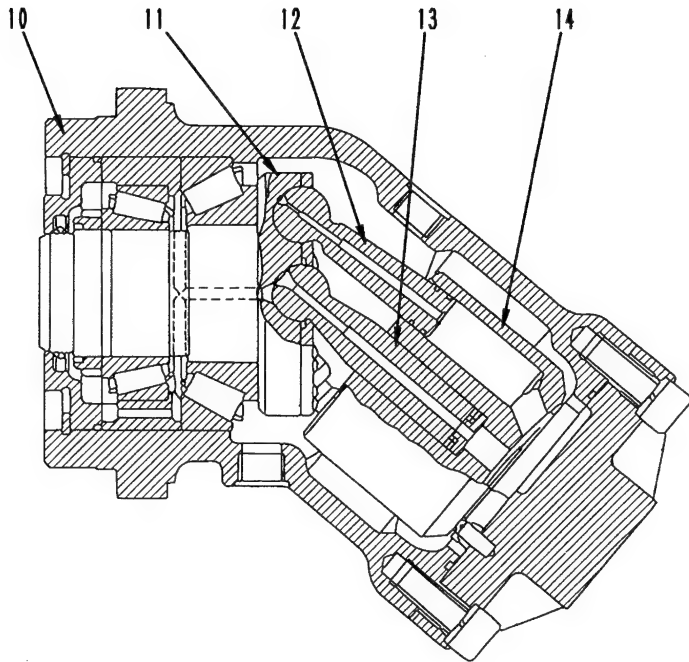
- The winch hydraulic system consists of winch pump (2) and the valves, motors, and cylinders actuated by the winch levers and pedals in the operator's compartment.
The main winch and auxiliary winch consist respectively of winch motors (5) and (6), the reduction gears and winch drums. A clutch is assembled to the winch drum, and this is engaged and disengaged by the clutch cylinder.
A disc brake is assembled to the outside circumference of the winch drum, and when brake cylinder (18) is actuated by the operation of the brake master cylinder, braking force is applied to the winch drum.
- The oil from hydraulic tank (1) is pressurized by winch pump (2), passes through swivel joint (3), and is then sent under pressure to boom and winch control valve (4).
The oil from boom pump (9) passes through the swivel joint and is also sent under pressure to boom and winch control valve (4).
- When the main winch lever is operated, the main winch valve inside control valve (4) is actuated, and main winch motor (6) rotates. When this happens, if the boom lever and power tilt lever are at the NEUTRAL position, the oil from boom pump (9) is automatically merged, so main winch motor (6) rotates at high speed.
- When the auxiliary winch lever is operated, the auxiliary winch valve is actuated in the same way as the main winch valve, and auxiliary winch motor (5) rotates.
In the same way as with the main winch, if the boom lever and power tilt lever are at the NEUTRAL position, the oil from boom pump (9) is automatically merged, so auxiliary winch motor (5) rotates at high speed.
- Winch clutch valve (16) operates the clutch cylinder and brake cylinder using the oil pressure in accumulator (15), and selects the operating condition of the main winch and auxiliary winch, or the free-fall condition.
Accumulator (15) stores the oil from outrigger and steering pump (11).
If there is enough oil stored inside accumulator (15), charge valve (12) opens, and the oil from the outrigger and steering pump is drained to the hydraulic tank.

023S05

WINCH MOTOR
COUNTERBALANCE VALVE



WINCH MOTOR



SLL00433

023S05

1. Winch motor assembly
2. Counterbalance valve assembly
3. Cover
4. Plunger
5. Relief valve
6. Spool
7. Plug
8. Piston
9. Orifice assembly
10. Housing
11. Control plate
12. Piston
13. Center pin
14. Cylinder block

Outline

- There are two winch motors: one each for the main winch and auxiliary winch. They are each installed to the rear of the revolving frame, and rotate the winch drum.
- The winch motor can be broadly divided into two parts: the hydraulic motor and counterbalance valve assembly (2).
- The hydraulic motor is an inclined shaft, axial piston type. Seven pistons (12) slide under the pressure of the oil entering cylinder block (14) from the rear flange, and rotate cylinder block (14) to rotate the drive shaft.
- The counterbalance valve assembly is in the circuit between the winch motor and the winch control valve. When the oil pressure in the circuit at the WIND OUT side of the motor reaches 1.7 MPa {17 kg/cm²}, it opens the return circuit.
- During crane operations, the weight of the raised load is brought to bear on the winch drum, and tries to make the winch drum rotate faster than the winch motor.

If the engine is running at low idling in this condition, the motor will rotate under no load and may be damaged.

The counterbalance valve acts to prevent this and to make the motor rotate at a speed which matches the engine speed (pump delivery amount).

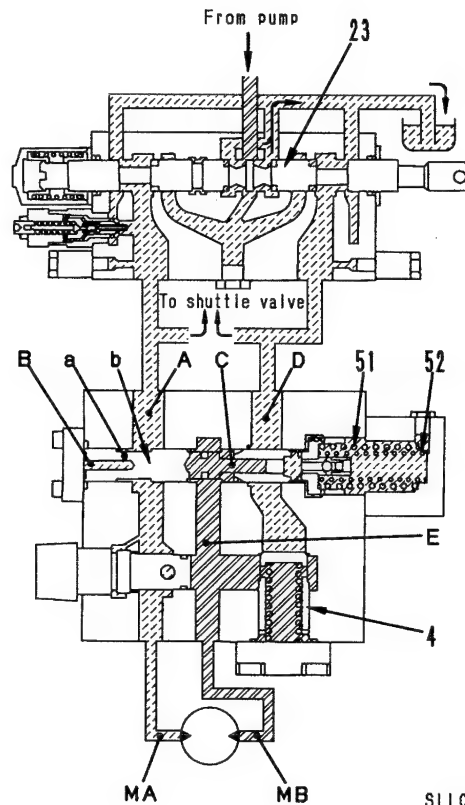
COUNTERBALANCE VALVE

Operation

1. When winch lever is at neutral

When the winch lever is at the NEUTRAL position, winch valve spool (23) is also at the NEUTRAL position, and ports **A** and **D** of the counterbalance valve are connected to the drain circuit.

Therefore, port **MA** at the WIND OUT side of the winch motor, which is connected to port **A**, is also connected to the drain circuit. However, with port **MA** at the WIND IN side, the passage from port **E** to port **D** is shut off by check valve (4), so even if external force is generated that tries to wind out the winch motor, the winch motor does not turn. This prevents the load from moving down suddenly.



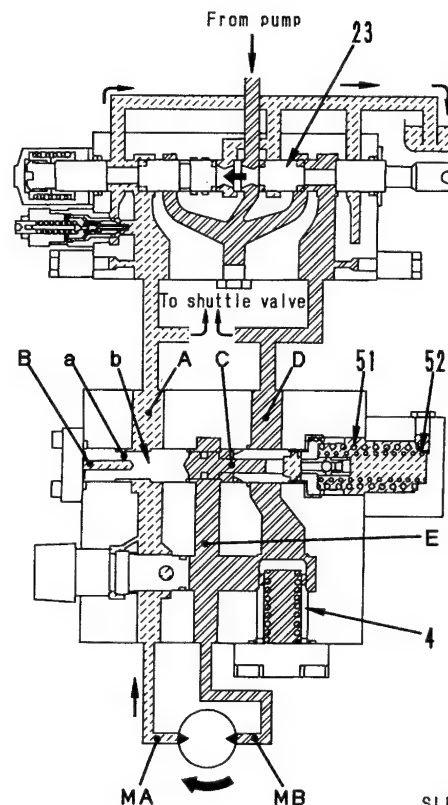
SLL01188

2. When winch lever is at WIND IN

If the winch lever is set to the WIND IN position, winch valve spool (23) moves to the left, and the circuit between the pump port and port **D** and the circuit between the tank port and port **A** are connected.

When this happens, the oil from the pump goes as far as port **D**, and is stopped at check valve (4), so the pressure rises.

When the pressure rises to 0.2 MPa {2 kg/cm²}, the oil at port **D** pushes open check valve (4), and flows from port **E** to motor port **MB**. When the pressure in the circuit rises, the motor rotates to the left and winds in the load. The oil leaving motor port **MA** returns from port **A** to the winch valve, and is drained.



SLL01189

023S05

3. When winch lever is at WIND OUT

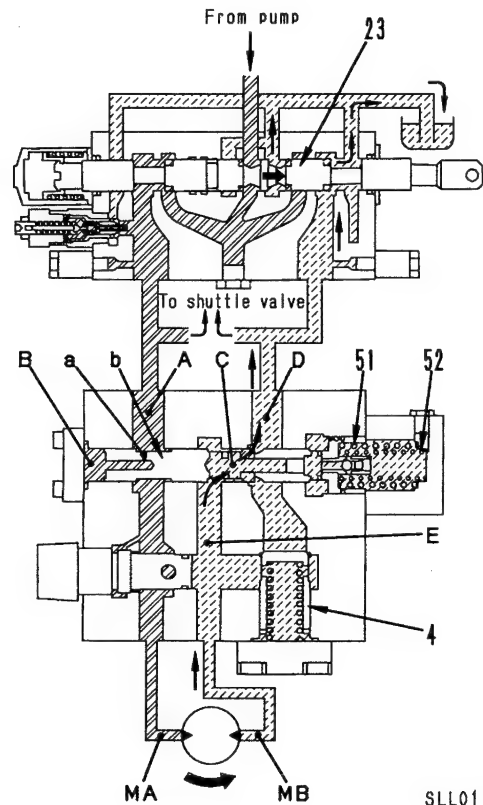
When the winch lever is set to the WIND OUT position, winch valve spool (23) moves to the right, and connects the circuit between the pump port and port **A** and the circuit between the tank port and port **D**.

When this happens, the oil from the pump enters port **A** and flows to motor port **MA**.

However, the oil at motor port **MB** returns to port **D**, and is stopped from flowing to port **D** by check valve (4), so the pressure at motor port **MA** rises.

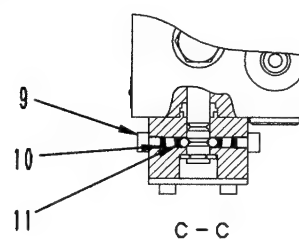
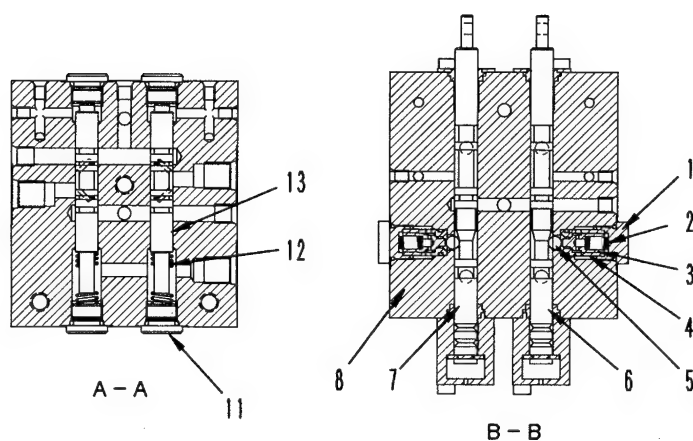
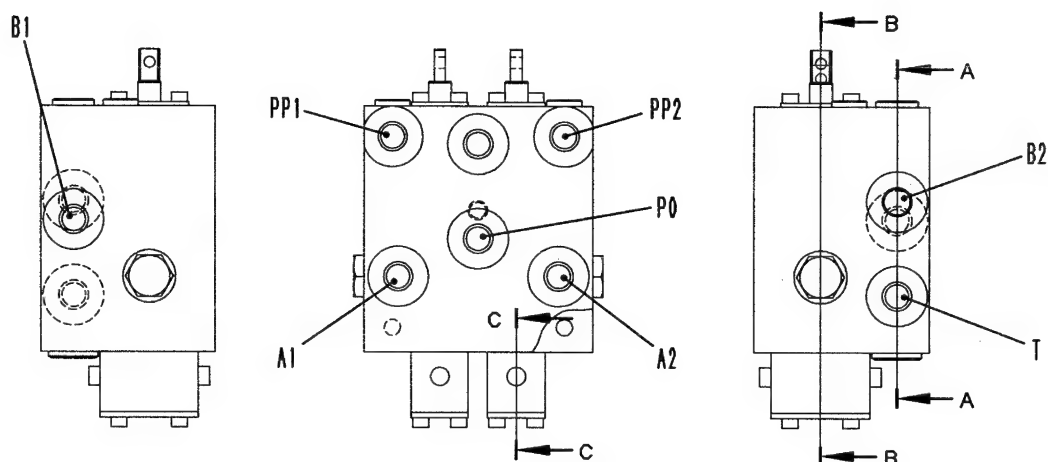
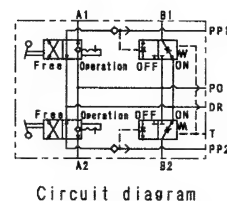
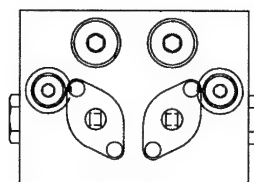
When the pressure rises to 2.0 MPa {20 kg/cm²}, the oil at port **A** passes through orifice **a**, enters back pressure port **B**, and pushes spool (6) to the right. This compresses springs (51) and (52), and opens the circuit between ports **C** and **D** and the circuit between ports **E** and **D**.

As a result, the oil at motor port **MB** returns from ports **E** and **D** to the tank port of the winch valve, and the motor rotates to the right to wind out the load.



SLL01190

WINCH CLUTCH VALVE



023S05

SKL01191

1. Plug
2. Spring
3. Plunger
4. Valve seat
5. Ball
6. Spool (for auxiliary winch)
7. Spool (for main winch)
8. Valve body
9. Bolt
10. Spring
11. Ball
12. Plug
13. Spring
14. Spool

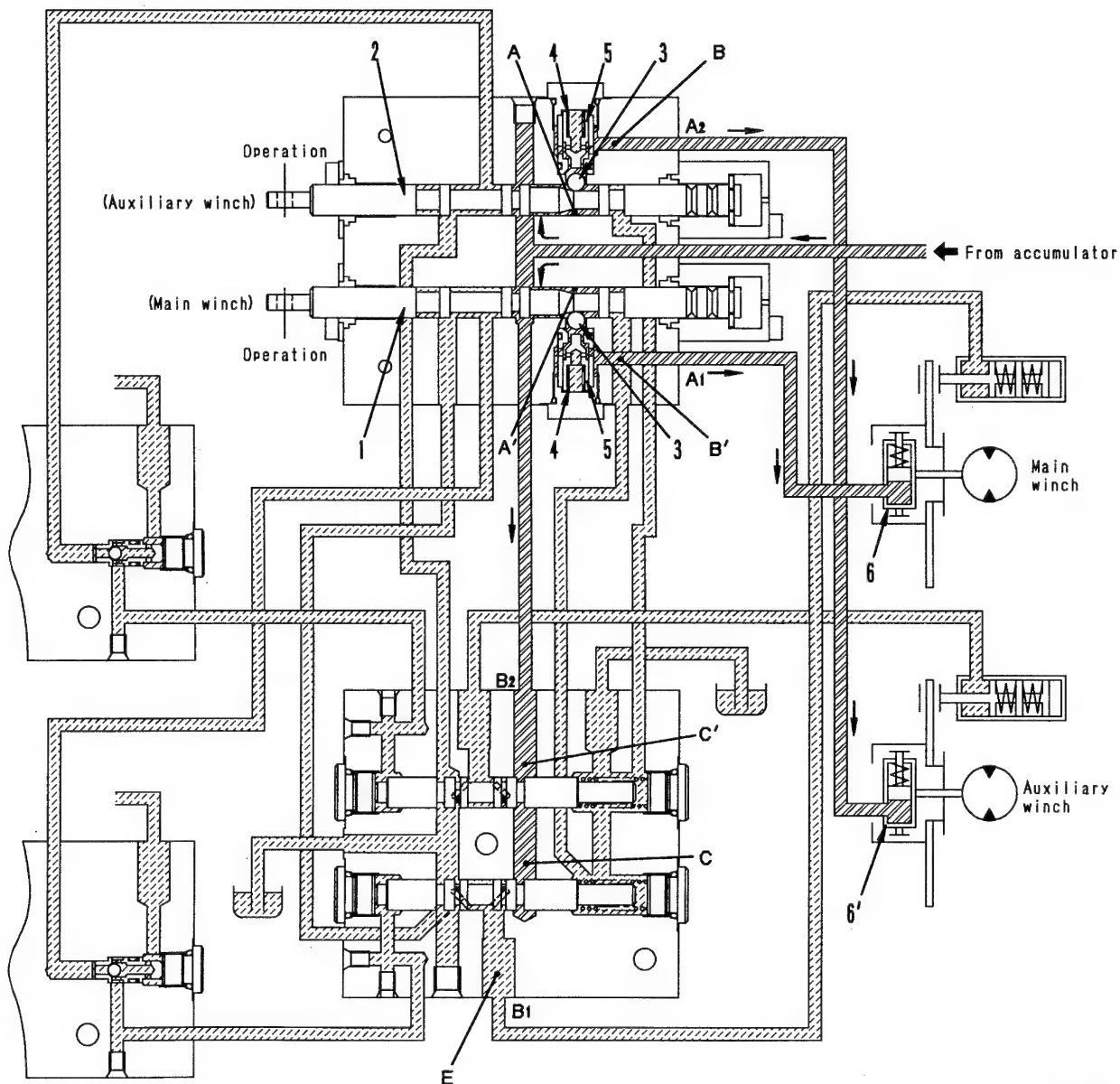
A1. To main winch clutch cylinder
A2. To auxiliary winch clutch cylinder
B1. To main winch brake cylinder (automatic)
B2. To auxiliary winch brake cylinder (automatic)
P0. From accumulator
PP1. From main winch valve
PP2. From auxiliary winch valve
T. Drain circuit

Outline

- The winch clutch valve is in the circuit between the accumulator oil pressure circuit and the winch brake cylinder and winch clutch cylinder. It consists of two spools (6) and (7) for the main winch and auxiliary winch.
The winch clutch valve is designed to make it possible to switch the main winch and auxiliary winch from the operating condition to the free-fall condition.
- The winch consists of the winch motor, reduction gear, and drum, but the winch motor and winch drum are formed into one unit by the clutch assembled to the drum to wind the load in and out.
The clutch valve actuates the cylinder assembled to the clutch.
The winch drum has a disk brake assembled to its outer circumference, and when the winch brake master cylinder is operated, the brake cylinder is actuated to apply the braking force. It can also be actuated by operating the clutch valve.
The clutch cylinder and brake cylinder are actuated at the same time by the clutch valve.

OPERATION

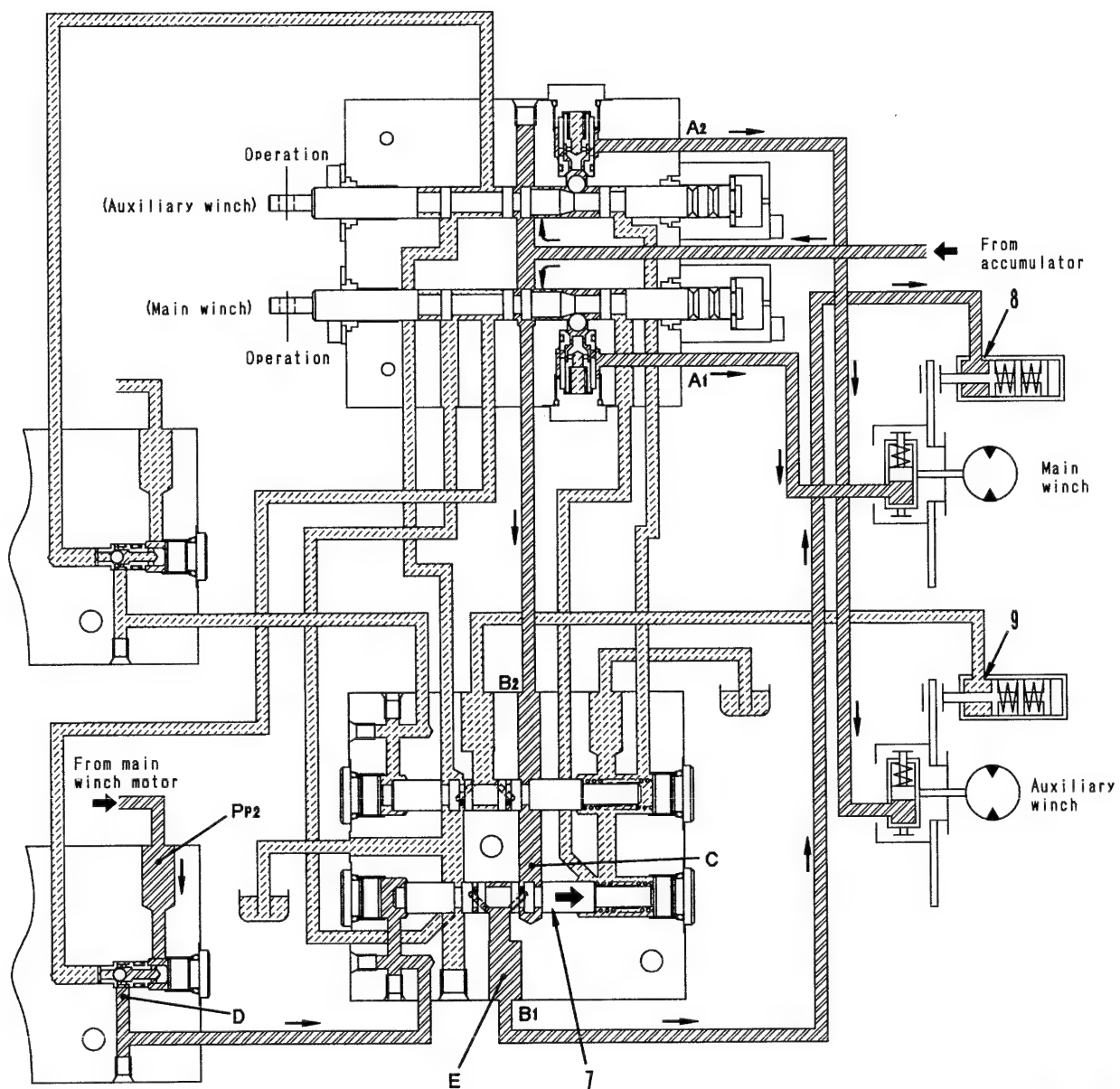
1. When clutch lever is operated



- Placing both the main winch and auxiliary winch clutch levers at the "Operation" position is the normal condition. In this position, there is ball (3) in the groove of main winch spool (1) and auxiliary winch spool (2). This forms one unit with plunger (5) because of the tension of spring (4), and pushes against the spool. As a result, the circuit between main winch port A and port B and the circuit between aux-

iliary winch port A' and port B' open. When this happens, some of the oil from the accumulator circuit enters ports B and B' from ports A and A'. The oil pushes open plunger (5), flows to main winch clutch cylinder (6) and auxiliary winch clutch cylinder (6'), and engages the clutch. The remaining oil enters main winch and auxiliary winch automatic brake release ports C and C', and stops.

023S05

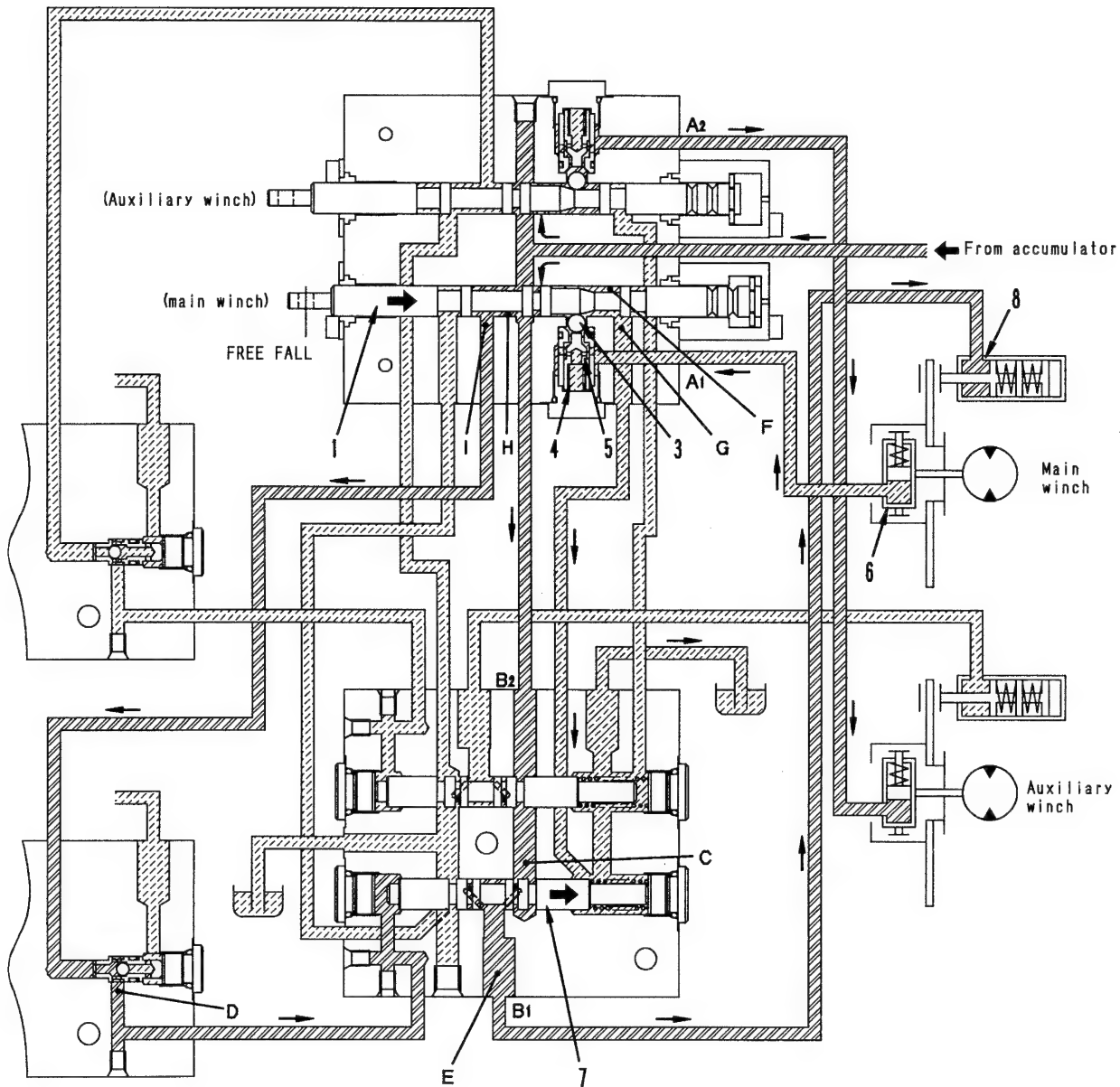


SKL01193

- If the main winch control lever is operated to the WIND IN or WIND OUT position, the oil from the winch motor enters from port PP2, passes through double check valve D, moves spool (7), and opens the circuit between port C and port E. The oil flows from the accumulator circuit, so main winch automatic brake (8) is RELEASED and the winch is actuated. When the auxiliary winch is operated, the operation is the same as when the main winch

control lever is operated. Auxiliary winch automatic brake (9) is RELEASED and the winch is actuated.

2. When clutch lever is at FREE FALL



SKL01194

- If the main winch clutch lever is set to the FREE FALL position, spool (1) moves to the right, ball (3) is pushed up, spring (4) is compressed, and poppet (5) moves, so the circuit between ports F and G and the circuit between ports H and I are opened.

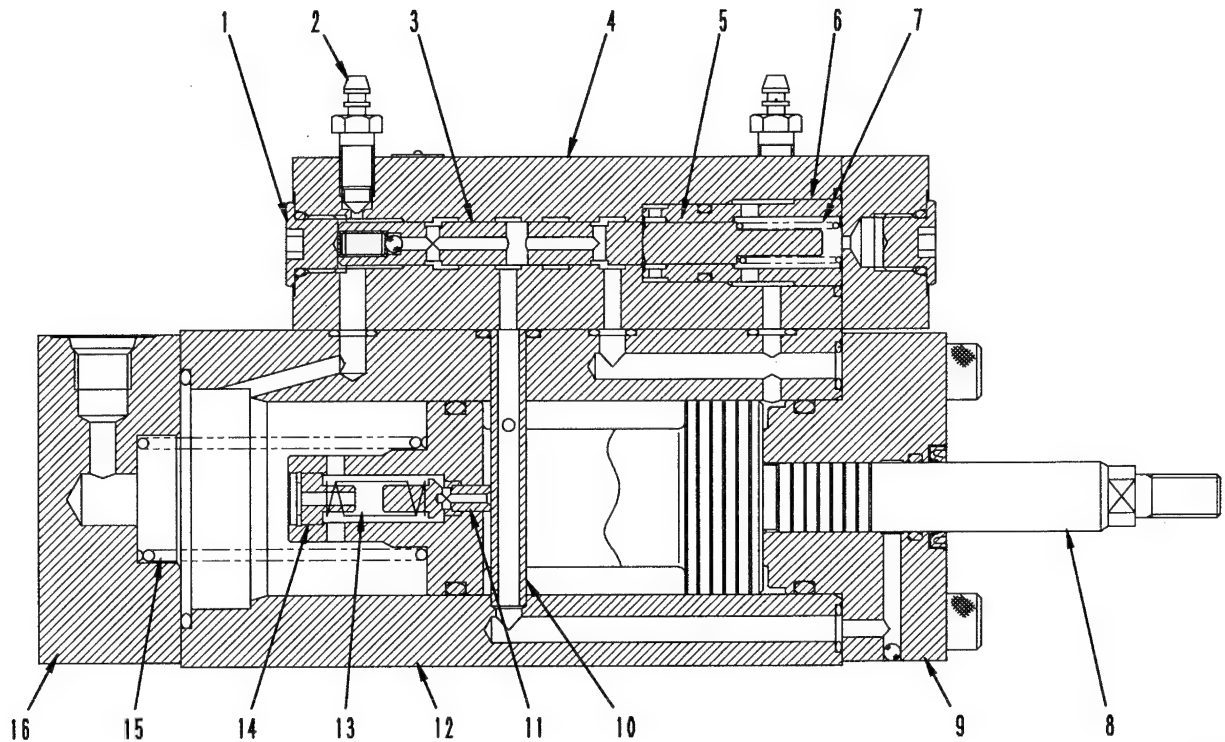
When this happens, some of the oil from the accumulator circuit passes through double check valve D, moves spool (7) to the right, and opens the circuit between ports C and E. When port C opens, the rest of the oil flows from port C to port E, and main winch auto-

matic brake (8) is RELEASED.

- When spool (1) moves, the oil from main winch clutch cylinder (6) flows into the other circuit between ports F and G, and is drained to the hydraulic tank, so the clutch is disengaged.
- As a result, the winch is not actuated, whatever position the winch lever is in. The brake hydraulic circuit is released, so if the winch brake pedal is depressed, the load is HOLD in position, and if it is released, free-fall operations can be carried out.

023S05

WINCH BRAKE MASTER CYLINDER



023S05

SKD00441

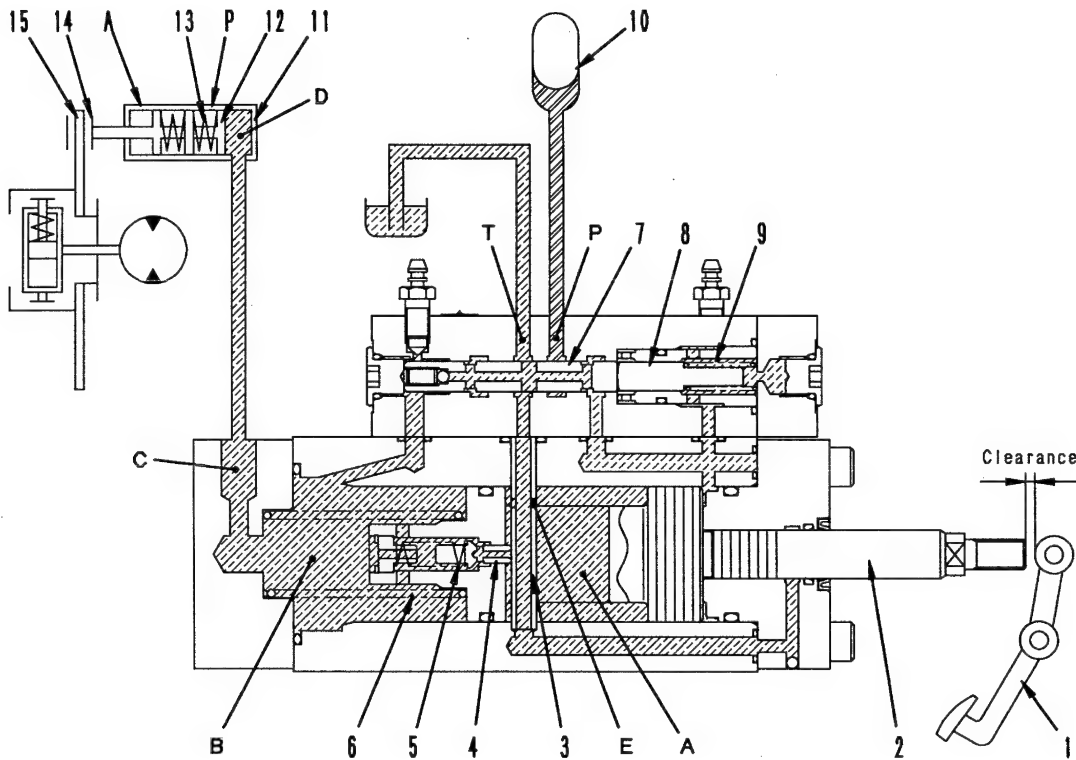
1. Plug
2. Bleeder
3. Spool
4. Body
5. Piston
6. Sleeve
7. Spring
8. Piston
9. Cover
10. Stopper
11. Poppet
12. Cylinder
13. Spring
14. Stopper
15. Spring
16. Cover

Outline

- The winch brake master cylinder is interconnected with piston (8) and the brake pedal inside the operator's compartment. When the brake pedal is depressed, the pressure in the brake circuit rises and actuates the disc brake piston assembled to the winch drum.
- The pressure generated when the brake is depressed moves spool (3), and the brake master cylinder functions to send the pressure from the accumulator to the rod end of the piston to reduce the operating effort of the brake.

OPERATION

1 When winch brake (pedal) is not depressed



SKL01195

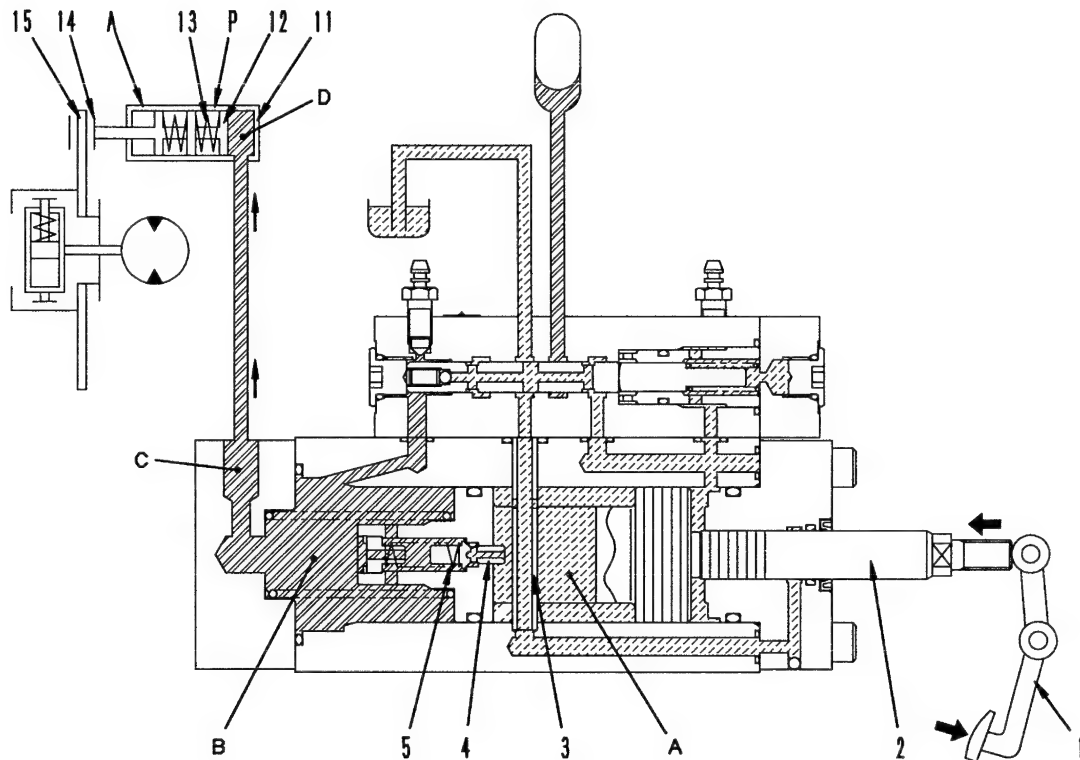
023S05

When the winch brake pedal is not being depressed, there is a clearance between link (1) of the brake pedal and piston (2) of the winch brake master cylinder.

In this condition, piston (2) is pushed back to the right by spring (6), the right end of poppet (4) contacts stopper pin (3), and the seat portion of poppet (4) is open, so the passage between A and B is connected. In addition, chamber A is connected to the hydraulic tank through hole E in stopper pin (3).

Port D of brake power cylinder (11) is connected to the tank through C, B, A, and E. Piston (12) of power cylinder (11) is pushed fully to the right by spring (13), and brake pad (14), which is interconnected with the piston, is separated from disc plate (15), so the winch brake (pedal) is released.

2. When winch brake (pedal) is depressed



SKL00443

When brake pedal (1) is depressed, piston (2) of the winch brake master cylinder moves to the left.

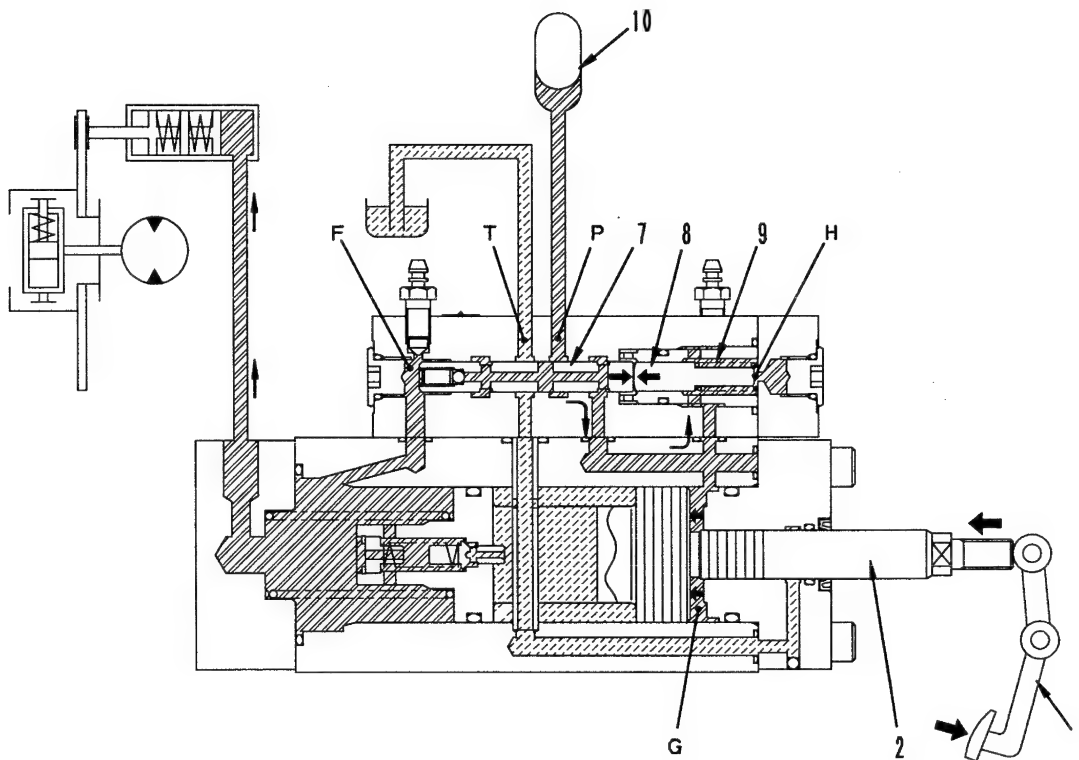
When this happens, the right end of poppet (4) separates from stopper (3) and is pushed to the right by the tension of spring (5). Poppet (4) closes the hole in the piston, and closes the circuit between **B** and **A** of the master cylinder.

When this happens, the pressure in the circuit from port **C** to port **D** of brake power cylinder (11) starts to rise.

If the brake pedal is depressed further, the oil from the master cylinder overcomes the tension of spring (13) and moves piston (12) of brake power cylinder (11) to the left.

Brake pad (14), which is interconnected with piston (12), pushes disc plate (15) of the winch drum fully, and the brake generates braking force.

3. When winch brake (pedal) remains actuated



SKL00444

023S05

When brake pedal (1) is depressed, brake power cylinder (11) is actuated and brake pad (14) contacts disc plate (15). If the pedal is depressed further, the pressure in the circuit for the winch brake master cylinder rises, and the pressure in the circuit pushes spool (7) inside chamber F and spool (8), which is in contact with spool (7). This compresses spring (9), and spool (7) and spool (8) move to the right.

When spool (7) moves to the right, the oil pressure in accumulator (10), which is connected with port P of spool (7), is connected to chamber H at the right end of piston (2) and cham-

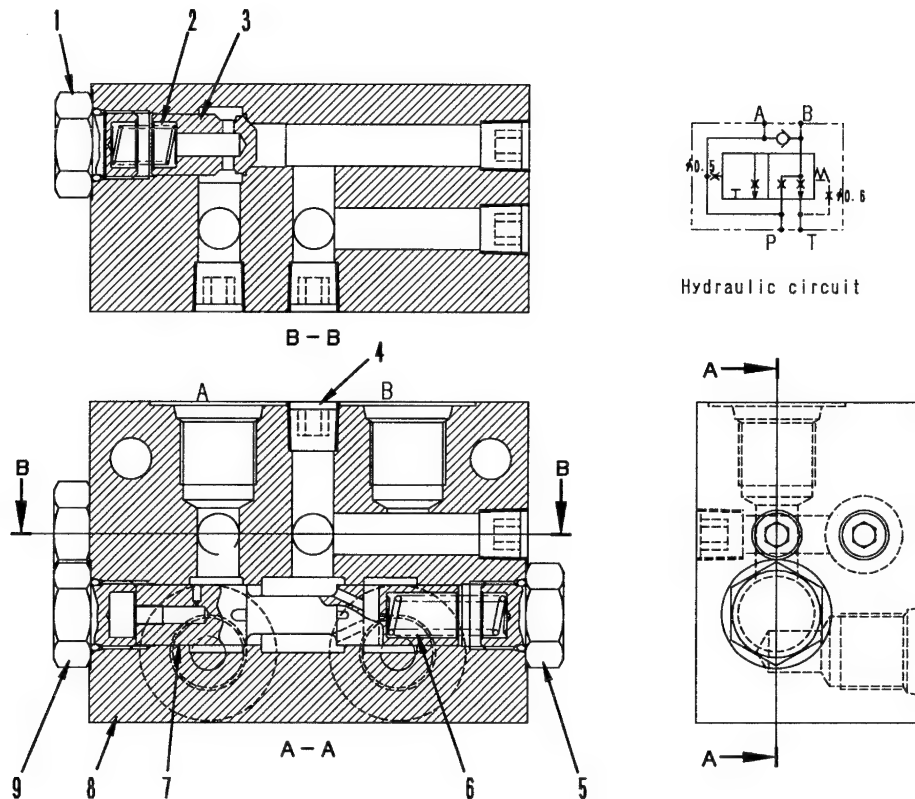
ber G of the master cylinder.

The pressure oil entering chamber H at the right end of spool (8) becomes the force pushing spool (8) back to the left, so it pushes spool (7) back to the left and closes the passage from spool (7) to the accumulator.

Spool (7) is actuated so that the hydraulic pressure in chamber F is balanced with the hydraulic pressure in chamber H + the force of the spring.

At the same time, the pressure oil connected to chamber G of the master cylinder becomes the force pushing piston (2) to the left, so the operating effort of brake pedal (1) is reduced.

OVERRUN PREVENTION VALVE



Hydraulic circuit

SKD01196

1. Plug
2. Spring
3. Check valve
4. Plug
5. Plug
6. Spring
7. Spool
8. Valve body
9. Plug

Outline

- The overrun prevention valve uses the steering and outrigger pump as the source of hydraulic power and is installed to the air conditioner compressor drive hydraulic motor.
- It has check valve (3) built in to prevent cavitation of the hydraulic motor if the supply of oil to the air conditioner compressor drive hydraulic motor should stop when the outriggers or steering are being operated.
- It also acts to prevent rotation impact noise from the hydraulic motor or overrun of the motor after sudden increase of speed caused by oil suddenly flowing to the hydraulic motor from the hydraulic pump when the operation of the outrigger or any other operation is stopped.

OPERATION**1. When starting to supply oil to hydraulic motor**

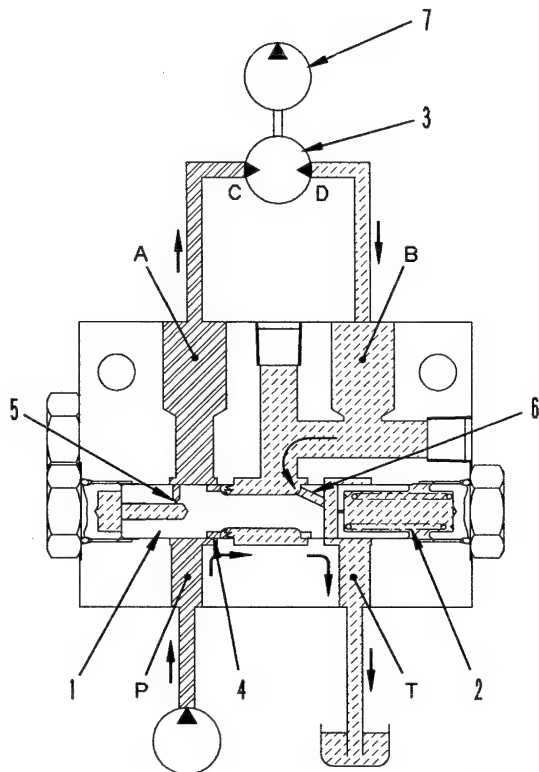
When operation of the outrigger or steering is stopped, the oil from the steering and outrigger pump suddenly flows to hydraulic drive pump (3) of the air conditioner compressor.

The oil from the hydraulic pump enters port **P** of the valve, passes through the inside of the valve, and is connected to inlet port **C** of the hydraulic motor from valve port **A**.

The oil entering port **P** passes through notch (4) in spool (1) and is connected to outlet port **D** of the hydraulic motor from valve port **B**. The oil also passes through notch (6) of spool (1) and is connected to the tank circuit.

Therefore, the oil from the hydraulic pump temporarily enters inlet port **C**, goes to outlet port **D** of the hydraulic motor, and then is returned to the tank from spool notch (6).

In this way, it is possible to reduce the pressure difference at the inlet port and outlet port of hydraulic motor (3) and to reduce the impact noise caused by the rise in pressure inside the hydraulic motor when oil suddenly flows in. This prevents any sudden increase in speed and any resulting overrun.

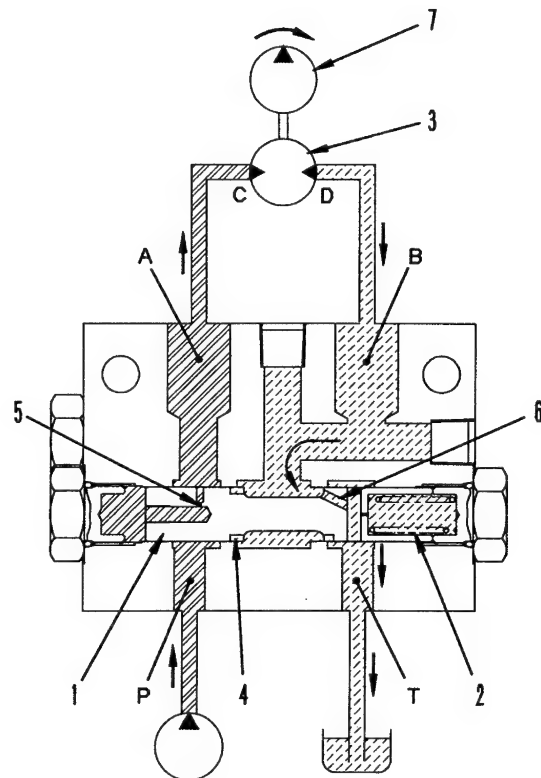


SKL00446

2. When hydraulic motor is rotating

The oil from the outrigger and steering pump enters port **P** of the valve, passes through orifice (5) of spool (1), and enters the left end of spool (1). When the pressure becomes greater than the load of spring (2), it pushes spool (1) out to the right.

When the spool moves to the right, the passage at spool notch (4) is closed, so the oil passing from spool notch (4) through spool notch (6) and returning to the tank is all sent from valve port **A** to inlet port **C** of the hydraulic motor. Hydraulic motor (3) rotates at the specified speed and drives air conditioner compressor (7).



SKL00447

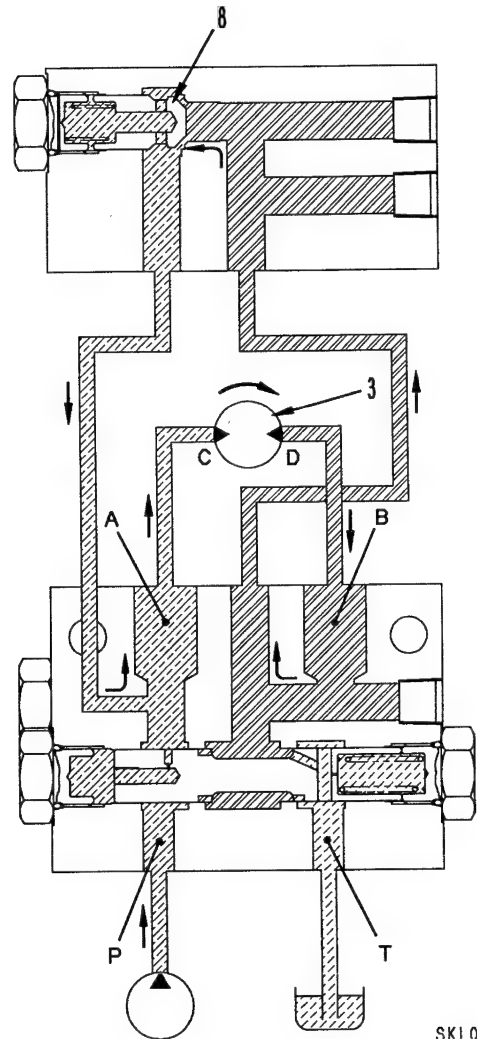
023S05

3. When supply of oil to hydraulic motor is stopped

When the outriggers or steering are operated or the charge valve is actuated, the supply of oil to hydraulic motor (3) temporarily stops.

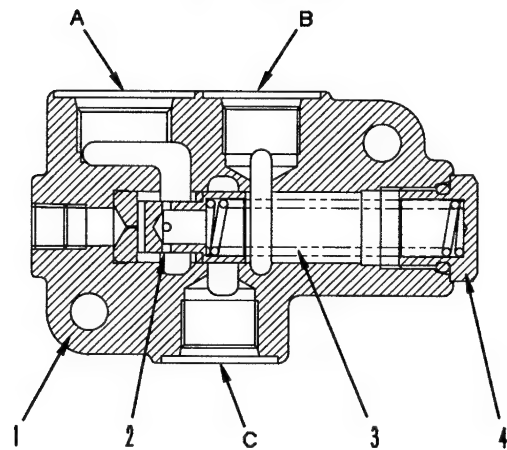
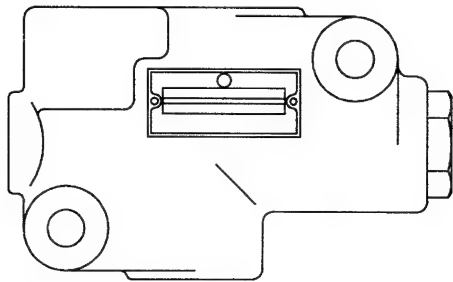
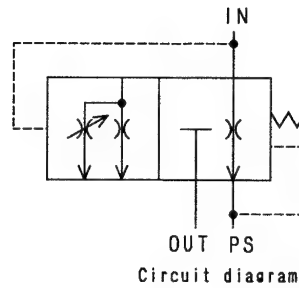
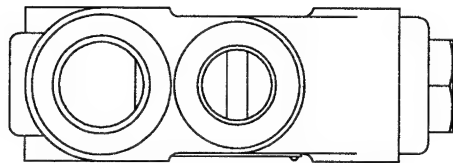
When this happens, hydraulic motor (3) is rotating under the force of inertia, so oil is discharged to hydraulic motor outlet port **D**. The oil discharge from the hydraulic motor returns to the valve and moves check valve (8). It then passes through check valve (8), reaches hydraulic motor inlet port **C** and is sucked into the hydraulic motor. It then passes through the inside of the hydraulic motor and is again discharged from the hydraulic motor.

In this way, a continuous circuit for the oil is formed, and this prevents cavitation of hydraulic motor (3).



SKL00448

FLOW PRIORITY VALVE (MAX. FLOW CONTROL VALVE)



SKD01197

023S05

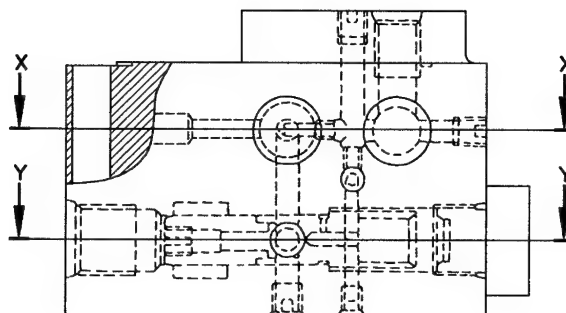
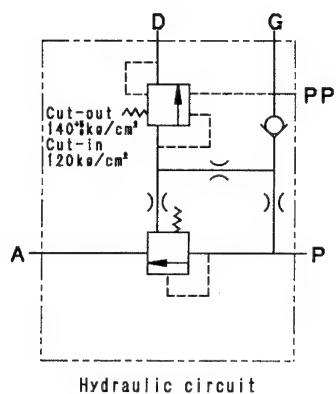
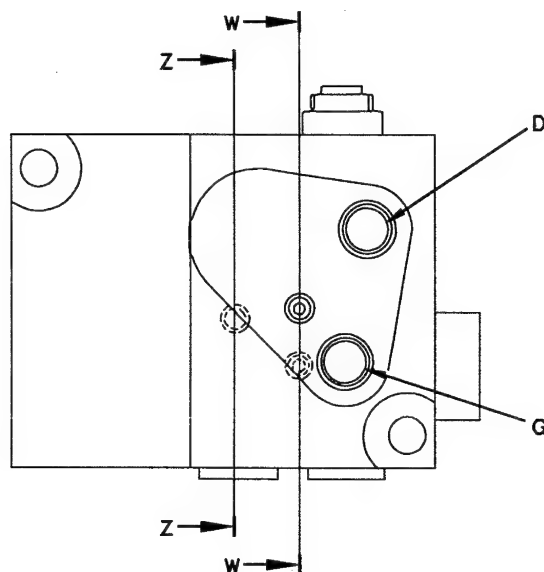
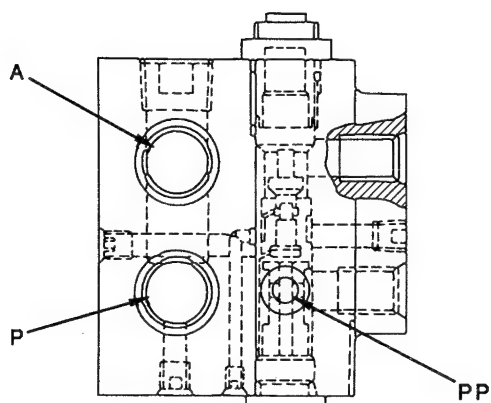
1. Valve body
2. Flow control spool
3. Spring
4. Plug

- A. IN port
- B. PS port
- C. OUT port

Outline

- The flow priority valve is in the circuit between the steering and outrigger pump and the accumulator charge valve. It limits the flow of oil from the pump to the air conditioner compressor drive hydraulic motor to a maximum of 27ℓ/min, thereby preventing the hydraulic motor from overrunning.

CHARGE VALVE



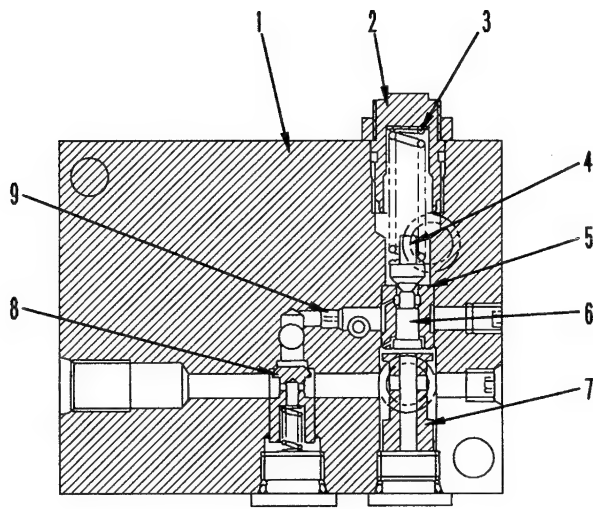
- | | |
|--------------------------------|---------------------------------------|
| 1. Body | 11. Spool |
| 2. Screw | 12. Spring |
| 3. Spring | 13. Orifice |
| 4. Poppet
(R1 relief valve) | A: To overrun preven-
tion valve |
| 5. Valve seat | G: To accumulator (Acc
port) |
| 6. Piston | P: From pump
(flow priority valve) |
| 7. Retainer | D: Drain (Dr port) |
| 8. Check valve | PP: To pressure switch |
| 9. Orifice | |
| 10. Orifice | |

Function

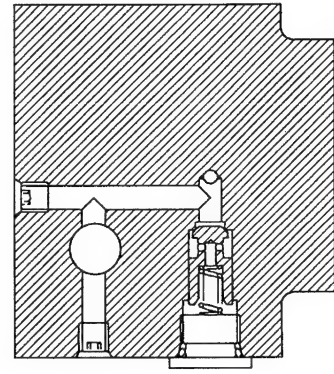
- The charge valve acts to maintain the hydraulic pressure from the pump at the specified pressure and to store it in the accumulator. When the hydraulic pressure reaches the specified pressure, the oil from the pump is connected to the drain circuit to reduce the load on the pump.

SLL01198

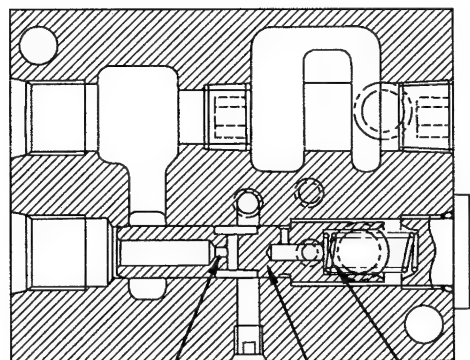
023S05



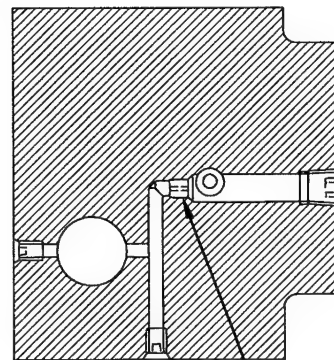
X - X



Z - Z



Y - Y



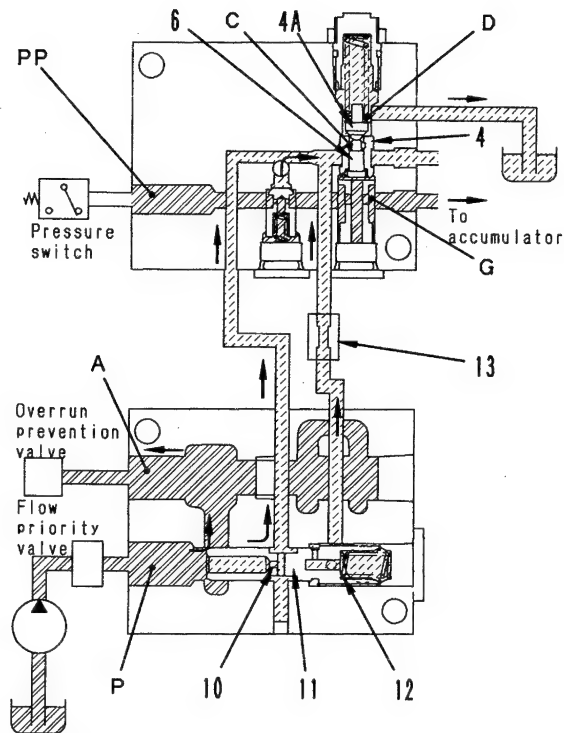
W - W

SLL00451

023S05

OPERATION**1. When oil is not being supplied to accumulator (cut-out condition)**

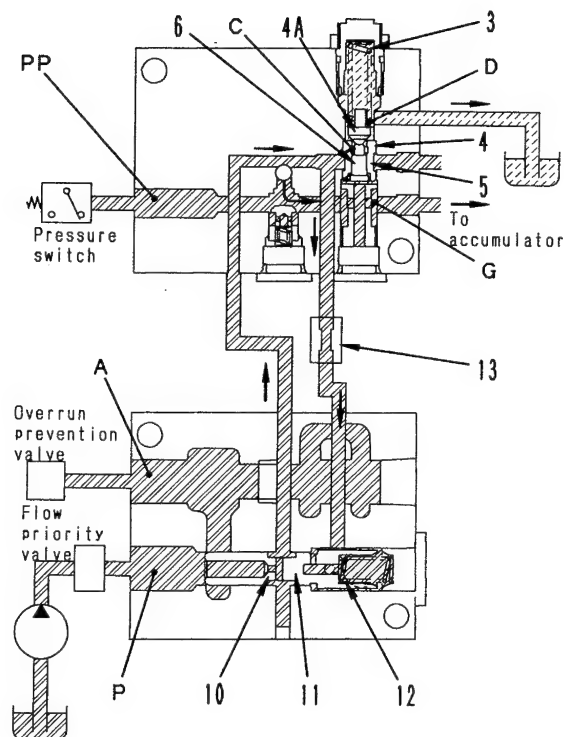
- The pressure at port **G** is higher than the set pressure of R1 relief valve (4), so piston (6) is forcibly pushed up by the hydraulic pressure at port **G**. Poppet (4A) opens and short circuits port **C** and port **D**.
- The spring chamber at the right end of spool (11) is connected through orifice (13) to port **C** of R1 relief valve (4), so it becomes the tank pressure.
- The oil from the pump passes through the flow priority valve, enters port **P** and pushes spool (11) at a low pressure equivalent to the load of spring (12), so the oil flows to port **A**.
- At the same time, the oil also passes through orifices (10) and (13) and returns to the tank.



SLL01199

2. When oil is supplied to accumulator**(1) Cut-in condition**

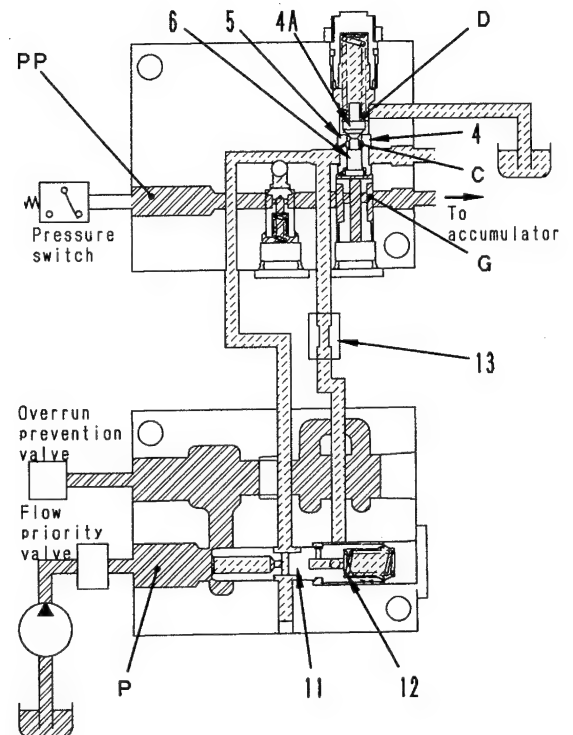
- If the pressure at port **G** goes below the set pressure of R1 relief valve (4), piston (6) is returned in a downward direction by spring (3). Valve seat (5) and poppet (4A) are brought into close contact and shut off port **C** and port **D**.
- The spring chamber at the right end of spool (11) is also shut off from port **D**, so the pressure rises. The pressure at port **P** also rises in the same way.
- When the pressure at port **P** goes above the pressure at port **G** (accumulator pressure), the supply of oil to the accumulator starts. In this case, a fixed amount of oil determined by the size (area) of orifice (10) and the difference in pressure generated on both sides (equivalent to the load of spring (12)) is provided, regardless of the engine speed. The remaining oil flows to port **A**.



SLL01200

023S05

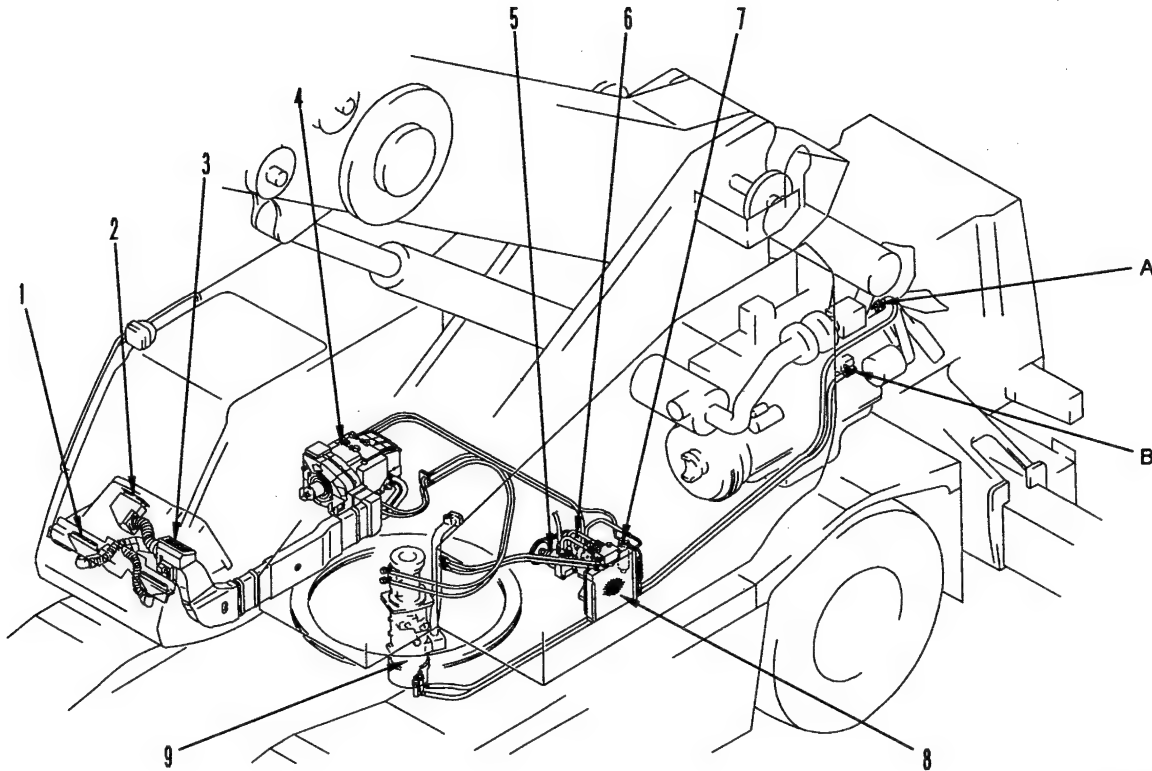
- (2) When cut-out pressure is reached
- When the pressure at port **G** (accumulator pressure) reaches the set pressure of R1 relief valve (4), poppet (4A) separates from valve seat (5), so the oil flows to relieve the circuit.
 - When the relief operation starts, a difference in pressure is created at the top and bottom of piston (6), so piston (6) moves up, forcibly opens poppet (4A) and short circuits port **C** and port **D**.
 - The spring chamber at the right end of spool (11) is connected to port **C** of R1 relief valve (4) through orifice (13), so it becomes the tank pressure.
 - The pressure at port **P** goes down in the same way until it reaches a pressure equivalent to the load of spring (12), and the supply of oil to port **G** stops.



SLL01201

AIR CONDITIONER

AIR CONDITIONER PIPING



SLL00455

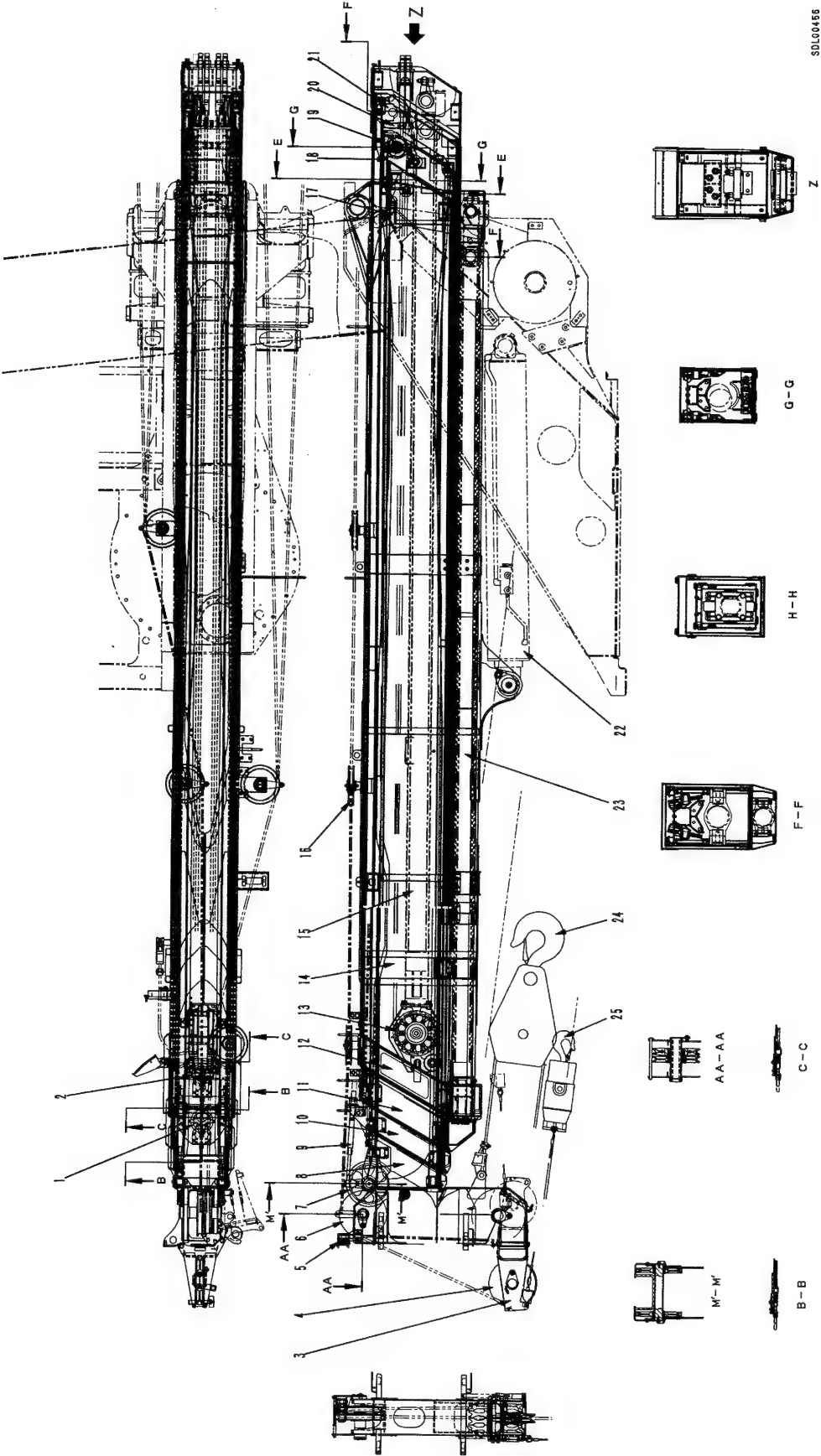
1. Defroster window
2. Vent
3. Vent
4. Air conditioner unit
5. Hydraulic motor for air conditioner drive
6. Compressor
7. Dry receiver
8. Air conditioner condenser
9. Swivel joint

- A. Hot water return port
B. Hot water pickup port

023S05

BOOM

★ For details of this page, see page 90-21.



023S05

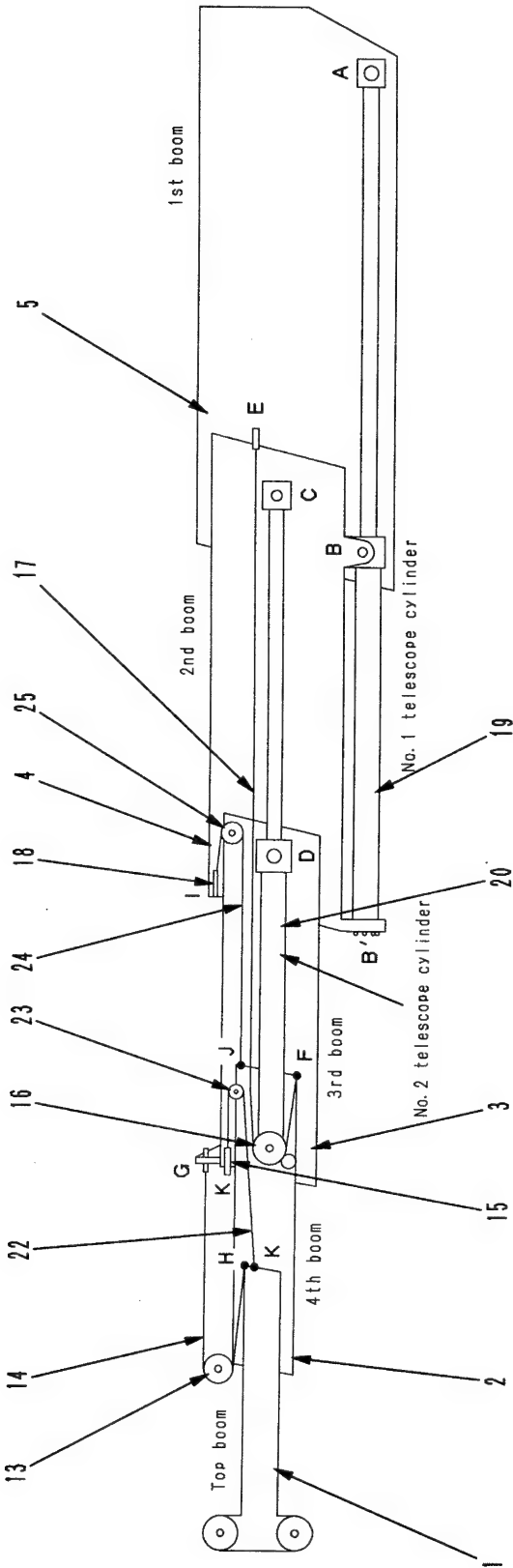
1. Top boom retraction sheave
2. 4th boom retraction sheave
3. Single top
4. Single top sheave
5. Top boom
6. Main sheave
7. Top boom extension sheave
8. 4th boom
9. Top boom extension rope
10. 3rd boom
11. 2nd boom
12. Base boom
13. 4th boom extension sheave
14. 4th boom extension rope
15. Boom telescope No. 2 cylinder
16. Guide sheave
17. Top boom extension sheave
18. Top boom retraction rope
19. Top boom retraction sheave
20. 4th boom retraction sheave
21. 4th boom retraction rope
22. Boom hoist cylinder
23. Boom telescope No. 1 cylinder
24. Main hook
25. Auxiliary hook

Outline

- The boom is a **box type, 5-stage telescoping type**. It is a **hydraulically actuated, 2nd and 3rd stage sequential, 4th and 5th stage simultaneous rope-operated telescoping type** boom. The hoist system uses a **hydraulic cylinder** which pushes to the front.

There are slide pads (the hatched portion in the diagram) between each boom to reduce the sliding resistance when extending or retracting the stages of the boom. These pads also act to prevent play and to enable the booms to be extended or retracted smoothly. The slide pads are installed with shims to make it possible to adjust the clearance between the booms.

BOOM TELESCOPING STRUCTURE DIAGRAM



SKL01202

023S05

1. Extending boom

- With boom telescope No. 1 cylinder (19), the cylinder rod (point **A**) is fixed to base boom (5), and the cylinder itself (point **B** or **B'**) is installed to 2nd boom (4).
With boom telescope No. 2 cylinder (20), the cylinder rod (point **C**) is fixed to 2nd boom (4), and the cylinder itself (point **D**) is installed to 3rd boom (3).

- 4th boom extension rope (17) is fixed at one end to four places (point **A**) at the rear end of the 2nd boom. The other end is fixed to the rear end (point **F**) of 4th boom (2) through sheave (16) at the bottom end of No. 2 telescope cylinder (20).

- 4th boom extension rope (14) is fixed at one end to the top of the tip of 3rd boom (3) (point **G**). The other end is fixed to the rear end (point **H**) of top boom (1) through sheave (13) at the top of the 4th boom.

Therefore, when the boom telescope lever is moved to the EXTEND position, the oil from the boom pump enters the bottom end of the No. 1 telescope cylinder, and as the cylinder extends, point **B** moves to the front with point **A** as the starting point, and the 2nd boom extends.

When the No. 1 telescope cylinder is completely extended, the oil from the boom pump flows to the bottom end of the No. 2 telescope cylinder, and as the No. 2 telescope cylinder extends, point **B** moves to the front with point **A** as the starting point, and the 3rd boom extends.

Sheave (16) at the bottom end of the No. 2 telescope cylinder and the rear end of the 2nd boom and the rear end of the 4th boom are connected.

4th boom extension rope (17) uses point **E** as the starting point, and as the No. 2 telescope cylinder extends, the rear end (point **F**) of the 4th boom moves to the front and the 4th boom extends.

Top boom (1) moves at the same time as this, and jib (13) at the top of the tip of 4th boom (2) and the top of the tip of the 3rd boom and the rear of the top boom are connected.

Top boom extension rope (14) uses point **G** as the starting point, and as the 4th boom extends, the rear end (point **H**) of the top boom moves to the front and the top boom extends.

- As explained above, this boom is a 5-stage type boom: the 2nd boom and 3rd boom are actuated hydraulically and move sequentially, while the 4th boom and top boom are moved simultaneously by the rope.

2. Retracting boom

- With boom telescope No. 1 cylinder (19), the cylinder rod (point **A**) is fixed to base boom (5), and the cylinder itself (point **B** or **B'**) is installed to 2nd boom (4).
With boom telescope No. 2 cylinder (20), the cylinder rod (point **C**) is fixed to 2nd boom (4), and the cylinder itself (point **D**) is installed to 3rd boom (3).
- 4th boom retraction rope (24) passes around 4th boom retraction sheave (18) (point **I**), which can rotate but is fixed to the tip of the 2nd boom. It then passes around the two sheaves (25) at the rear end of the 3rd boom, and goes to the rear end of the 4th boom (point **J**), where each end of the rope is fixed.
- Top boom retraction rope (22) passes around top boom retraction sheave (15) (point **K**), which can rotate but is fixed to the tip of the 3rd boom. It then passes around the two sheaves (23) at the rear end of the 4th boom, and goes to the rear end of the top boom (point **K**), where each end of the rope is fixed.

Therefore, when the boom telescope lever is moved to the RETRACT position, the oil from the boom pump enters the head end of the No. 2 telescope cylinder, and as the No. 2 telescope cylinder retracts, point **D** moves to the rear with point **C** as the starting point.

When this happens, 4th boom retraction rope (24), which takes point **I** as the starting point pulls point **J** to the rear as sheave (25), which is installed to the 3rd boom, moves, and the 4th boom is retracted.

When this happens, 4th boom retraction rope (24), which takes point **I** as the starting point pulls point **J** to the rear as sheave (25), which is installed to the 3rd boom, moves, and the 4th boom is retracted.

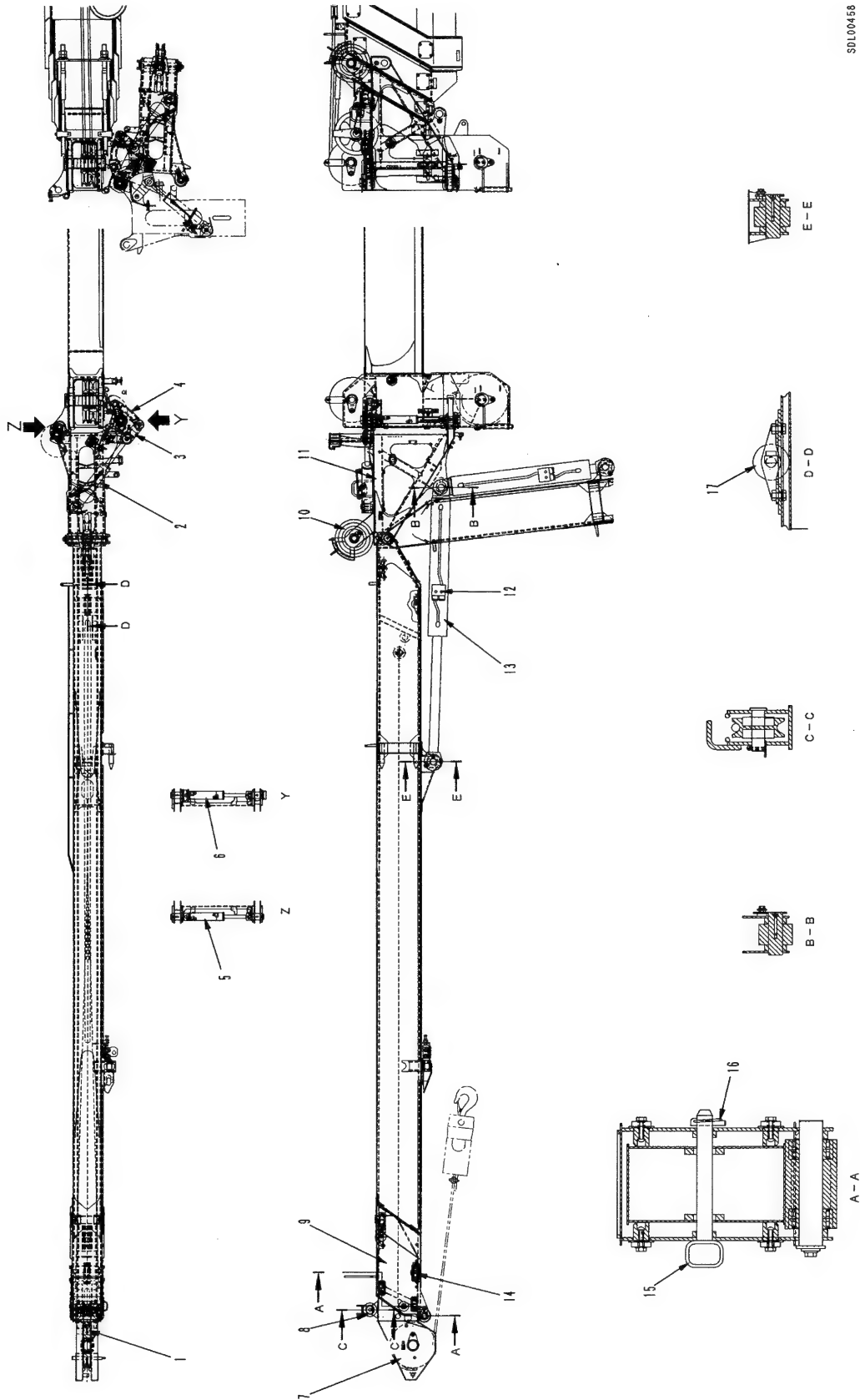
In other words, 3rd boom (3) is retracted inside 2nd boom (4) by the No. 2 telescope cylinder, the 4th boom is retracted inside the 3rd boom by the 4th boom retraction rope (24), and the top boom is retracted inside the 4th boom by 4th boom retraction rope (22).

- When the No. 2 telescope cylinder is completely retracted, the oil from the boom pump flows to the head end of the No. 1 telescope cylinder, and as the No. 1 telescope cylinder retracts, it moves point **B** to the rear using point **A** as the starting point, and retracts the 2nd boom.

023S05

JIB
(MACHINES WITH POWER TILT)

★ For details of this page, see page 90-23.



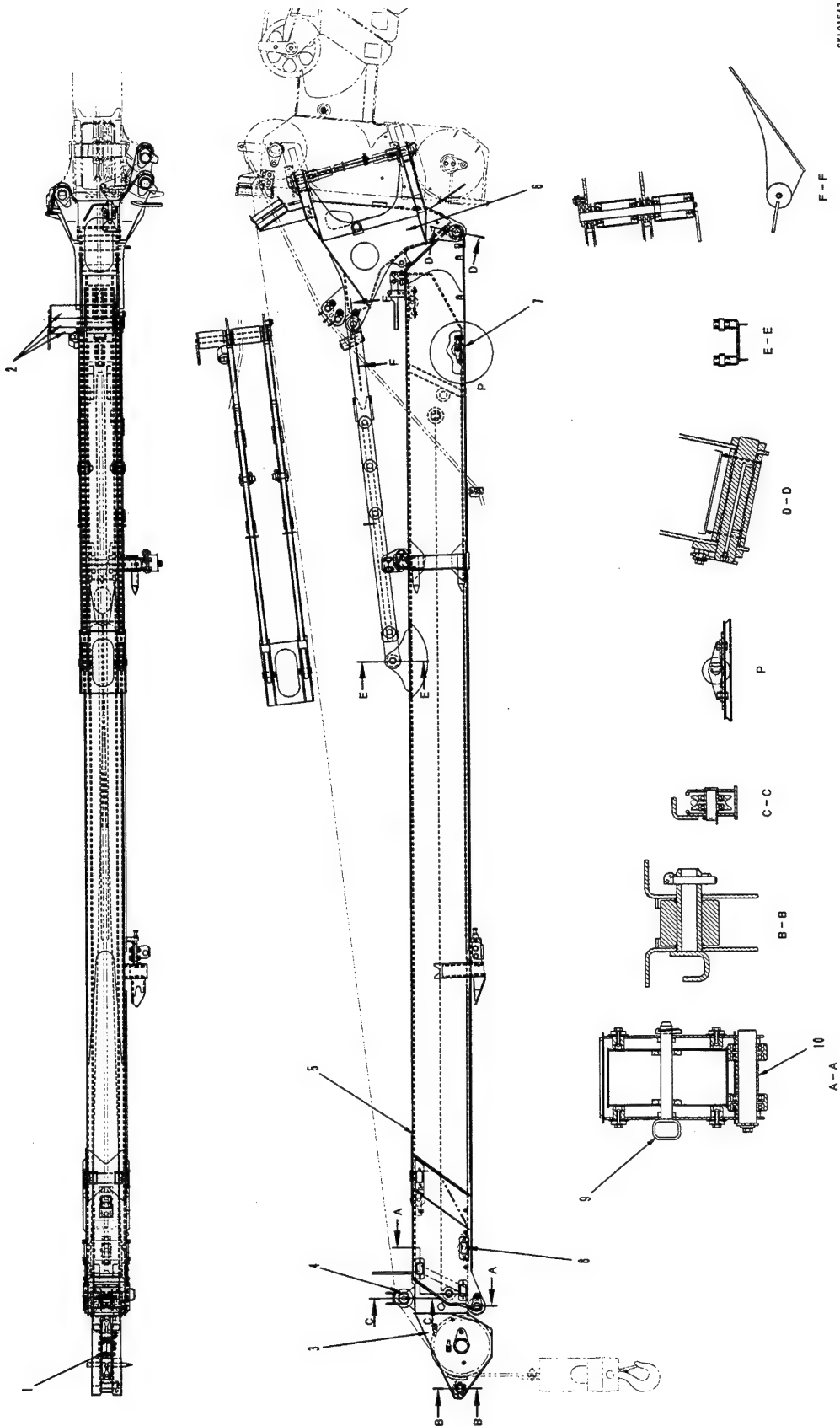
1. Auxiliary winch sheave
2. Rotating cylinder
3. Rotating link (1)
4. Rotating link (2)
5. Lock pin cylinder (right)
6. Lock pin cylinder (left)
7. No.2 jib
8. Guide sheave
9. No.1 jib
10. Guide sheave
11. Tilt bracket
12. Holding valve
13. Power tilt cylinder
14. Side pad
15. No.2 jib stopper pin
16. Roller
17. Guide roller (top, bottom)

Outline

- The jib is a power tilt type. It is fixed to the side of the boom and is swung out from below.
The No.1 jib and the No.2 jib have a box structure.

(MACHINES WITH MANUAL TILT JIB)

★ For details of this page, see page 90-25.



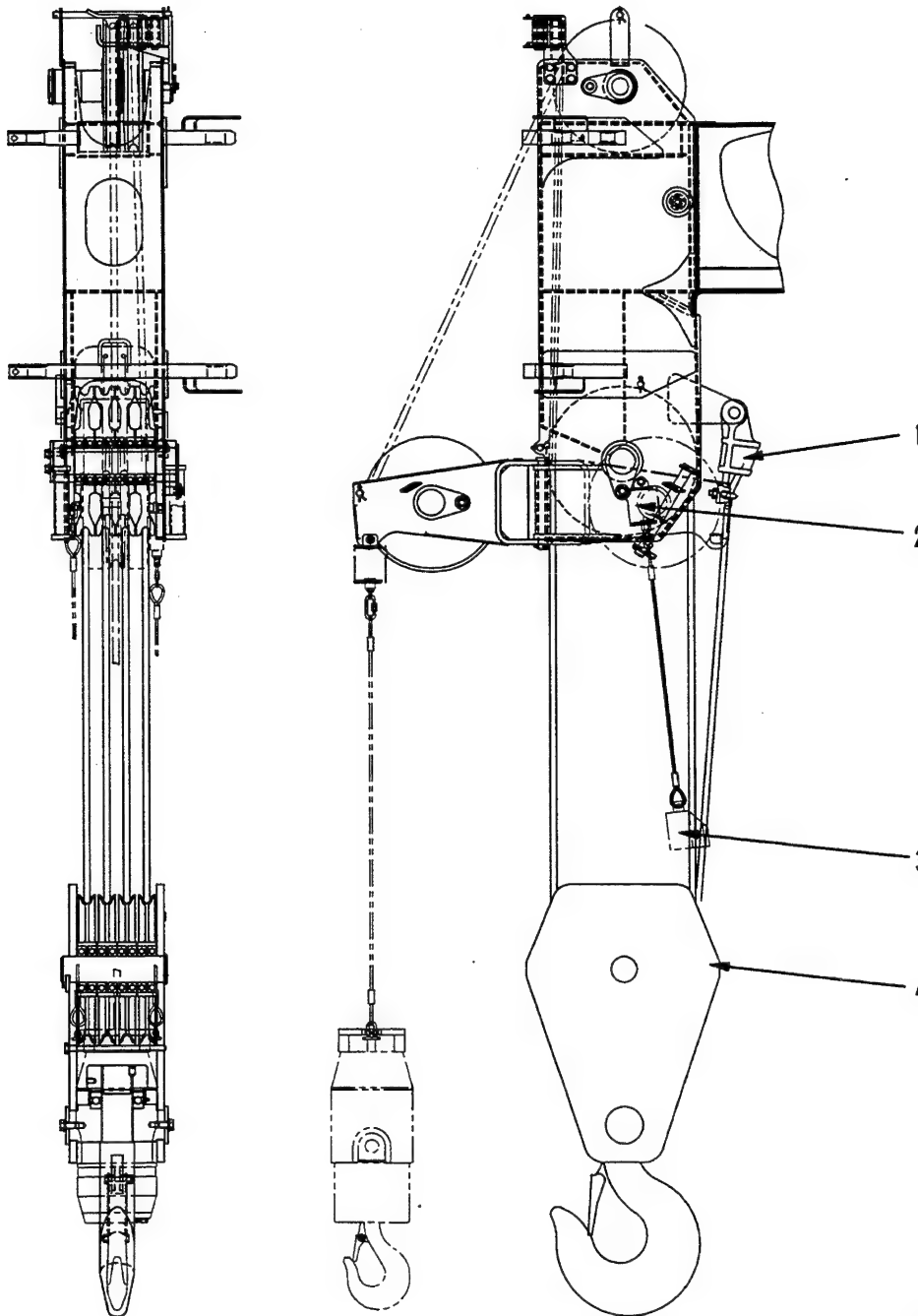
SKL01643

1. Auxiliary winch sheave
2. Jib side roller
3. No.2 jib (top jib)
4. Guide sheave
5. No.1 jib
6. Tilt bracket
7. Guide roller (top, bottom)
8. Side pad
9. No.2 jib stopper pin (top jib stopper pin)
10. Roller

Outline

- The jib is a manual tilt type. It is fixed to the side of the boom and is swung out from below.
The No.1 jib and the No.2 jib have a box structure.

MAIN HOOK



SDL00459

1. Rope clamp
2. Overwind detection switch
3. Overwind weight
4. Main hook assembly

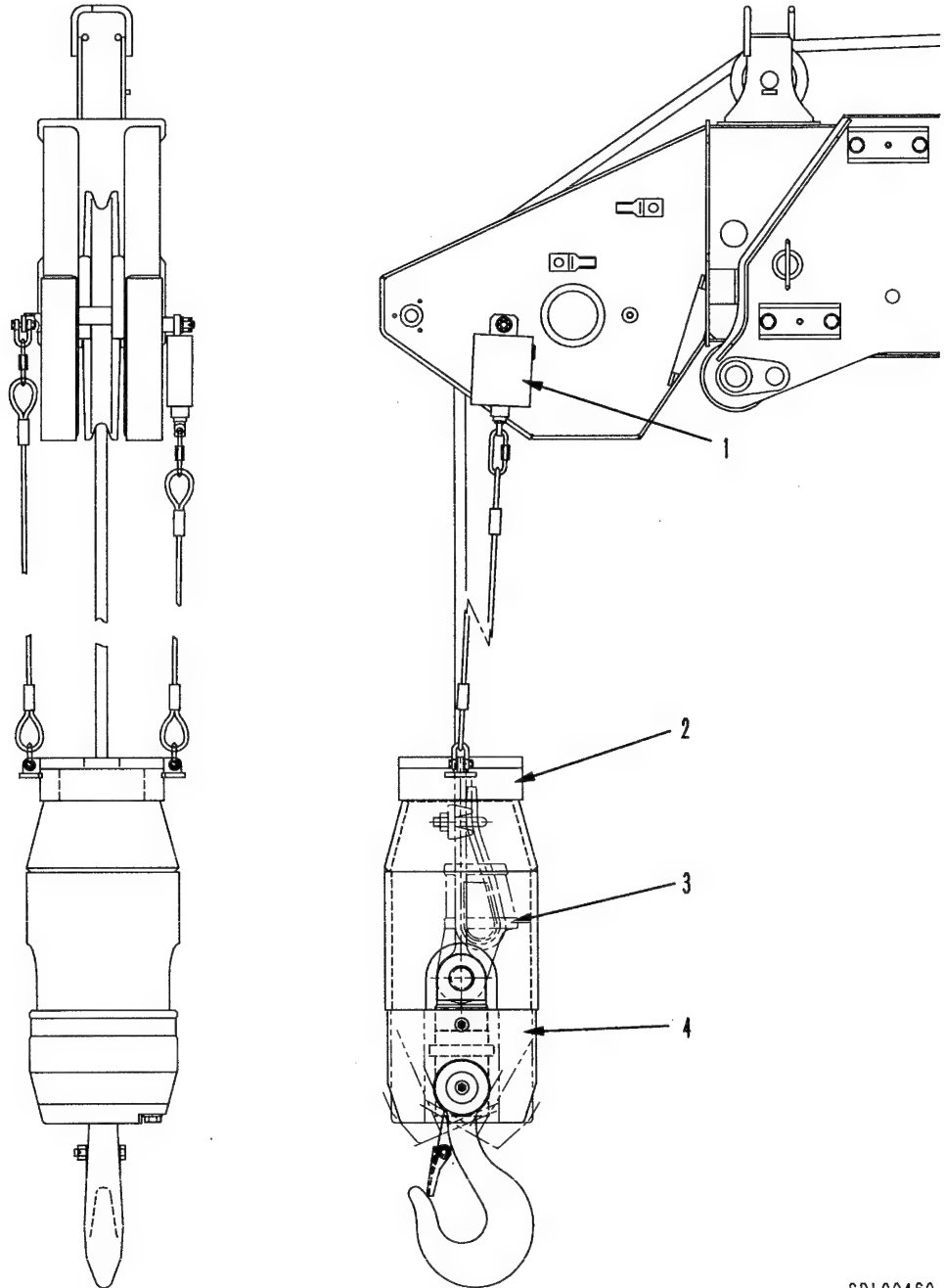
Outline

- The main hook is used for operations with the main boom. The maximum lifting weight is 26 tons, including the weight of the lifting equipment and main hook. Select the number of lengths of rope (4, 6, 8) to match the lifting weight.

023S05

AUXILIARY HOOK

023S05



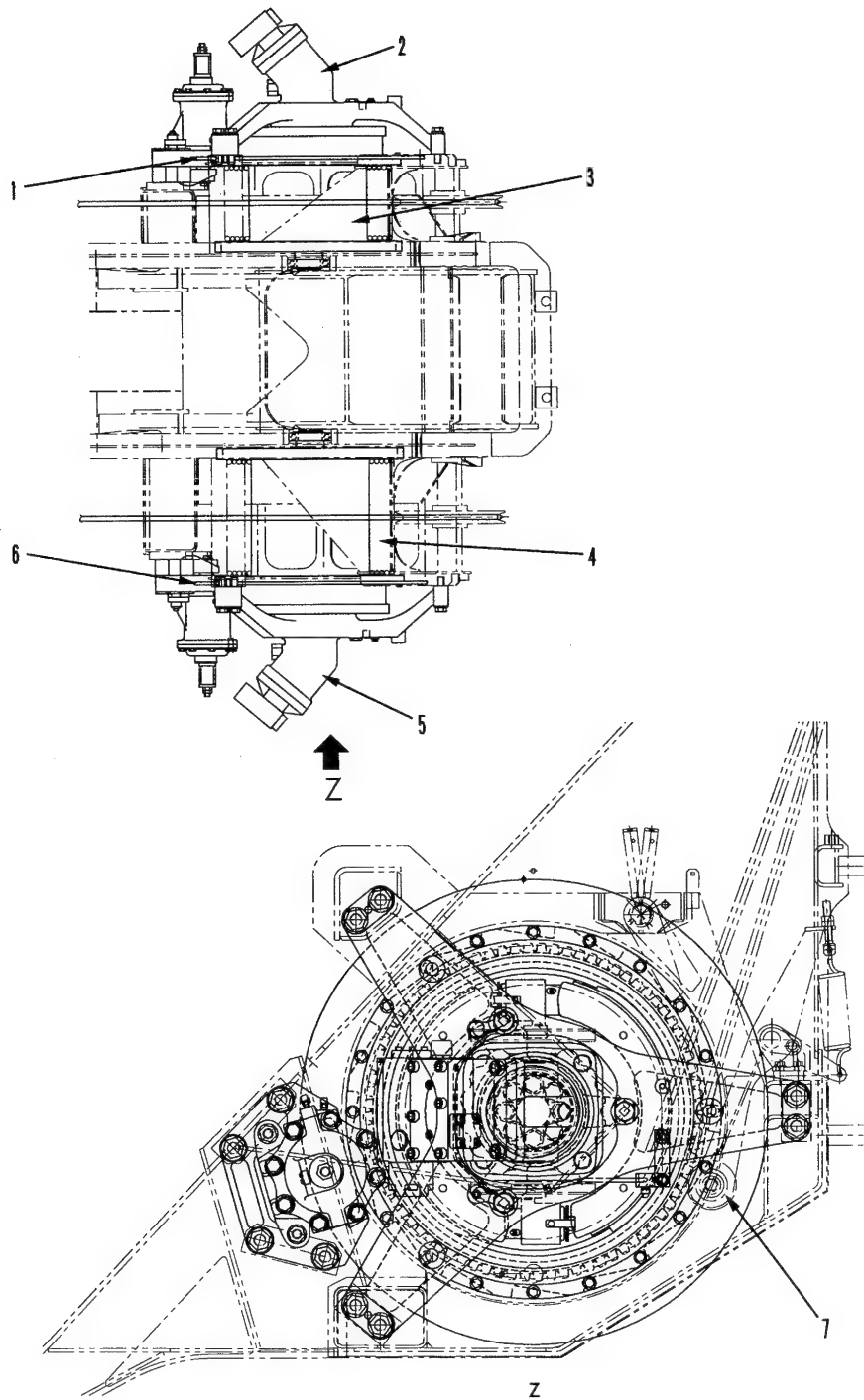
SDL00460

1. Overwind detection switch
2. Overwind weight
3. Rope clamp
4. Auxiliary hook assembly

Outline

- The auxiliary hook is used for operations with the auxiliary jib or single top. The maximum lifting weight is 3 tons, including the weight of the lifting equipment and the auxiliary hook.

WINCH



SDL00461

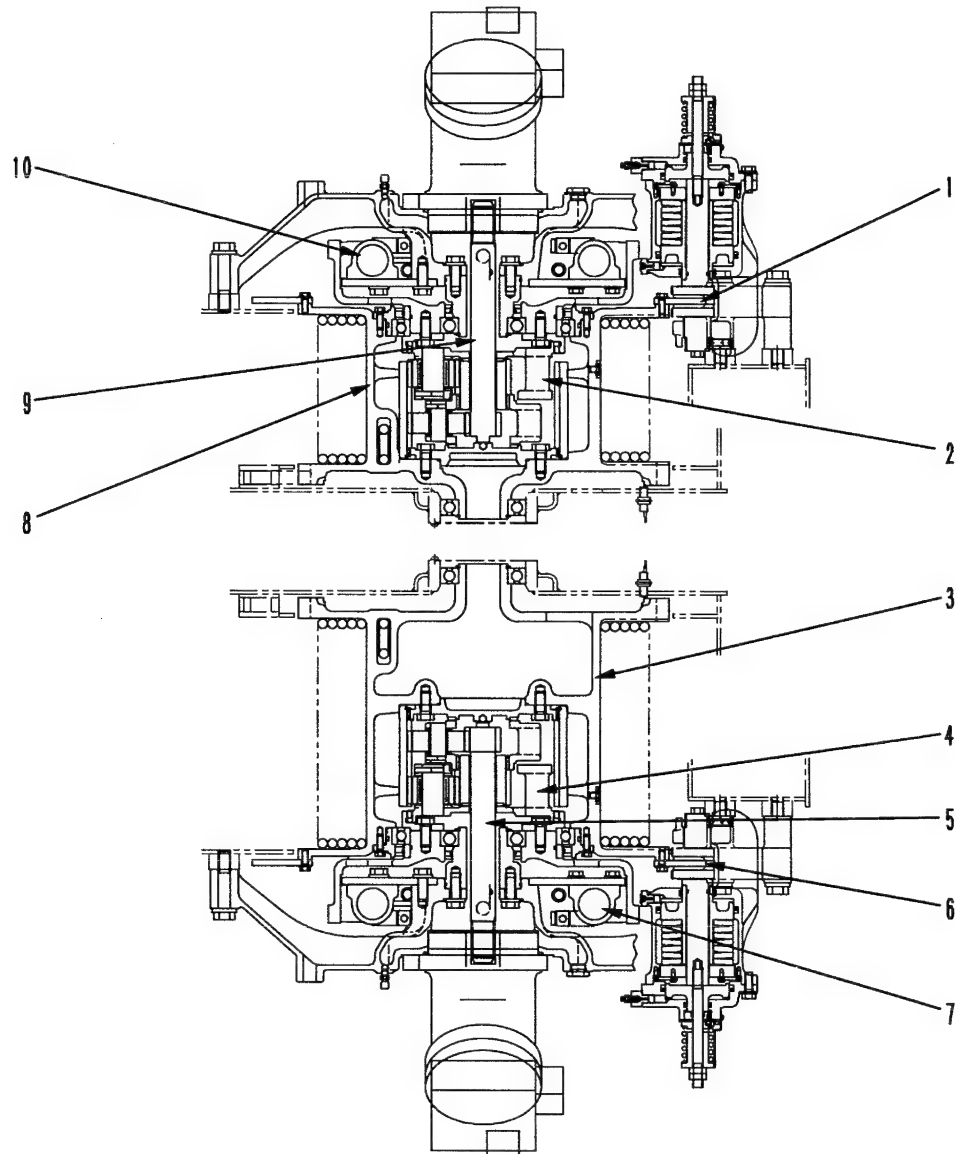
1. Auxiliary winch brake (disc brake) assembly
2. Auxiliary winch motor
3. Auxiliary winch drum
4. Main winch drum
5. Main winch motor
6. Main winch brake (disc brake) assembly
7. Drum roller

Outline

- The winch is a hydraulically driven type, and has two motors and two drums.
- The winch consists of two main components: the winch clutches, which transmit the drive force from the winch motor and reduction gear to the winch drum, and the winch brakes, which brake the rotation of the drum.

023S05

WINCH DRUM



SDL00462

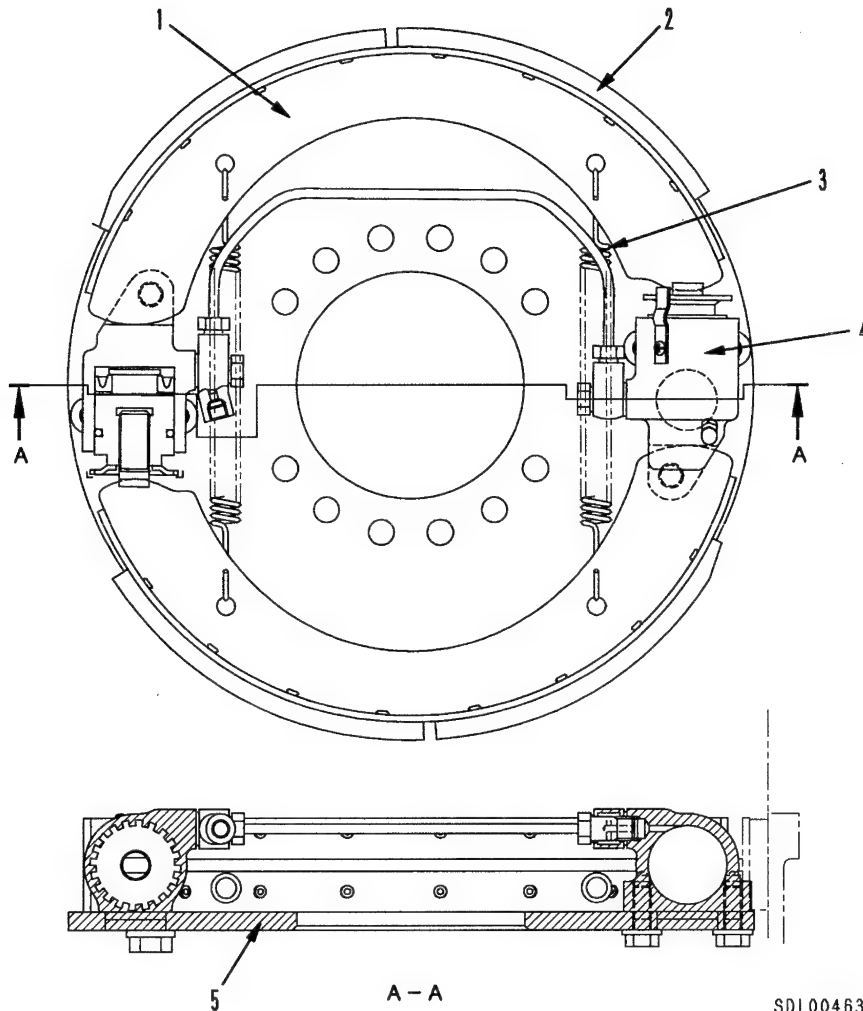
1. Auxiliary winch brake (disc brake) assembly
2. Auxiliary winch reduction gear
3. Main winch drum
4. Main winch reduction gear
5. Main winch drive shaft
6. Main winch brake (disc brake) assembly
7. Main winch clutch assembly
8. Auxiliary winch drum
9. Auxiliary winch drive shaft
10. Auxiliary winch clutch assembly

Outline

- The winch drum receives the power from the winch machinery through the drum gear. The power is engaged and disengaged by the winch clutch assembly. There are two winch drums: one for the main winch, and one for the auxiliary winch.
- ★ Rope specifications: IWRC6 x Fi (29) type B, normal Z lay (long pitch)

023S05

WINCH CLUTCH



1. Clutch shoe
2. Clutch lining
3. Shoe return spring
4. Clutch cylinder
5. Back plate

Outline

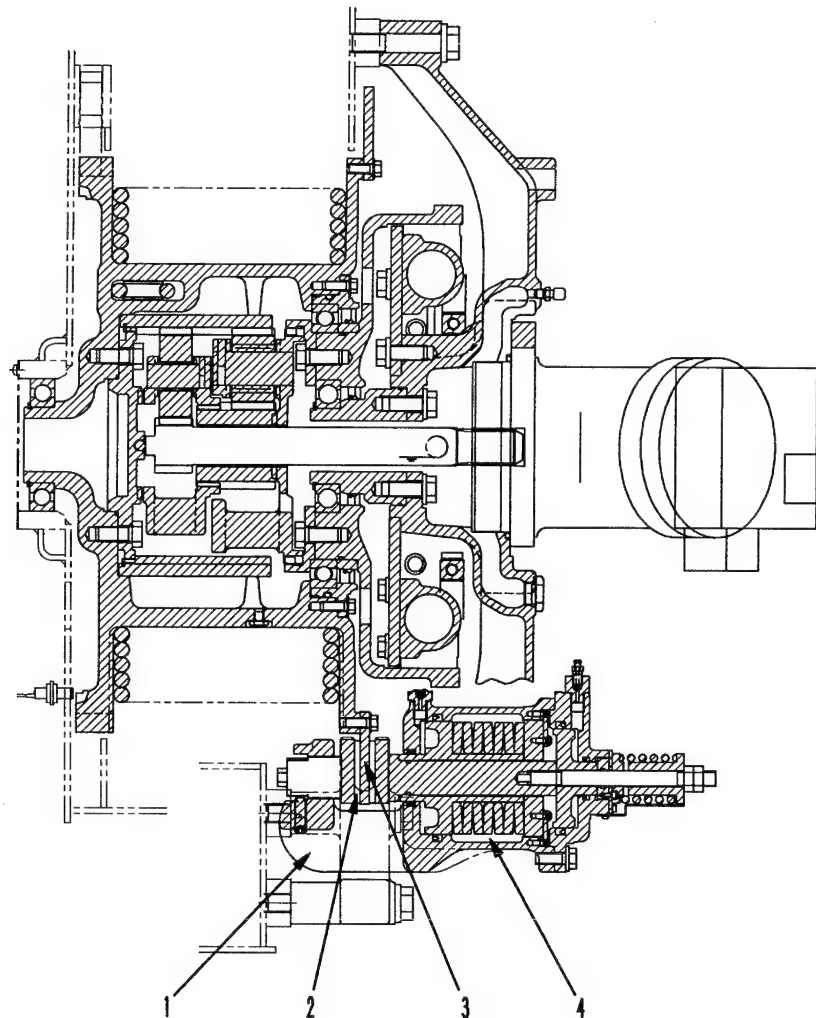
- The winch clutch is a dry type, internal expanding, hydraulically operated type. The winch clutch presses clutch shoe (1), which forms one unit with the winch case, against the face of the inside circumference of the clutch drum, and transmits the power from the winch assembly to the drum.

023S05

SDL00463

WINCH BRAKE

023S05



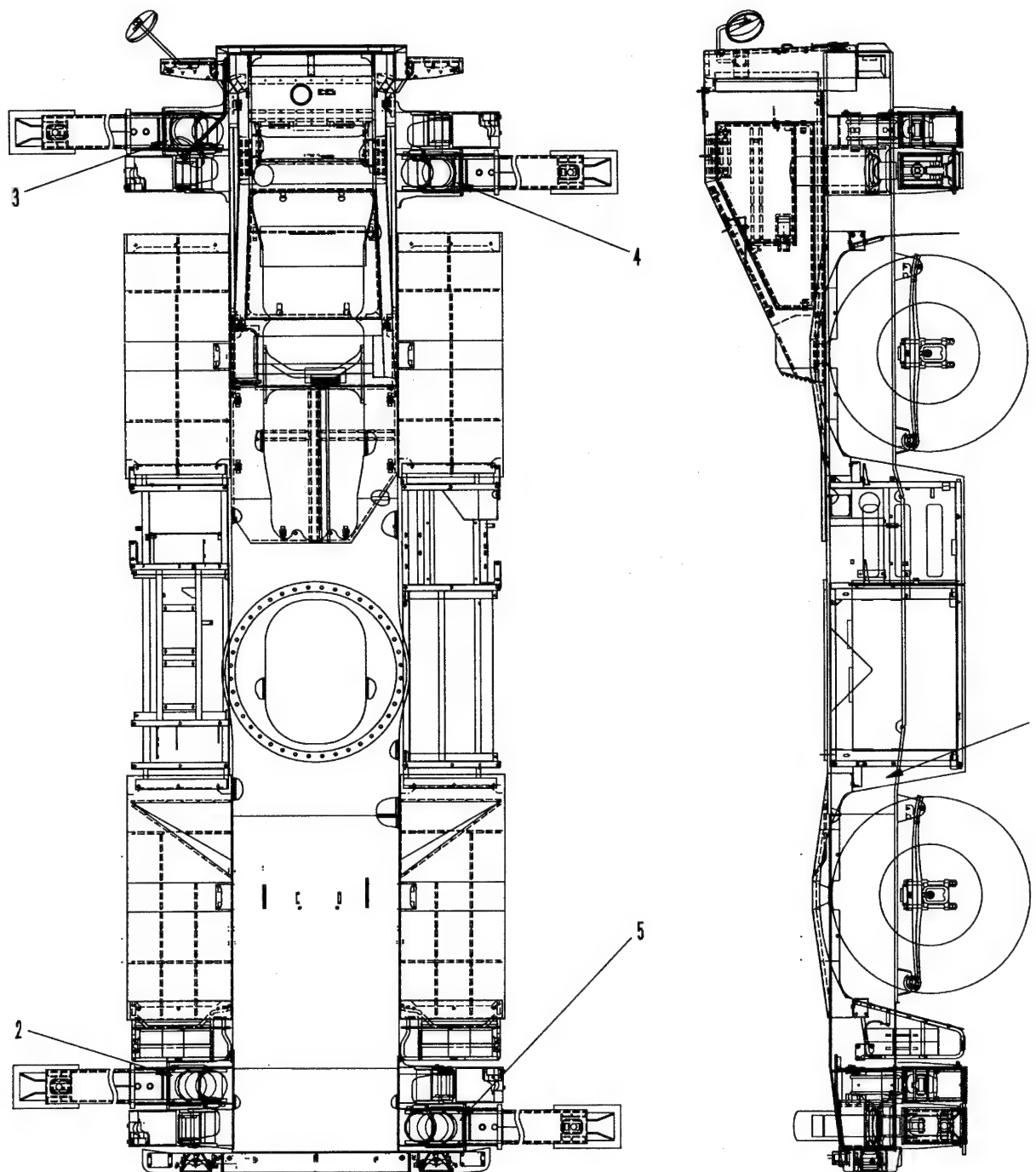
SDL00464

1. Winch brake caliper assembly
2. Disc pad
3. Winch brake disc plate
4. Winch brake cylinder assembly

Outline

- The winch brake is a dry, disc type operated by pedal and automatically (spring booster type). It is a caliper disc brake which clamps on both sides to the disc plate, which forms one unit with the winch drum.

CHASSIS, X-SHAPED OUTRIGGER

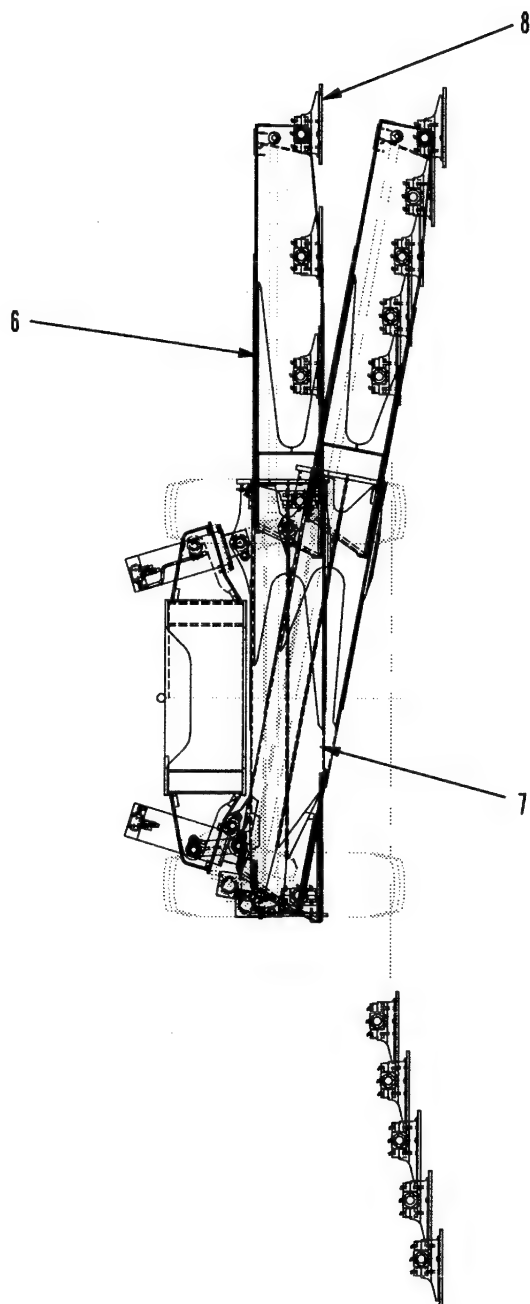


1. Chassis
2. Front right outrigger
3. Rear right outrigger
4. Rear left outrigger

5. Front left outrigger
6. Outrigger inner frame
7. Outrigger outer frame
8. Outrigger float

SDL00465

023S05



SDL00466

Outline

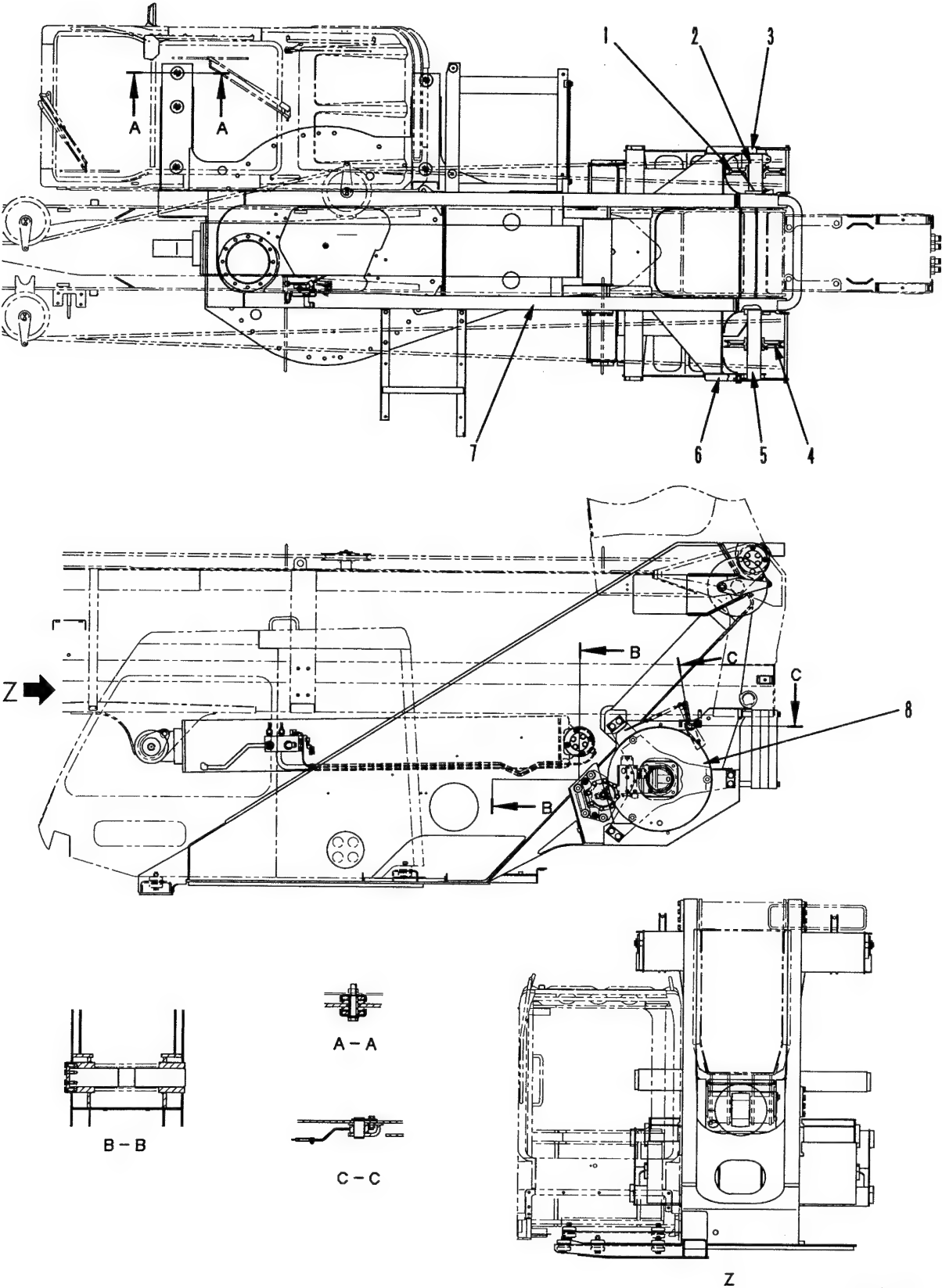
- Chassis (1) forms the base of the undercarriage, and mounts the following parts: the engine and power train, the outriggers, and the upper structure, which is installed to the swing circle at the center of the chassis.
- Main outriggers (2), (3), (4), and (5) are installed one each at the front, rear, left, and right of the machine, and are used to support the weight of the machine and the raised load during crane operations.

The outrigger structure consists of welded box type outer frame (7) and inner frame (6), and has an X-shaped structure. Each outrigger is equipped with a jack cylinder and slide cylinder.

Inner frame (6) is extended by the slide cylinder installed to outer frame (7), and the machine is supported by the jack cylinders installed to outer frame (7).

023S05

REVOLVING FRAME, GUIDE SHEAVE



023S05

SDL00467

1. Revolving frame
2. Main winch sheave shaft
3. Main winch guide sheave
4. Main winch guide sheave support
5. Auxiliary winch guide sheave support
6. Auxiliary winch guide sheave
7. Auxiliary winch sheave shaft
8. Winch drum (main winch and auxiliary winch)

OUTLINE

Revolving frame

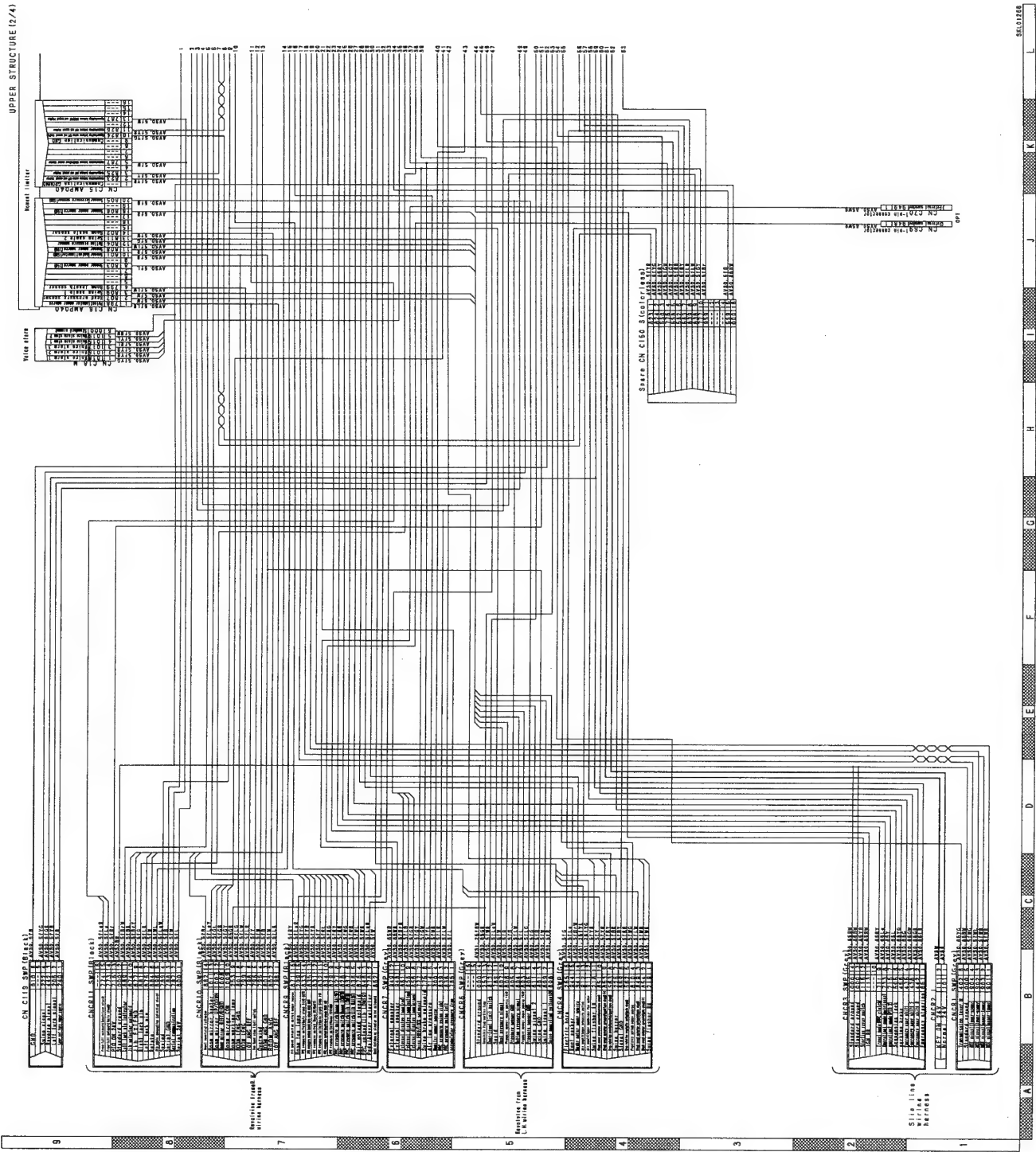
- The revolving frame forms the base of the upper structure. It mounts the operator's compartment, boom system, winch system, and swing system. It acts to swing the upper structure, which is installed on the swing circle.

Guide sheave

- Guide sheaves (3) and (6) are installed to sheave shafts (2) and (7), which are installed to supports (4) and (5). They guide the rope which is wound in and out from winch drum (8), and move to the left and right on sheave shafts (2) and (7) to ensure that the rope winds neatly on to the winch drum.

ELECTRIC CIRCUIT DIAGRAM

★ For details of this page, see pages 90-51 - 90-73.



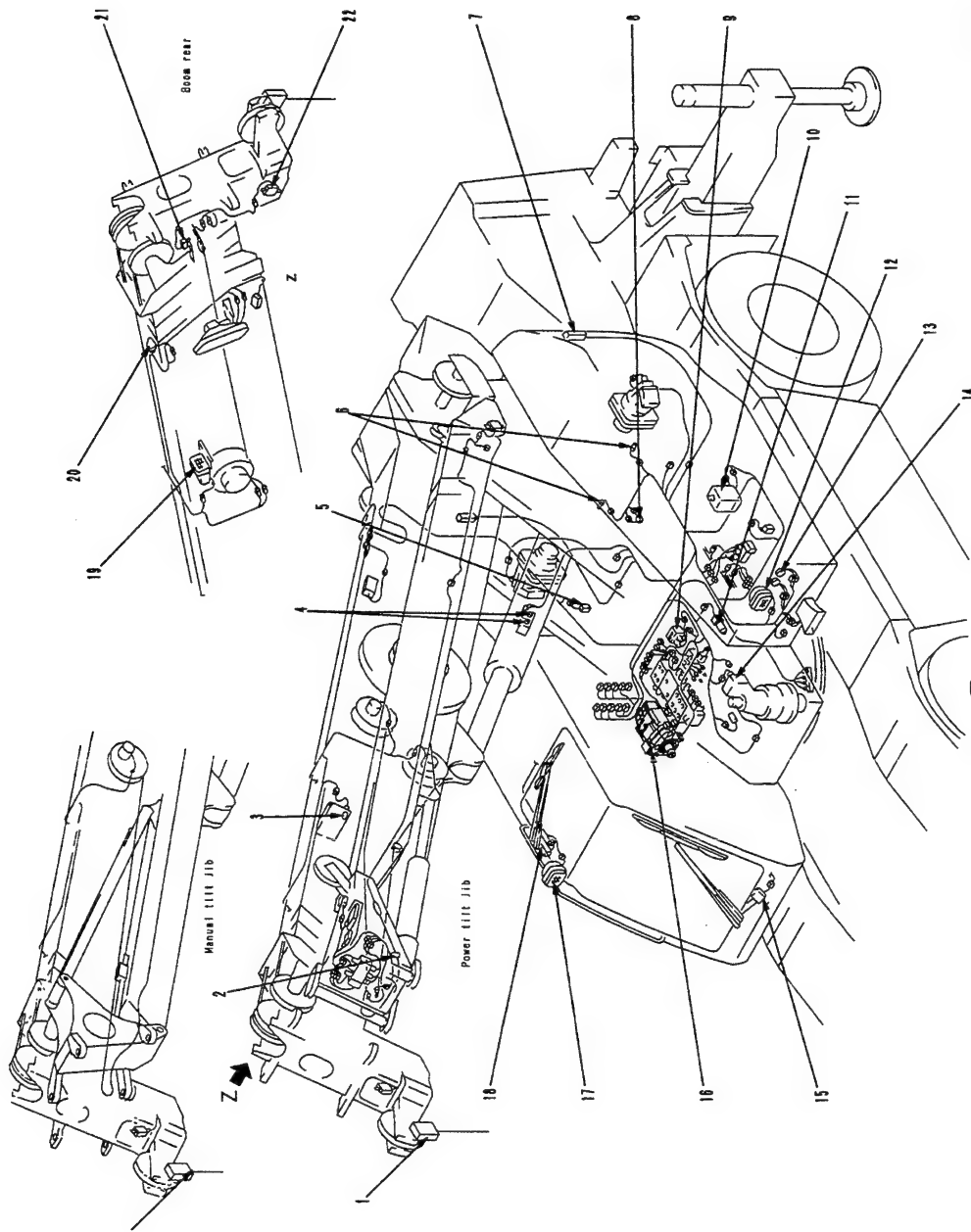
023S05

ELECTRICAL COMPONENT DIAGRAM (1/3)

UPPER STRUCTURE

★ For details of this page, see page 90-75.

1. Single top overwind switch
2. Jib rotation completion detection switch (Machine with power tilt jib)
3. Jib EXTEND/STOW detection switch (Machine with power tilt jib)
4. Hoist cylinder pressure sensor
5. Boom telescope selector valve
6. Drum rotation proximity switch
7. Swing flasher lamp
8. Swing buzzer
9. Pedal selector valve
10. Washer tank
11. Front wiper relay
12. Working lamp
13. Electric horn
14. Swing FREE/LOCK valve
15. Front wiper motor
16. Cooler amp (together with air conditioner unit)
17. Working lamp (top of cab)
18. Roof wiper motor



SVL01674

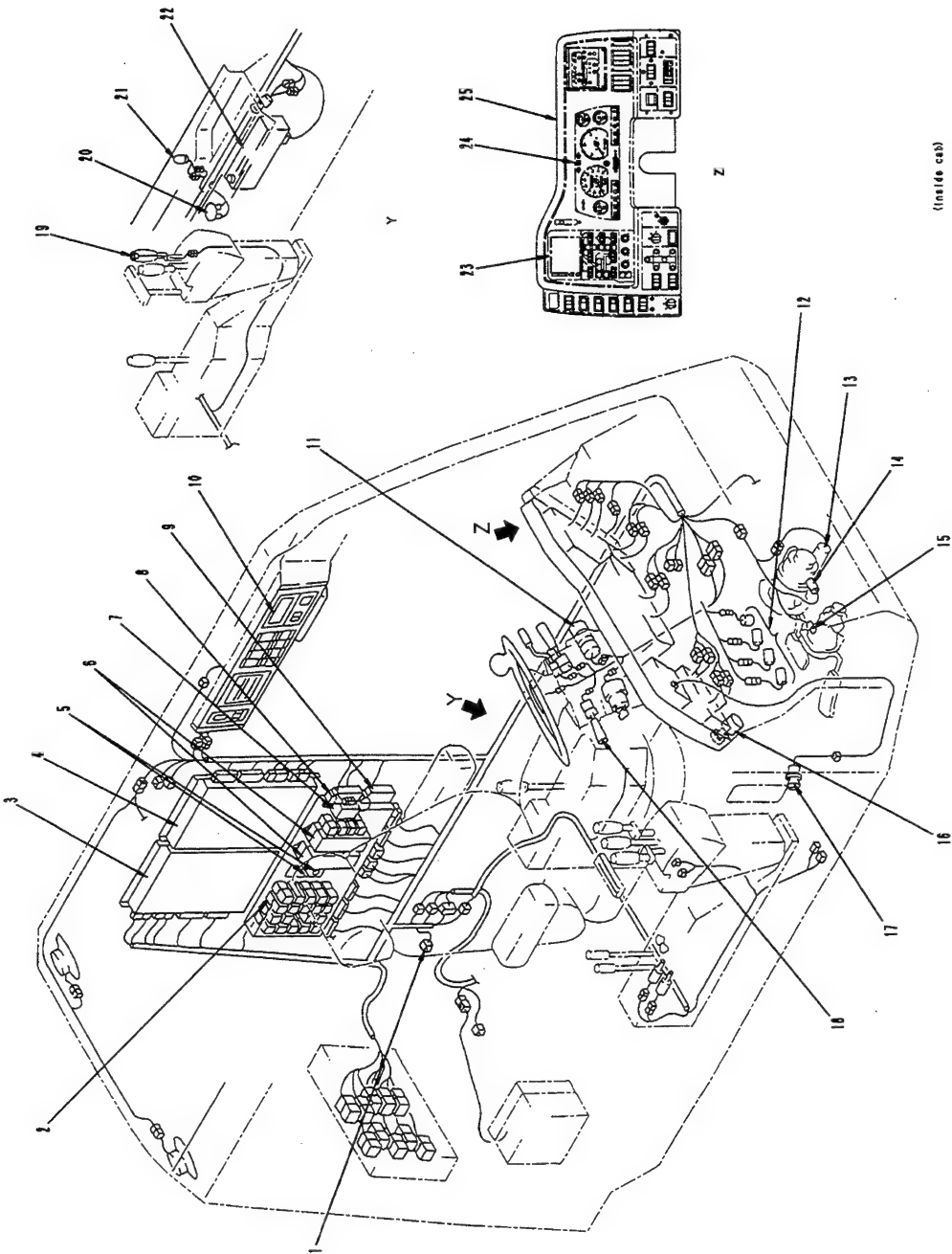
023S05

ELECTRICAL COMPONENT DIAGRAM (2/3)

UPPER STRUCTURE

★ For details of this page, see page 90-77.

- 1. Voice alarm (moment limiter)
- 2. Side winker selector relay
- 3. MDT (multiple transmission) upper controller
- 4. Moment limiter controller
- 5. Emergency gear shift selector switch
- 6. Top fuse box
- 7. Flasher unit
- 8. Roof wiper relay
- 9. Front wiper relay
- 10. Top panel
- 11. Wiper switch
- 12. Alarm buzzer
- 13. Air pressure sensor
- 14. Low pressure sensor
- 15. Accelerator OFF switch
- 16. Cigarette lighter
- 17. Door switch
- 18. Combination switch
- 19. Swing horn switch
- 20. Spirit level (inside cab)
- 21. Left panel lighting
- 22. Radio
- 23. Moment limiter panel
- 24. Meter panel
- 25. Front panel assembly



SLLO1204

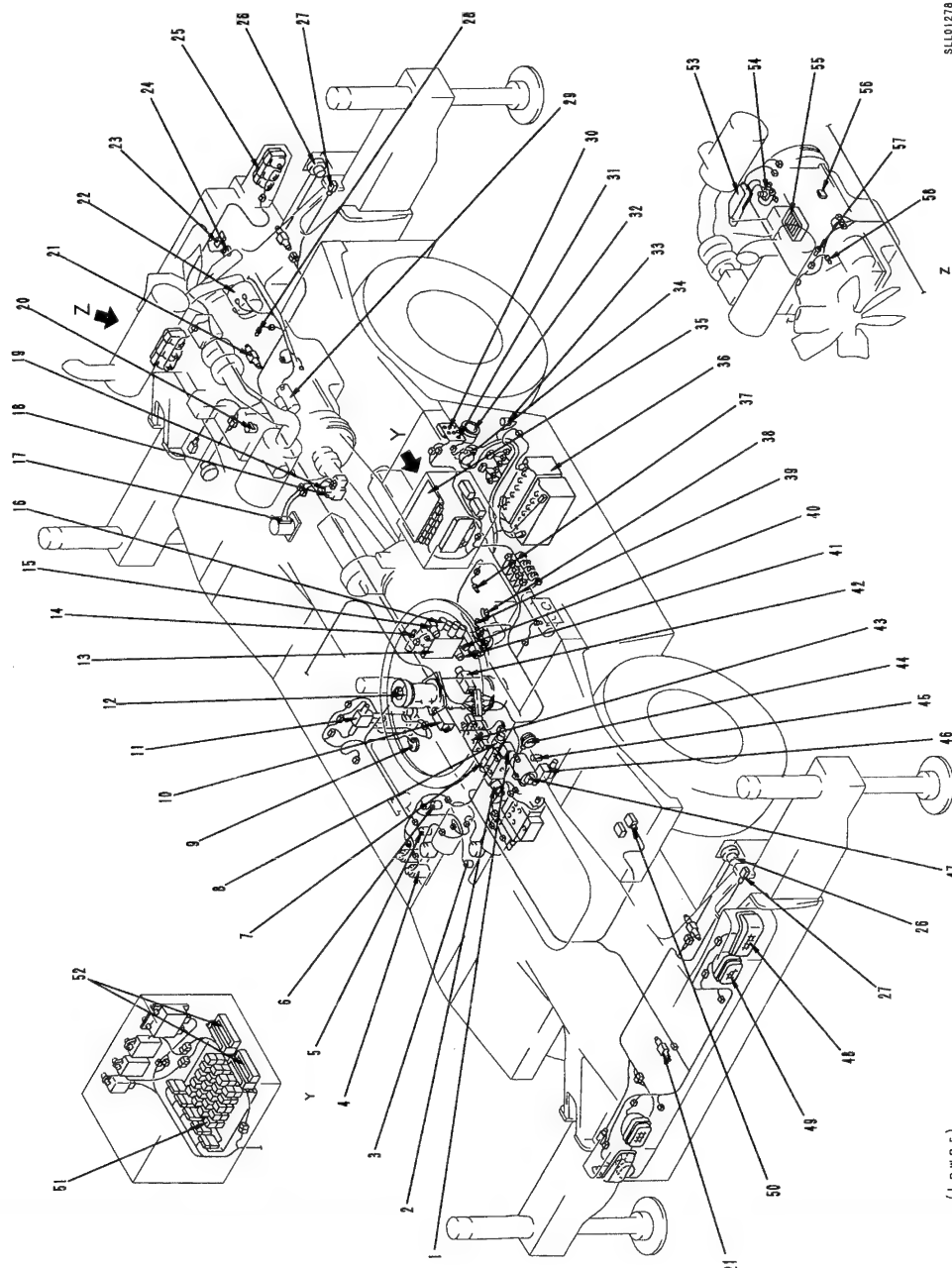
(inside cab)

ELECTRICAL COMPONENT DIAGRAM (3/3)

UPPER STRUCTURE

★ For details of this page, see page 90-79.

1. Rear wheel 2-wheel steering selector valve
2. Reverse steering compensation valve
3. Stop lamp switch
4. Brake oil reservoir (x2)
5. Auxiliary brake valve
6. Parking brake valve
7. 4-wheel steering selector valve
8. Crab steering selector valve
9. Fuel level sensor
10. Swing pump merge selector valve
11. Angle sensor
12. Swivel joint (slip ring)
13. Transmission solenoid valve
14. Torque converter oil temperature sensor
15. PTO clutch selector valve
16. Torque converter lockup solenoid valve
17. Rear steering lock detector
18. Suspension lock valve (front)
19. Suspension lock valve (rear)
20. Exhaust brake solenoid valve
21. Outrigger INDIVIDUAL valve
22. Alternator
23. License lamp
24. Backup buzzer
25. Rear combination lamp
26. Outrigger length sensor
27. Rear steering CENTER detection switch
28. Engine water temperature sensor
29. Starting motor
30. Outrigger control box
31. Engine control switch
32. Tachograph
33. Spirit level
34. Battery relay
35. MDT (multiple transmission) lower controller
36. Battery
37. Transmission oil temperature sensor
38. Tachograph signal pickup port
39. Speed sensor (electromagnetic pickup)
40. Hi/Lo selector solenoid valve
41. 2/4-wheel drive selector solenoid valve
42. Angle sensor
43. Outrigger selector valve
44. Emergency steering relay
45. Air pressure switch
46. Suspension selector switch
47. Emergency steering motor
48. Front turn signal
49. Head lamp
50. Central greasing pressure switch
51. Engine stop motor
52. Heater relay
53. Electrical intake air heater
54. Accelerator potentiometer
55. Engine oil pressure sensor
56. Engine speed sensor
- 57.
- 58.



SLL01278

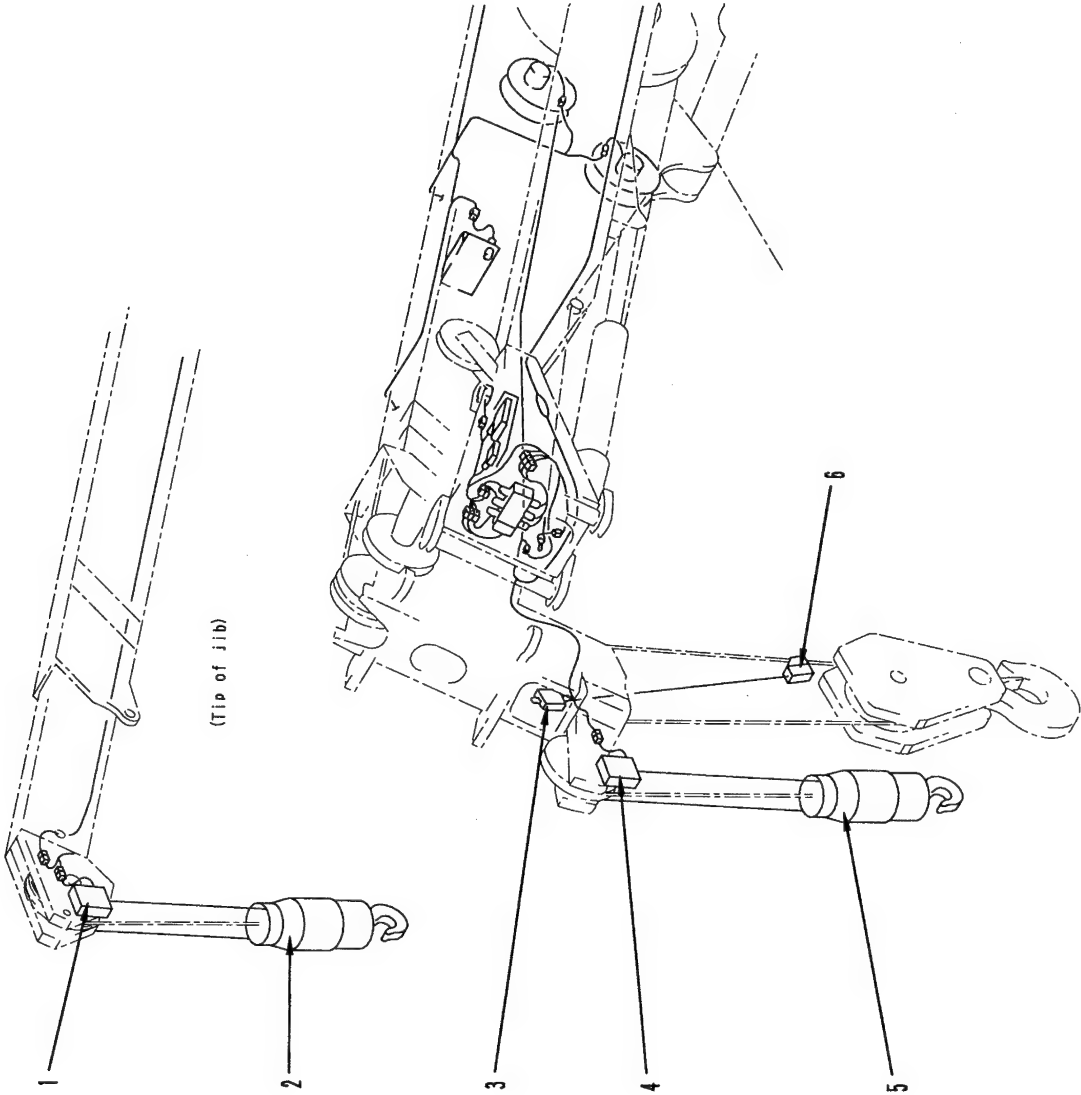
(Lower)

OVERWIND PREVENTION SYSTEM DRAWING

★ For details of this page, see page 90-81.

1. Overwind detection switch for auxiliary winch
2. Overwind weight for auxiliary winch
3. Overwind detection switch for main winch
4. Overwind detection switch for single top
5. Overwind weight for single top
6. Overwind weight for main winch

Outline
Overwind detection switches (1) and (3) are actuated by overwind sensors (2) and (4). When there is an overwind condition, they are turned OFF by the return spring inside the switch, and when the condition returns to normal, the switches are turned ON by the weight of the overwind sensor.



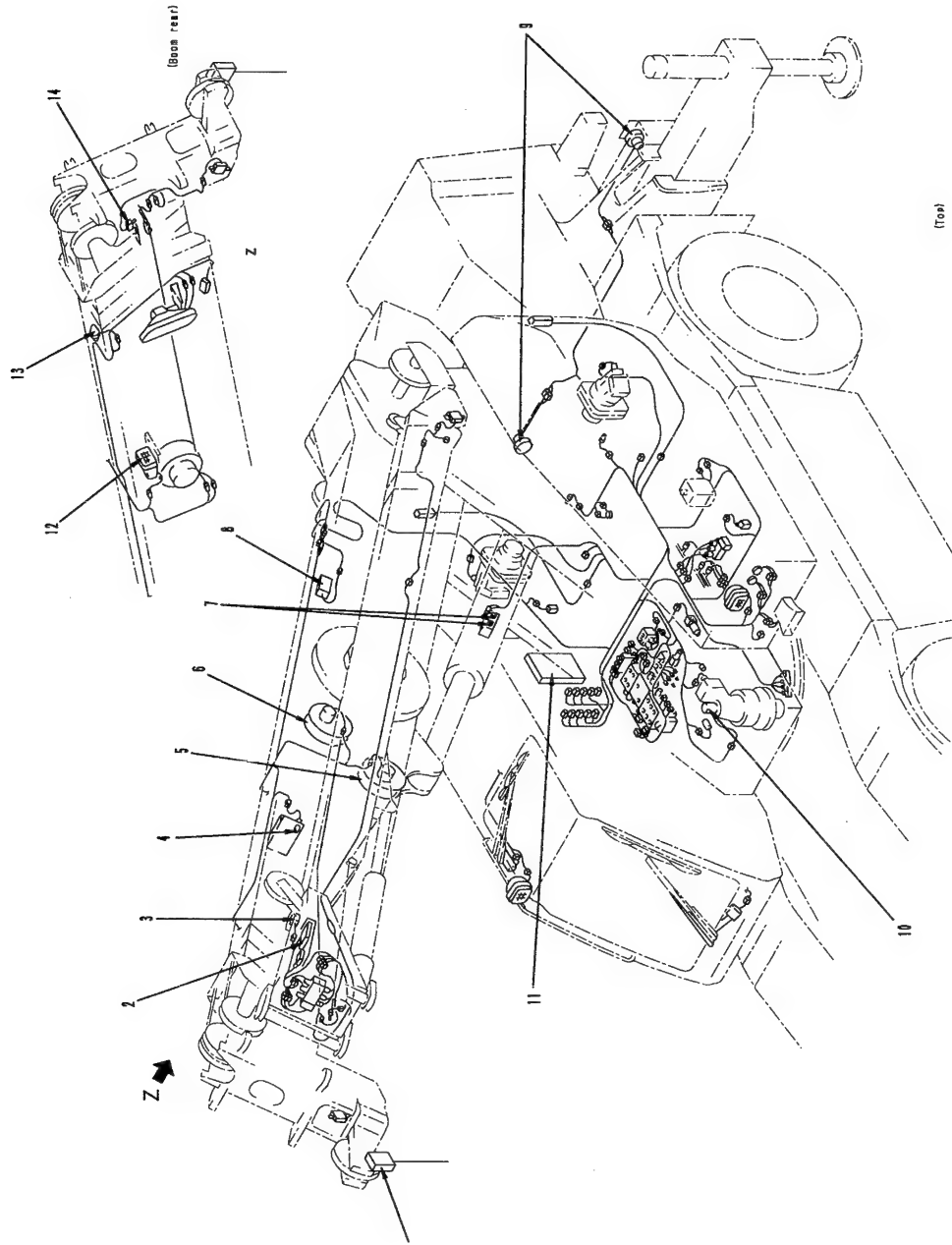
SLL01205

023S05

OVERLOAD SAFETY SYSTEM DRAWING

★ For details of this page, see page 90-83.

1. Single top overwind limit switch
2. Jib angle transmission module (power tilt machines)
3. Jib angle detector
5. Jib angle cord reel (power tilt machines)
6. Boom length detector (power tilt machines)
7. Boom pressure detector
8. Boom angle detector
9. 2nd boom extension limit switch
12. Boom working lamp
13. Boom top lamp
14. Top boom stowing limit switch



Outline

• Boom angle detector (8) is installed to the right side face of the boom and acts to detect the angle of the boom from the horizontal.

The boom angle detector consists of a potentiometer and a bob. The bob is actuated in accordance with the movement of the boom, and this movement is transmitted to the potentiometer and detected as an electric voltage output.

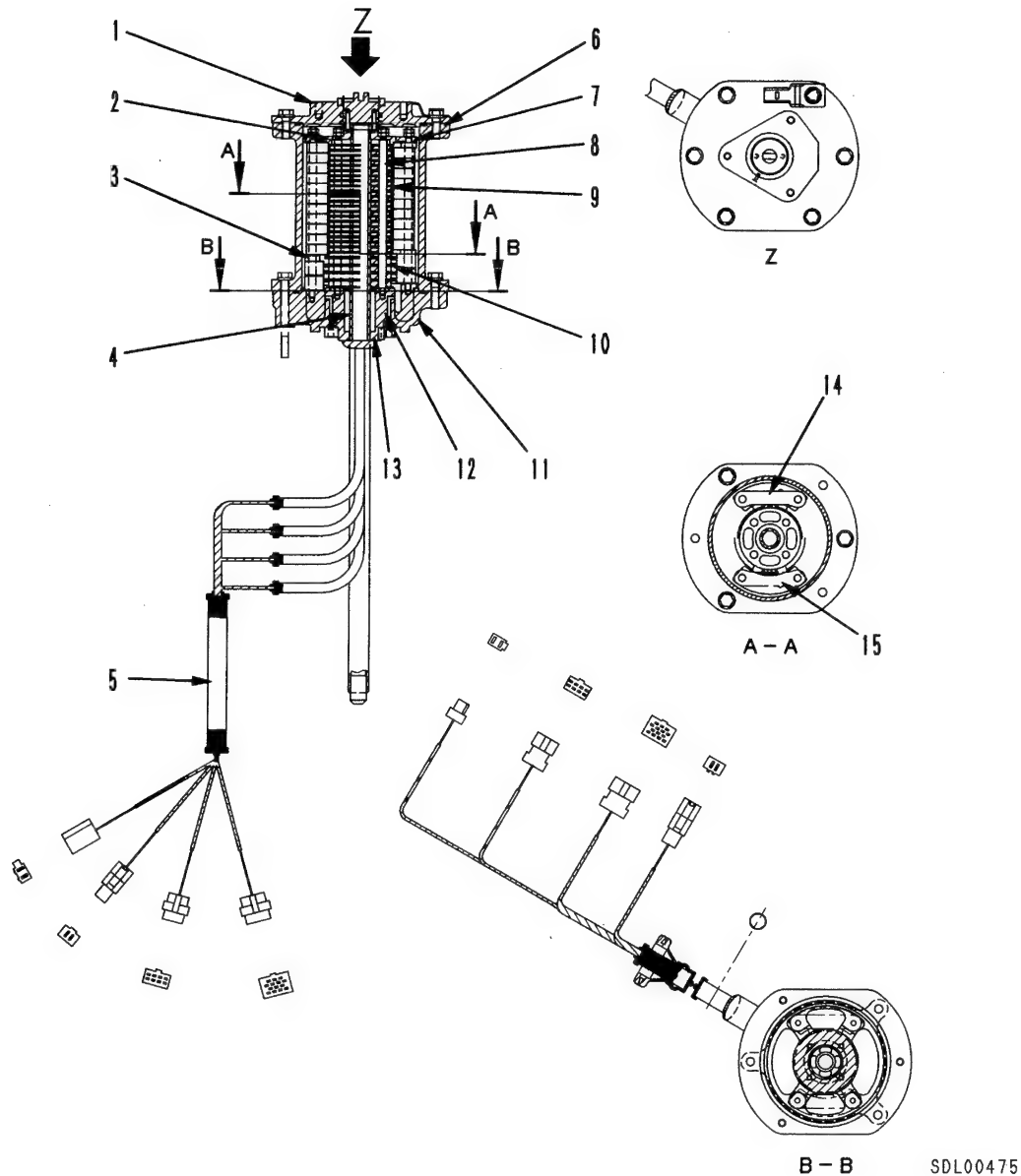
• Boom length detector (6) forms one unit with the cord reel. It is installed to the right side face of the boom and acts to detect the change in the length of the boom during boom telescope operations.

With boom length detector (6), the cable wound on to the cord reel is pulled out or wound back during boom telescope operations. The rotation of the cord reel shaft is transmitted to the potentiometer and detected as an electrical voltage output.

• Boom pressure detector (7) is installed to the top of the hoist cylinder and acts to detect the pressure that is applied to the boom hoist cylinder.

SILL01208

ELECTRIC SWIVEL JOINT (SLIP RING)



023S05

Outline

- The electric swivel joint is installed to the top of the hydraulic and air swivel joint, and connects the electrical circuits between the undercarriage and the upper structure.
- The electric swivel joint sends the current from the battery to the upper structure through the wiring which passes through the hole in the center of the shaft of the hydraulic and air swivel joint. At the same time, it transmits the signals from the undercarriage to the upper structure, and makes it possible to operate the electrical components with the switches from the upper structure.
- A potentiometer is installed to the top of the electric swivel joint. This makes it possible to detect the position of the crane on the upper structure in relation to the undercarriage.

MULTIPLE DATA TRANSFER (MDT) SYSTEM

OUTLINE

The upper MDT is installed to the upper structure and the lower MDT is installed to the undercarriage. A multiple transfer system (C-NET) system is used between this upper MDT and lower MDT. It sends and receives data (for the switches, sensors, solenoids, etc.) from the upper MDT to the lower MDT and from the lower MDT to the upper MDT.

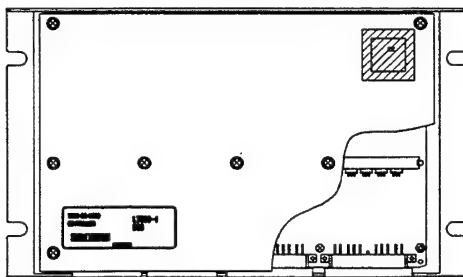
In addition, using S-NET transmission, the upper MDT sends and transmits data to the moment limiter, and the lower MDT sends and transmits data to the automatic gearshift system.

The shape of the upper and lower MDT is the same.

Controller

The internal circuits consist of the analog processing portion, digital processing portion, and power source. The controller carries out calculation according to the signals for each switch input, sensor, and communication data received. It then carries

out output of these results to the solenoids, gauges, lamps, and buzzers, and transmits the communication data.



SKL01411

- 1) Analog processing portion
The sensor signals are processed and converted to a digital value that can be read in the digital processing portion.
- 2) Digital processing portion
This consists of the central processing unit (which carries out various types of calculation and judgment), the memory unit (which records the programs run by the central processing unit), and the digital input and output portion.
- 3) Power source
This consists of a stabilized power source which converts the 24V voltage input from the battery to a stabilized voltage of + 5V or +12V used by the MDT.

Communication data

The main data sent and received by the MDT (C-NET) are as follows.

[Transmission from upper MDT to lower MDT]

- PTO mode, shift position, steering mode, 4-wheel drive, outrigger signal, head lamp/side lamp, turn signal, preheating, rear steering lock/free command, raise/lower, model selection code/input, etc.

[Transmission from lower MDT to upper MDT]

- Engine speed, travel speed, turn signal, charge, torque converter oil temperature, rear steering lock/free/center limit switch, hydraulic oil temperature, brake oil level, engine oil pressure, preheating lamp, fuel level gauge, engine water temperature gauge, outrigger length AD value, raise/lower, model selection code/input, etc.

The main data sent and received by the S-NET communications are as follows.

[Transmission from upper MDT to moment limiter]

- PTO mode, outrigger operation signal, shift position, accumulator pressure drop, hydraulic oil temperature 70°, winch drum speed, outrigger length AD value, service meter, side lamp, etc.

[Transmission from moment limiter to upper MDT]

- PTO mode, outrigger rear stability, swing, etc.

[Transmission from lower MDT to automatic gearshift system]

- PTO mode, shift position, exhaust brake, steering mode, 4-wheel drive, rear steering lock/free condition, travel speed, engine speed, etc.

[Transmission from automatic gearshift system to lower MDT]

- Throttle position, transmission input condition, gearshift pattern, steering solenoid condition, gearshift mode, travel speed, alarm buzzer, etc.

Function of MDT

The functions of the MDT are basically carried out by control in both the upper MDT and lower MDT. However, control of (3) swing flasher function, (5) monitoring function accumulator pressure drop, and (13) winch buzzer function is carried out only by the upper MDT.

1) Lighting function

- If the dimmer switch is turned on when the lamp switch is off, the head lamp Hi is turned on (passing).
- If the lamp switch is set to the stage 1 position, the side lamps are turned on. If the dimmer switch is turned on, the head lamp Hi is turned on (passing).
- If the lamp switch is set to the stage 2 position, the side lamps are turned on. If the dimmer switch is turned on an even number of times, the head lamp is turned to Lo; if the dimmer switch is turned on an odd number of times, the head lamp is turned to Hi.
- When the side lamps are on, the rear steering lock LED, rear steering free LED, rear steering center LED, shift indicator LED, and outrigger LED are dimmed.
- When the side lamps are on, the side lamp signal is transmitted to the moment limiter by the S-NET, and the back light of the multi safety job monitor lights up.

2) Turn signal, hazard function

- When the turn signal switch is operated to the left, the turn signal L flashes.
- When the turn signal switch is operated to the right, the turn signal R flashes.
- When the hazard switch is turned on, the turn signal L and R flash.

3) Swing flasher function

- If the PTO mode is at PTO1 or PTO2 and the swing is operated, the swing flasher will flash.

4) Service lamp function

- If the service lamp switch is turned on, the service lamp lights up.

5) Monitoring function**Engine speed**

- The engine speed is output to the meter according to the value of the engine speed sensor.

Travel speed

- The travel speed is output to the meter according to the value of the travel speed sensor.

Fuel

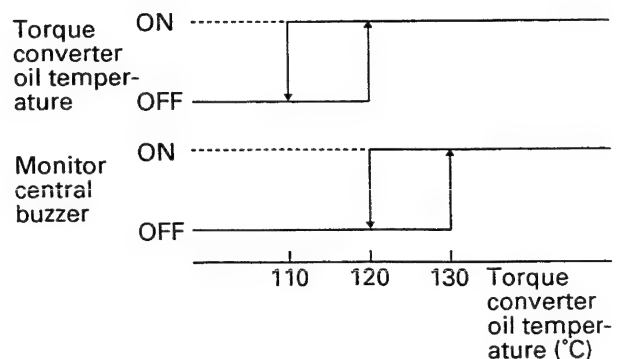
- The fuel level is output to the meter according to the value of the fuel sensor.

Engine water temperature

- The engine water temperature is output to the gauge according to the value of the engine water temperature gauge.

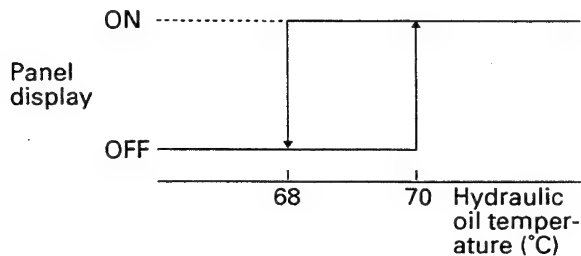
Torque converter oil temperature

- The torque converter oil temperature is controlled by the value of the torque converter oil temperature sensor.
- If the torque converter oil temperature goes above 120°, the torque converter oil temperature lamp lights up.
- If the torque converter oil temperature goes below 110°, the torque converter oil temperature lamp goes out.
- If the torque converter oil temperature goes above 130°, the monitor central buzzer sounds.
- If the torque converter oil temperature goes below 120°, the monitor central buzzer stops.



Hydraulic oil temperature

- If the hydraulic oil temperature goes above 70°C, [hydraulic oil temperature 70°C] is displayed on the control panel. If the hydraulic oil temperature goes below 68°C, the display goes out.



Brake oil level

- If the brake oil level goes down, the brake oil level lamp lights up and the panel central buzzer sounds. Once a drop in the brake oil level is detected, even if the brake oil level is restored, the brake oil level lamp and panel central buzzer condition is maintained. When the starting switch is turned off, the warning is canceled.

Accumulator pressure drop

- If the accumulator pressure drops, the panel central buzzer sounds and [Accumulator pressure drop] is displayed on the control panel.

6) Starting, charging, preheating function

Engine oil pressure

- When the starting switch is ON, if the engine oil pressure drops, the engine oil pressure lamp lights up and the panel central buzzer sounds.

Battery charge

- If the voltage at alternator terminal R becomes less than 10V, the battery charge lamp lights up and the panel central buzzer sounds.

Hourmeter

- When the starting switch is on, if the engine oil pressure is normal, the hourmeter is actuated.

Preheating

- If the starting switch is set to R1, the preheating (heater relay) is turned on and the preheating pilot lamp lights up.

7) Transmission control function

Travel mode

- The travel mode based on the travel mode switch input is transmitted to the automatic gearshift system and control is carried out by the automatic gearshift system.

Shift position

- The shift position based on the shift lever input is transmitted to the automatic gearshift system.

8) Brake function

Parking brake/auxiliary brake

- When the parking brake switch is set to PARKING, the parking brake is applied, and the parking brake pilot lamp lights up.
- When the parking brake switch is set to AUXILIARY, the auxiliary brake is applied.
- If the shift lever is not at N and the parking brake is applied, the panel centralized buzzer sounds to warn that the parking brake is dragging.

Exhaust brake

- If the accelerator is not being used and the exhaust brake & retarder combination switch is set to EXHAUST BRAKE, the exhaust brake is actuated.
- If the accelerator is being depressed, the exhaust brake is not actuated.

Retarder

- If the accelerator is not being used and the exhaust brake & retarder combination switch is set to RETARDER, the retarder is actuated. Note that the retarder is not actuated independently; it is used together with the exhaust brake.
- If the accelerator is being depressed, the retarder is not actuated.

9) Steering function

Special steering selector control

- As a rule, travel operations are carried out in the front-wheel mode (rear steering locked).
- If the rear steering is locked, the mode is always the front-wheel mode, regardless of the operation of the steering mode selector.
- The rear steering lock/cancel operation is permitted only in the front-wheel mode. If the selector operation is not permitted, the panel central buzzer sounds intermittently (2 Hz).

- (4) While the rear steering lock/cancel switch is being operated in Step 3), it is possible to set to the 4-wheel mode and align the rear steering center.
- (5) Switching to the special steering mode is permitted only when the rear steering is free and the travel speed is less than 10 km/h. There is no restriction on the travel speed when switching to the front-wheel mode.
- (6) When switching the mode is not permitted in Step 5)
 - ※ The steering mode in use before the switching operation was carried out is retained.
 - ※ The steering mode indicator and buzzer give an alarm.
 - The mode indicator in use before the switching operation lights up.
 - The mode indicator in use after in the switching operation flashes (2 Hz).
 - Note:
If the steering mode switches all go OFF after the switching operation:
 - The mode indicator in use before the switching operation lights up.
 - All the other mode indicators flash (2 Hz).
 - The panel central buzzer sounds intermittently (2 Hz).
 - The alarm buzzer sounds.
 - ※ The alarm continues until the steering mode is switched back to the mode in use before the switching operation, and no new operation of the steering mode selection is accepted until the alarm is canceled.
- (7) When the starting switch is ON and the steering mode selector switches are all OFF
 - ※ The front-wheel mode indicator lights up.
 - ※ All the other mode indicators flash (2 Hz).
 - ※ The panel central buzzer sounds intermittently (2 Hz).
 - ※ The alarm buzzer sounds.

The alarm continues until the steering mode is switched back to the front-wheel mode in use before the switching operation, and no new operation of the steering mode selection is accepted until this is done.

Reverse steering selection control

- (1) Selecting reverse steering is possible only within a range of ± 5 deg to the rear.
- (2) When switching the mode is not permitted in Step (1) (outside the range to the rear)
 - ※ The reverse steering mode indicator and buzzer give an alarm.
 - The reverse steering mode indicator flashes (2 Hz).
 - The alarm buzzer on the panel sounds intermittently (2 Hz).
 - ※ The alarm continues until the reverse steering switch is operated again. (Switch OFF once: returns to normal steering)
- (3) After operation of the reverse steering, the mode returns to normal steering if it is not within a range of ± 5 deg to the rear. If it is not within a range of ± 5 deg to the rear after operation of the reverse steering
 - ※ The reverse steering indicator and buzzer give an alarm.
 - The reverse steering indicator flashes (2 Hz).
 - The panel central buzzer sounds intermittently (2 Hz).
 - ※ The warning continues until the reverse steering switch is operated again. (Switch OFF once: returns to normal steering)
- (4) When the starting switch is on, if the reverse steering compensation switch is at reverse steering, it does not switch to reverse steering.
 - ※ The reverse steering mode indicator and buzzer give an alarm.
 - The reverse steering indicator flashes (2 Hz).
 - The alarm buzzer sounds intermittently (2 Hz).
 - ※ The alarm continues until the reverse steering switch is operated again. (Switch OFF once: returns to normal steering)

10) Outrigger control function

- (1) Operation of the outriggers is permitted only when the PTO mode is at PTO1 and when the shift lever is at N.
- (2) When the outriggers are stowed away and the machine is on-tire, if the over-rear stability stop condition exists, the outrigger mode signal is turned OFF and it becomes impossible to operate the outriggers.
- (3) When the outriggers are operated, the on-tire/reset signal is transmitted to the moment limiter.
- (4) The type of machine (X-type outrigger machine or H-type outrigger machine) is distinguished by the outrigger X/H selection input.

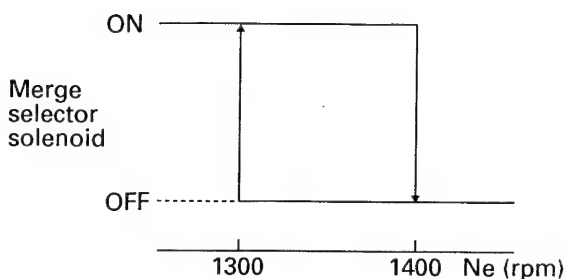
11) Suspension lift function

- When the PTO mode is at PTO1, the shift lever is at neutral, and the suspension switch is at suspension lock, if the suspension lift switch is turned on, the system is set to suspension lift.
- If the suspension lift is operated during outrigger operations, the movement of the outriggers will stop and operation will change to suspension lift. (If outrigger control and suspension lift are both operated, priority is given to suspension lift.)

12) Swing pump/outrigger merge selector function

(1) When PTO mode is at Travel

- This assists the steering operation when engine speed $N_e < 1300$ rpm (see note) and the swing pump/outrigger merge selector solenoid is on, and the engine is running at low speed.



Note: When PTO mode is at Travel, the ON/OFF selection of the merge selector solenoid is provided with a hysteresis for engine speed N_e .

(2) When PTO mode is at PTO1

- When using the upper outrigger panel to operate all the outriggers, or when using the lower outrigger panel to operate all the outriggers, turn the swing pump/outrigger merge selector solenoid ON and increase the speed of movement of the outriggers.

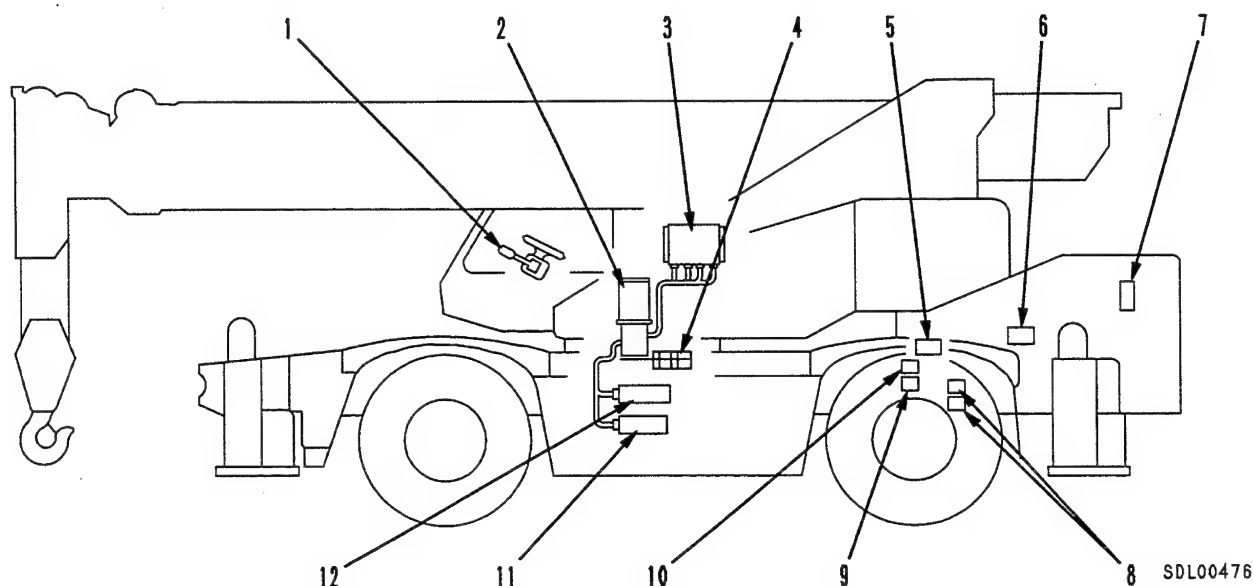
13) Winch buzzer function

- When the PTO mode is at PTO1 or PTO2, to improve the ease of fine control of the winch, if the main winch and auxiliary winch are operated, the buzzer sounds in the range where the frequency of the winch drum rotation pulse is $0 < F < 12$ (Hz).

14) PTO selector function

- When the PTO switch is at TRAVEL, the PTO mode is at Travel.
- When the PTO switch is at PTO1, the PTO mode is at Operation 1.
- When the PTO switch is at PTO2, the PTO mode is at Operation 2.

AUTOMATIC GEAR SHIFT SYSTEM (AESC)



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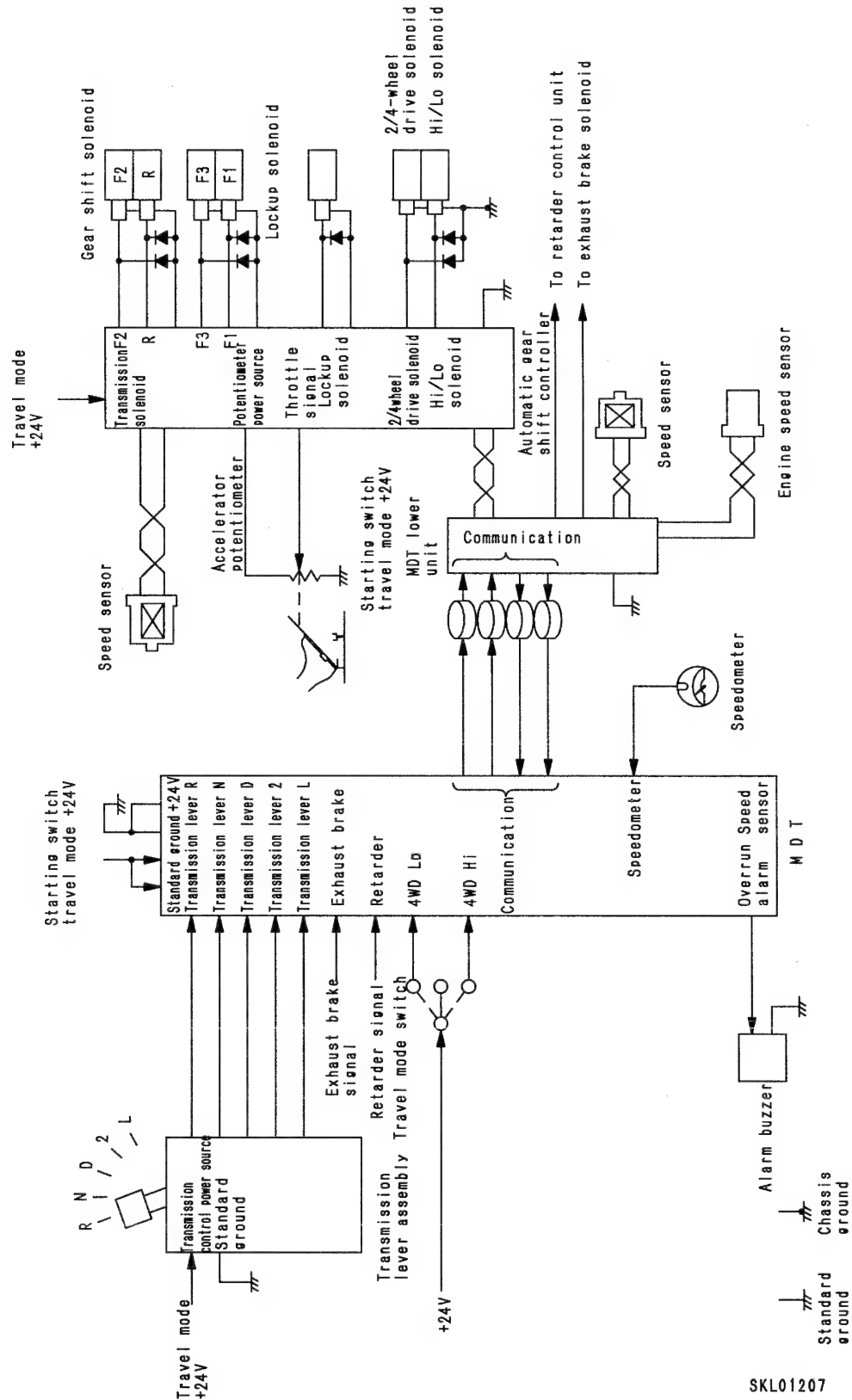
- | | | |
|--|----------------------------------|---|
| 1. Gear shift lever | 6. Accelerator potentiometer | 10. 2/4-wheel drive selector solenoid valve |
| 2. Electric swivel joint | 7. Engine speed sensor | 11. Automatic gearshift controller |
| 3. MDT upper unit | 8. Speed sensor | 12. MDT lower unit |
| 4. Gear shift solenoid valve | 9. Hi/Lo selector solenoid valve | |
| 5. Torque converter lock-up solenoid valve | | |

Outline

- The automatic gear shift system consists of the gear shift lever assembly, the MDT installed at the rear left side of the operator's cab, and the speed sensor and other components installed to the undercarriage.
- The gear lever assembly uses a combination of 5 types of signals (**R**, **N**, **D**, **2**, **L**) in accordance with the position of the gear shift lever to send the shift position to the MDT. The **N** (neutral) signal is also used for other functions, such as the neutral safety system.
- The automatic gear shift controller takes the gear shift lever signal, the mode selector signal (which changes the gear shifting pattern), the signal which inputs the accelerator pedal position, and the travel speed to select the most suitable speed range, and drives the gear shift solenoid valve. It also has the function of switching between high and low speed and engaging the torque converter automatic lock-up.

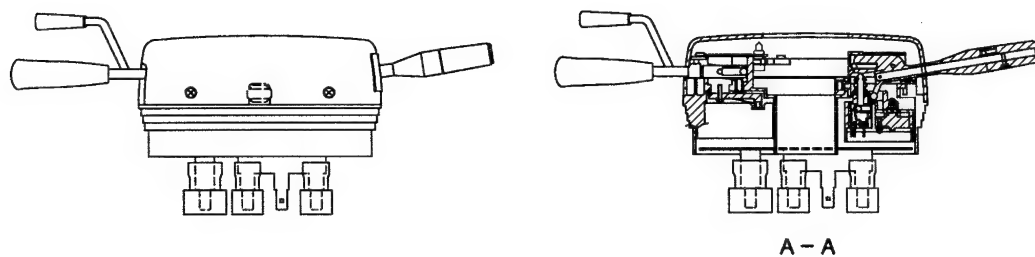
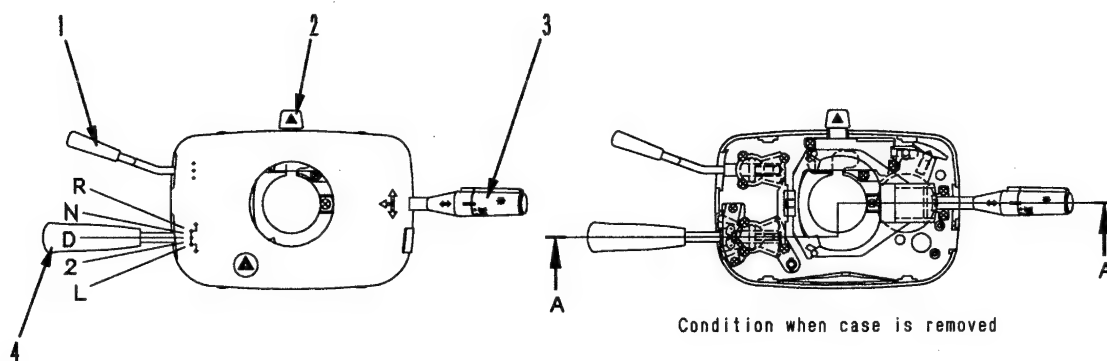
SYSTEM STRUCTURE DIAGRAM

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SKL01207

GEAR SHIFT LEVER (TRIM SWITCH)



SKL01263

1. Exhaust brake, retarder brake switch
2. Hazard switch
3. Turn signal, lighting switch
4. Gear shift lever

023S05

Function

- The gear shift lever assembly gives the output in the table on the right according to the lever position.
When the output signal is ON, 24V is output by the transistor.
When checking this output, insert a T-adaptor when connected to the MDT, and measure the voltage of the output.
The voltage of the output is approx. +24V when it is ON.
- The neutral (N) signal is connected to the MDT, and also to the neutral safety relay.
If there is a failure in the gear shift lever assembly, and it is impossible to start the engine, the emergency gear shift switch can be used to forcibly output +24V.

- Gear shift lever position and output signal**

Lever position	Output signal				
	R	N	D	2	L
R	○				
N		○			
D			○		
2				○	
L					○

MOMENT LIMITER (OVERLOAD PREVENTION SYSTEM)

OUTLINE

The moment limiter (overload prevention system) is installed to prevent the crane from tipping over or the boom from bending. To do this, it picks up the changes in the hoist cylinder shaft force, boom angle, and boom length from the electrical signals output by the sensors installed to the work equipment.

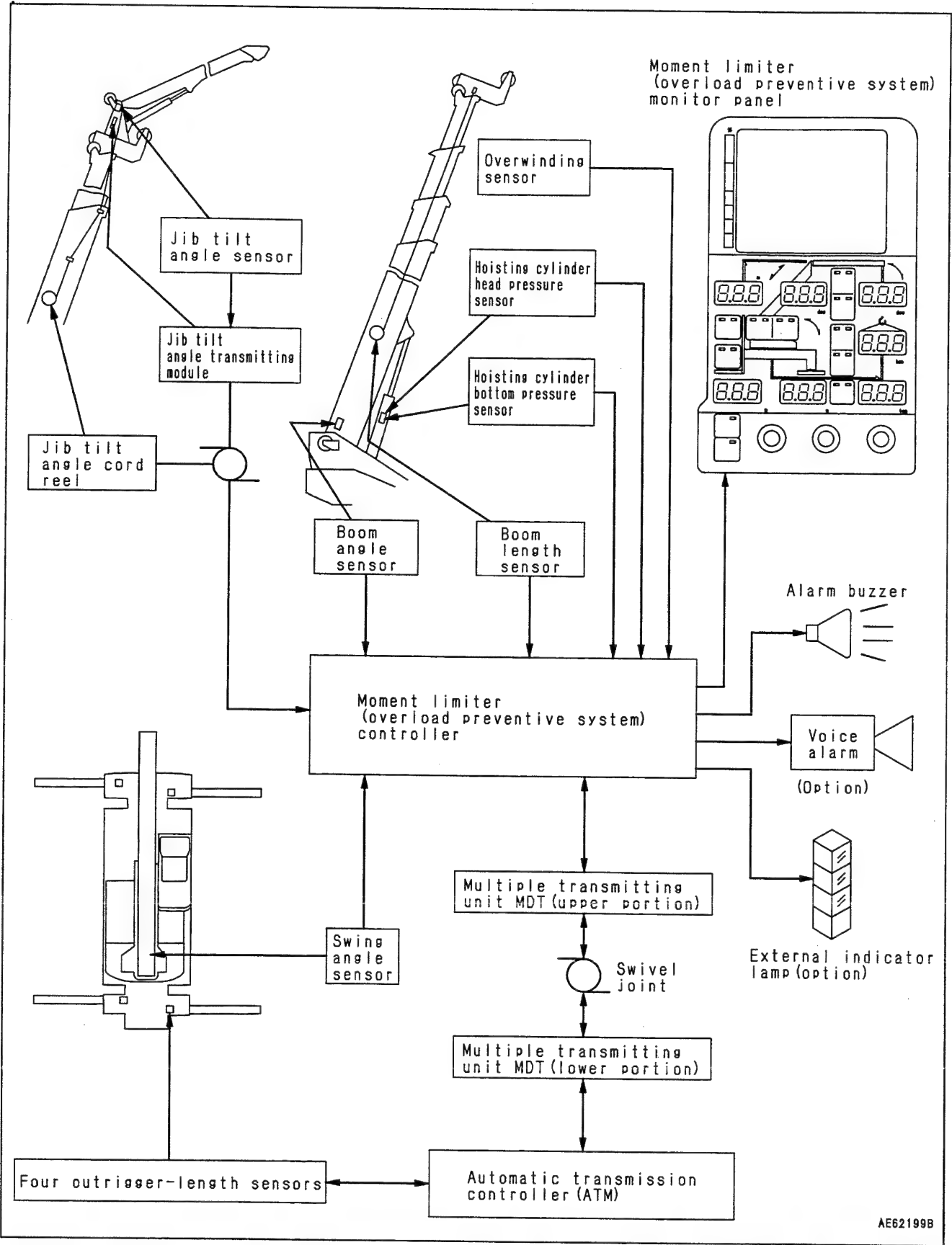
It sends these signals to the control box, calculates the rated overall load from the boom angle, boom length, outrigger setting, position of upper structure, jib angle, and other chassis data, and compares it with the actual load being raised.

When this raised load reaches 90% of the rated overall load (load ratio), the alarm buzzer sounds intermittently. If the load ratio increases further and reaches 100%, the alarm buzzer sounds continuously. When this happens, the stop signal of the over-load prevention system is actuated and the crane operations are stopped automatically.

In this condition, it becomes impossible to carry out any movement of the crane in the direction where the moment increases (direction of danger). It becomes possible only to operate the work equipment in the direction of safety to prevent the machine from tipping over (boom RAISE, boom RETRACT, winch WIND OUT), so it is possible to return the machine to a safe condition.

This group of movements makes it possible to improve the safety of the crane operations and also increases the reliability of the crane itself.

PRINCIPLE OF OPERATION

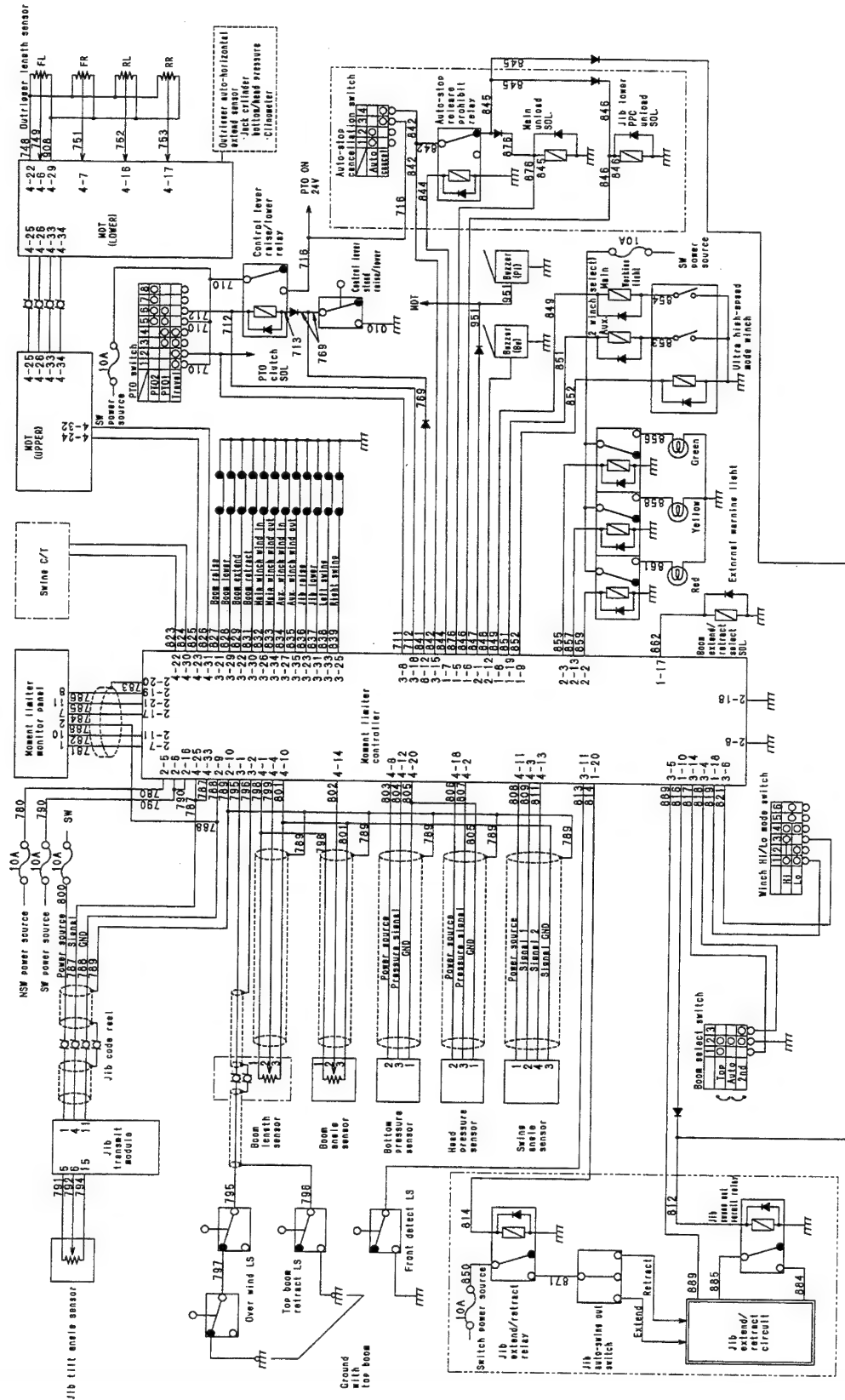


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SYSTEM CONSTITUTION CHART

★ Details of this page, see page 90-85.

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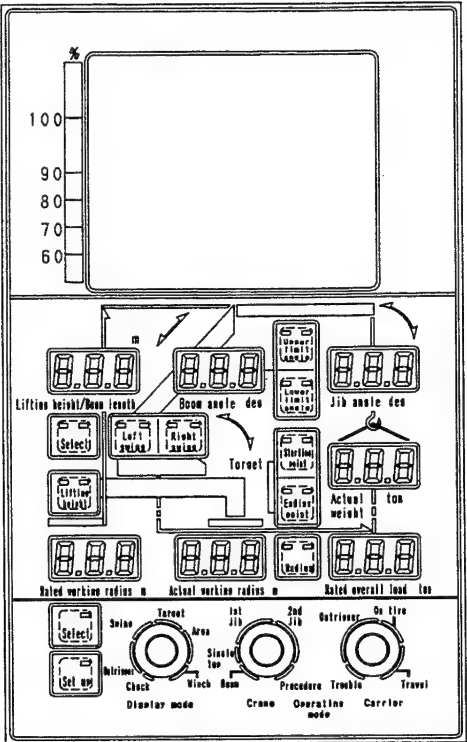
STRUCTURE OF SYSTEM

This system consists of the components shown below (Table 1).

Table 1 Components

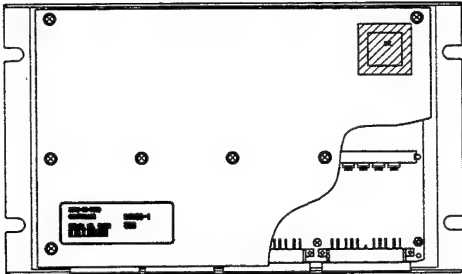
No.	Part name	Q'ty
1	Control panel	1
2	Controller	1
3	Pressure sensor	2
4	Boom angle sensor	1
5	Boom length sensor	1
6	Swing angle sensor	1
7	Outrigger extension length sensor	4
8	Multiple data transfer MDT	2

Diagram of components



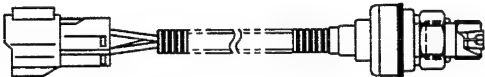
SVL01677

1. Control panel



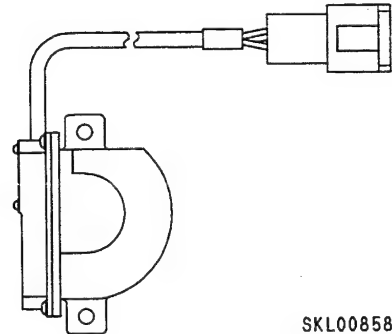
SKL00857

2. Controller



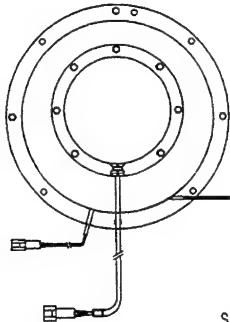
SKL00855

3. Pressure sensor



SKL00858

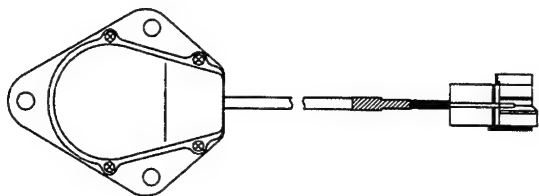
4. Boom angle sensor



SKL00856

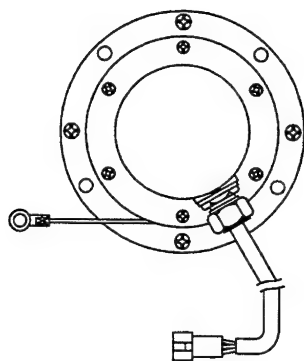
5. Boom length sensor

023S05



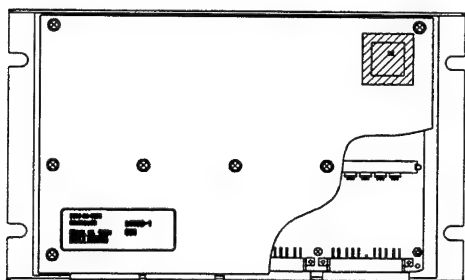
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6. Swing angle sensor



SKL00860

7. Outrigger extension length sensor



SKL00861

8. MDT

1. MOMENT LIMITER CONTROL PANEL

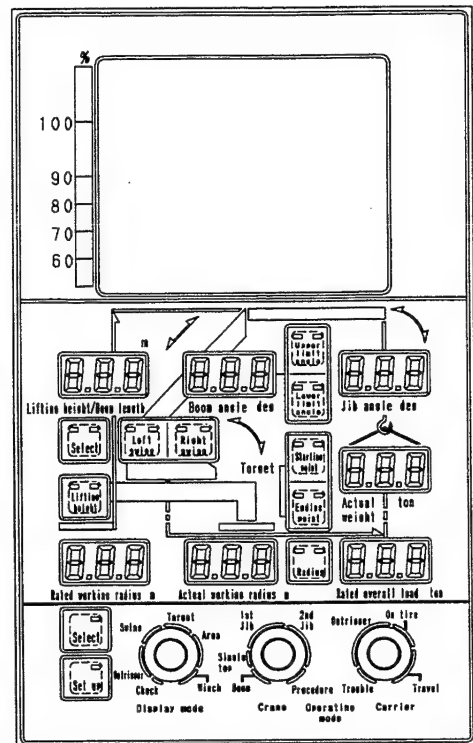
Outline

- This is installed to the dashboard inside the operator's compartment and indicates the existing condition of the crane operation. The internal circuit consists of the power source, the digital processing unit, communications unit, and analog processing unit. It transmits the data for the switches to the moment limiter controller or calculates from the displayed data received from the moment limiter controller and displays the result.

Function

- Analog processing unit
 - It processes the signal from the temperature sensors in the internal circuit and converts them to digital values that can be read in the digital processing unit.
 - The command values from the digital processing unit are converted to analog values, and are then output.
- Digital processing unit

This consists of the central processing unit which carries out processing and judgment, and the memory storing the display data and the programs carried out by the central processing unit. The details of the central processing unit are as follows.



SVL01677

Details of functions

- It carries out display based on the data received from the moment limiter controller through the S-NET and sends the data for the condition of the switches to the moment limiter controller through the S-NET.
- If communications are lost with the moment limiter controller, the emergency stop error is displayed, and OSS error E○○ message is displayed.

Switch input : The condition of 13 tact switches and 3 rotary switches is sent to the moment limiter controller through the S-NET.

EL back light : If the side lamp ON signal is received through the S-NET during operations, it lights up. If there is any error or warning message when the machine is traveling, it lights up.

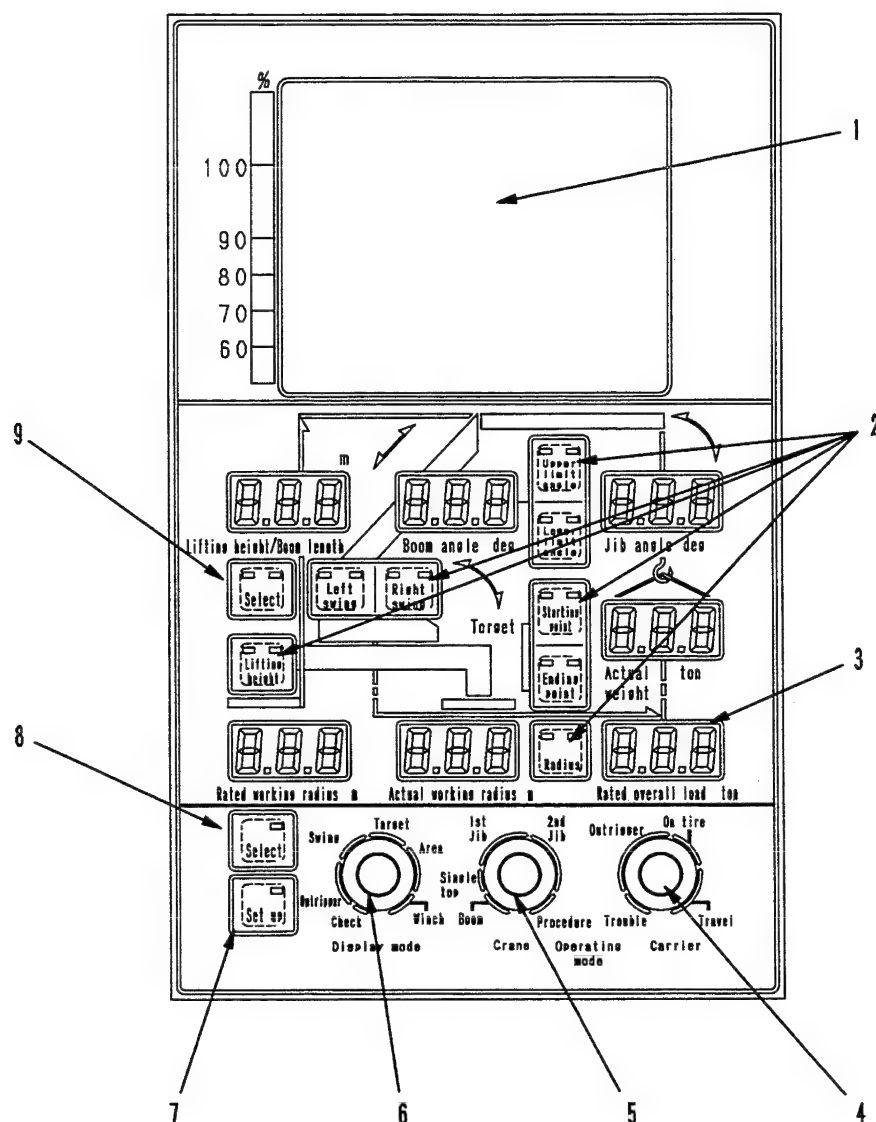
LED : These light up or go out according to the data received from the moment limiter controller.

7seg LCD : This displays the data according to the data received from the moment limiter controller.

Graphic LCD : This determines the display mode according to the detector received from the moment limiter controller. It processes the data for this display mode and displays the graphic display data and the position.

For details of the method of input for the switches and details of the displays, see the section on detailed functions of the moment limiter.

EXPLANATION OF MOMENT LIMITER CONTROL PANEL



SVL01676

1. Graphic display

- Load ratio bar code display, digital display
- Message displays
- Outrigger extension condition and other graphic displays
- Caution displays

2. Working range set switches

3. Digital display (7 places)

- Displays rated overall load, actual load, jib angle, boom angle, lifting height/boom length, rated working radius, actual working radius

4. Lower working mode set switch

5. Upper working mode set switch

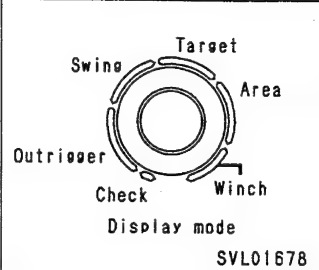
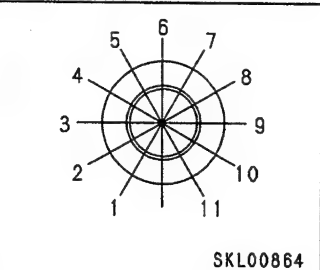
6. Display mode set switch

7. Outrigger working mode set switch

8. Selector switch

9. Lifting height/boom length display selector switch

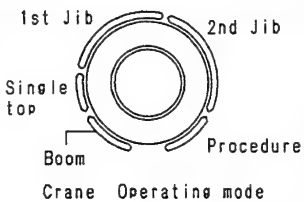
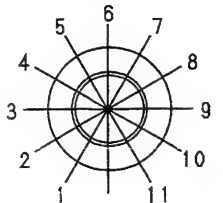
1. Display mode set switch (working mode display)

Set switch					Set position					
 SVL01678					 SKL00864					
1	2	3	4	5	6	7	8	9	10	11
Check mode	Crane set mode		Swing range mode		Target mode		Hoist range mode		Winch mode	

Set the PTO to PTO1 and after the setting of the work equipment (outrigger setting) is completed, it changes the display mode for the graphic display.

023S05

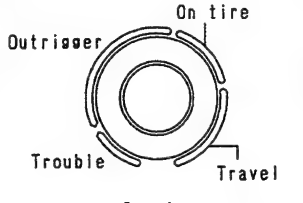
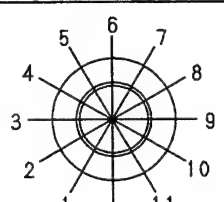
2. Upper working mode switch

Set switch					Set position						
											
1	2	3	4	5	6	7	8	9	10	11	
Boom		Single top	Power tilt jib stage 1			Power tilt jib stage 2			Winch mode		
			Fixed tilt stage 1			Fixed tilt stage 2					
			0°	25°	45°	0°	25°	45°			
			(Fixed tilt machine only)			(Fixed tilt machine only)					

Switches used to select upper working mode

Setting for jib extension/stowing operations

3. Lower operating mode switch

Set switch					Set position					
										
1	2	3	4	5	6	7	8	9	10	11
Emergency setting		Outrigger				On-tire setting			Running hang (on-tire travel)	

Switches used to select lower working mode (undercarriage)

Use the 2 upper and lower switches to make the settings for the work to be carried out.

Even if the setting operation is carried out for non-permitted combination of operations (jib + running hang), the setting is not carried out.

MOMENT LIMITER CONTROL PANEL FUNCTION DISPLAY

	Name	Performance	Function
1	Graphic display	160 x 128 dot matrix LCD	Graphic display for method needed to match job site, Load ratio display
2	Bar graph scale	50% – 100%, divided into 6 ranges distinguished by color	Scale for load ratio bar graph on graphic display
3	Lifting height/boom length LCD	7 segments x 3 digits + 2 dots	Displays boom length or lifting height [m]
4	Boom LCD	7 segments x 3 digits + 2 dots	Displays boom angle [deg]
5	Jib angle LCD	7 segments x 3 digits + 2 dots	Displays jib angle [deg] • Power tilt jib machine & jib operation
6	Actual load LCD	7 segments x 3 digits + 2 dots	Displays actual load [ton]
7	Rated working radius LCD	7 segments x 3 digits + 2 dots	Displays rated working radius [m]
8	Actual working radius LCD	7 segments x 3 digits + 2 dots	Displays actual working radius [m]
9	Rated overall load LCD	7 segments x 3 digits + 2 dots	Displays rated overall load [ton]
10	Selector switch	Tact switch Red LED (left side as seen when facing panel) Green LED (right side as seen when facing panel)	Lifting height/boom length display selector Lights up when displaying lifting height Lights up when displaying boom length
11	Left swing switch	Tact switch Red LED (left side as seen when facing panel) Green LED (right side as seen when facing panel)	Left swing angle limit set/cancel Lights up when limit is exceeded Lights up when limit is set
12	Right swing switch	Tact switch Red LED (left side as seen when facing panel) Green LED (right side as seen when facing panel)	Right swing angle limit set/cancel Lights up when limit is exceeded Lights up when limit is set
13	Lifting height switch	Tact switch Red LED (left side as seen when facing panel) Green LED (right side as seen when facing panel)	Hook lifting height limit set/cancel Lights up when limit is exceeded Lights up when limit is set
14	Upper limit switch	Tact switch Red LED (left side as seen when facing panel) Green LED (right side as seen when facing panel)	Boom hoist angle upper limit set/cancel Lights up when limit is exceeded Lights up when limit is set
15	Lower limit switch	Tact switch Red LED (left side as seen when facing panel) Green LED (right side as seen when facing panel)	Boom hoist angle lower limit set/cancel Lights up when limit is exceeded Lights up when limit is set
16	Starting point switch	Tact switch Green LED (right side as seen when facing panel)	Target point (starting point) set/cancel Lights up at set point
17	Stopping point switch	Tact switch Green LED (right side as seen when facing panel)	Target point (stopping point) set/cancel Lights up at set point
18	Radius switch	Tact switch Red LED (left side as seen when facing panel) Green LED (right side as seen when facing panel)	Working radius limit set/cancel Lights up when limit is exceeded Lights up when limit is set
19	Selector switch	Tact switch Green LED (right side as seen when facing panel)	Differs according to mode No conditions for lighting up
20	Set switch	Tact switch Green LED (right side as seen when facing panel)	Differs according to mode No conditions for lighting up

023S05

1. Controller body

The internal circuit consists of the analog processing unit, digital processing unit, and power source. Calculation is carried out according to the signals from each sensor, and the result is displayed on the moment limiter control panel.

(1) Analog processing unit

This converts the signals from the sensors (boom angle, boom length, head pressure, bottom pressure) to digital values that can be read in the digital processing unit (see Section 2.2).

(2) Digital processing unit

This consists of the central processing unit that carries out processing of calculations and judgments, the rated load table, the memory that stores the content of the programs carried out by the central processing unit, and the digital inputs and out-puts.

(For details of the central processing unit, see Section 2.4.)

It inputs the digital values of the digital inputs and limit switches according to section 2.1, processes the calculation in the processor, and carries out the outputs to the lamps, buzzers, and solenoids.

(3) Power source

This consists of the stabilized power source which converts the 24V input voltage of the battery to a stabilized voltage of +5V, +10V, +12V, and +15V for use on the machine.

(4) Details of central processing unit

1) Calculating axial load

The output (Pb and Ph) of the bottom and head pressure sensors is converted to a digital value by the analog processing unit, and the cylinder axial load is calculated by using the following formula.

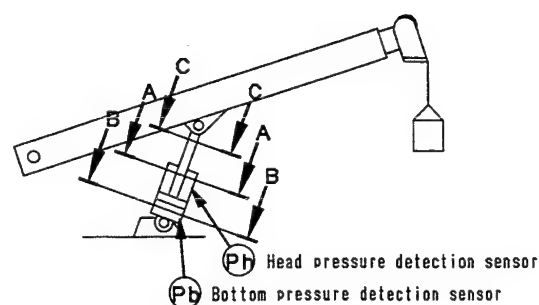
$$F = P_b \times A_b - P_h \times A_h$$

A_b: Area receiving pressure at bottom end

A_h: Area receiving pressure at head end

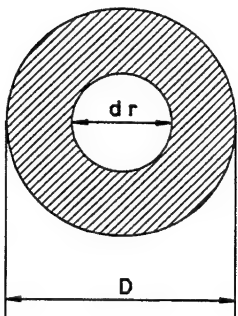
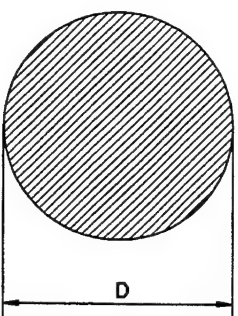
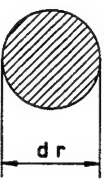
P_b: Pressure at bottom end

P_h: Pressure at head end



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Table 2 Cross-sectional shape of portions of cylinder

	Cross section A – A	Cross section B – B	Cross section C – C
details of cross section	<div><p>SKL00869</p><p>Portion receiving head pressure (hatched portion)</p></div>	<div><p>SKL00870</p><p>Portion receiving bottom pressure (hatched portion)</p></div>	<div><p>SKL00871</p><p>Axial force</p></div>
Pressures	$F_h = A_h \times P_h$ $= \frac{\pi}{4} (D^2 - d^2) \cdot P_h$	$F_h = A_h \times P_h$ $= \frac{\pi}{4} D^2 \cdot P_h$	$F = F_b - F_h$

023S05

2) Calculating lifted load

The lifted load is calculated from the boom angle, jib angle, boom length, axial load of hoist cylinder, and the settings made by the operator (jib used, outrigger, number of loops of rope, etc.). Using the foot pin (Fig. 3-(1)) as the fulcrum, the following formula is made from the balance between the moment in the direction of lowering the boom (Fig. 3-(2)) and moment created by the axial load of the hoist cylinder (Fig. 3-(3)) increased by the lifted load from the time when there is no load. (See Fig. 3)

$$(F - F_0) \times Y = W_a \times (L \cos \theta + d) \quad \text{..... Formula (1)}$$

Where

F : Cylinder axial load when there is lifted load (calculated from previous item)

F₀ : Cylinder axial load when there is no load (stored as data)

Y : Length of arm of moment F (stored as data)

W_a : Lifted load

L : Boom length

θ : Boom angle

d : Deflection of boom (horizontal component)

When Formula 1 is changed and W_a is calculated, the formula becomes as shown below and the lifted load can be calculated.

$$W_a = \frac{(F - F_0) \times Y}{L \cos \theta + d} \quad \text{..... Formula (2)}$$

3) Calculating rated overall load

In the central processing unit, the most suitable rated overall load table is selected from the boom length, outrigger condition, and position of the upper structure in comparison with the rated overall load table data in memory. The working radius is input to this load table and the rated overall load is calculated.

Fig. 3 Calculating lifted load

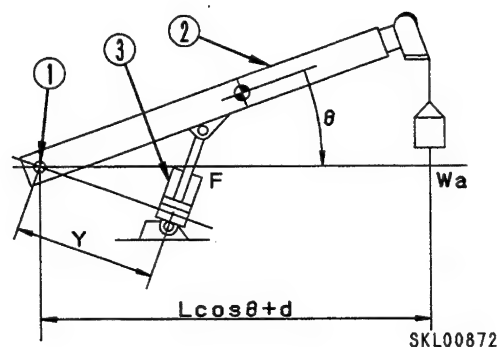
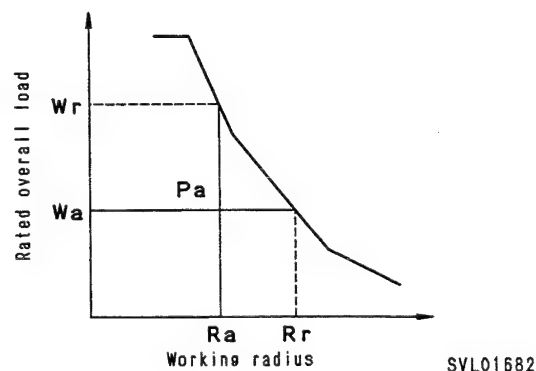


Fig. 4 Calculating rated overall load



P_a : Actual lifted load

R_a : Actual working radius

W_a : Lifted load (including weight of hook)

R_r : Rated working radius when W_a is lifted

W_r : Rated overall load when radius is R_a

- 4) Calculating rated working radius
With lifted load W_a , when the boom is lowered and W_a is the same as the rated overall load, the working radius becomes the rated working radius (R_r), and this is output to the digital display of the control panel.
- 5) Calculating load ratio
The load ratio is calculated by inserting lifted load W_a calculated in Item 2) and rated overall load W_r calculated in Item 3) into the following formula.

$$\text{Load ratio} = \frac{W_a}{W_r} \times 100 [\%]$$

- 6) Self-diagnostic function
If operations are carried out when the signals input from the sensors deviate from the permitted voltage range, or the sensors are defective, or there are short circuits or disconnections in the wiring system, this creates a dangerous condition because it becomes impossible to issue the automatic stop or other signals even if there is an overload condition.
This device is equipped with a self-diagnostic function which displays the location of the abnormality if such an abnormality occurs. The device automatically issues a warning and actuates the automatic stop function at the same time.
- 7) Automatic stop function when there is overload
A signal is issued to the main unload solenoid (automatic stop valve) and the buzzer is sounded according to the value for the load ratio calculated in Item 5).
This system has a fail-safe structure: The automatic stop is actuated when the main unload solenoid is OFF (no electricity is flowing) and it is also actuated when there is a disconnection or defective connection in the wiring.
The algorithm for the automatic stop is as follows.
 - (1) The overload is detected.
 - (2) When there is overload and it is detected that the control lever signal input is an operation prohibited.
Main unload solenoid OFF
 - (3) When only a control signal that is not prohibited is detected.
Main unload solenoid ON
 In addition to overload, there are various causes for automatic stop and the

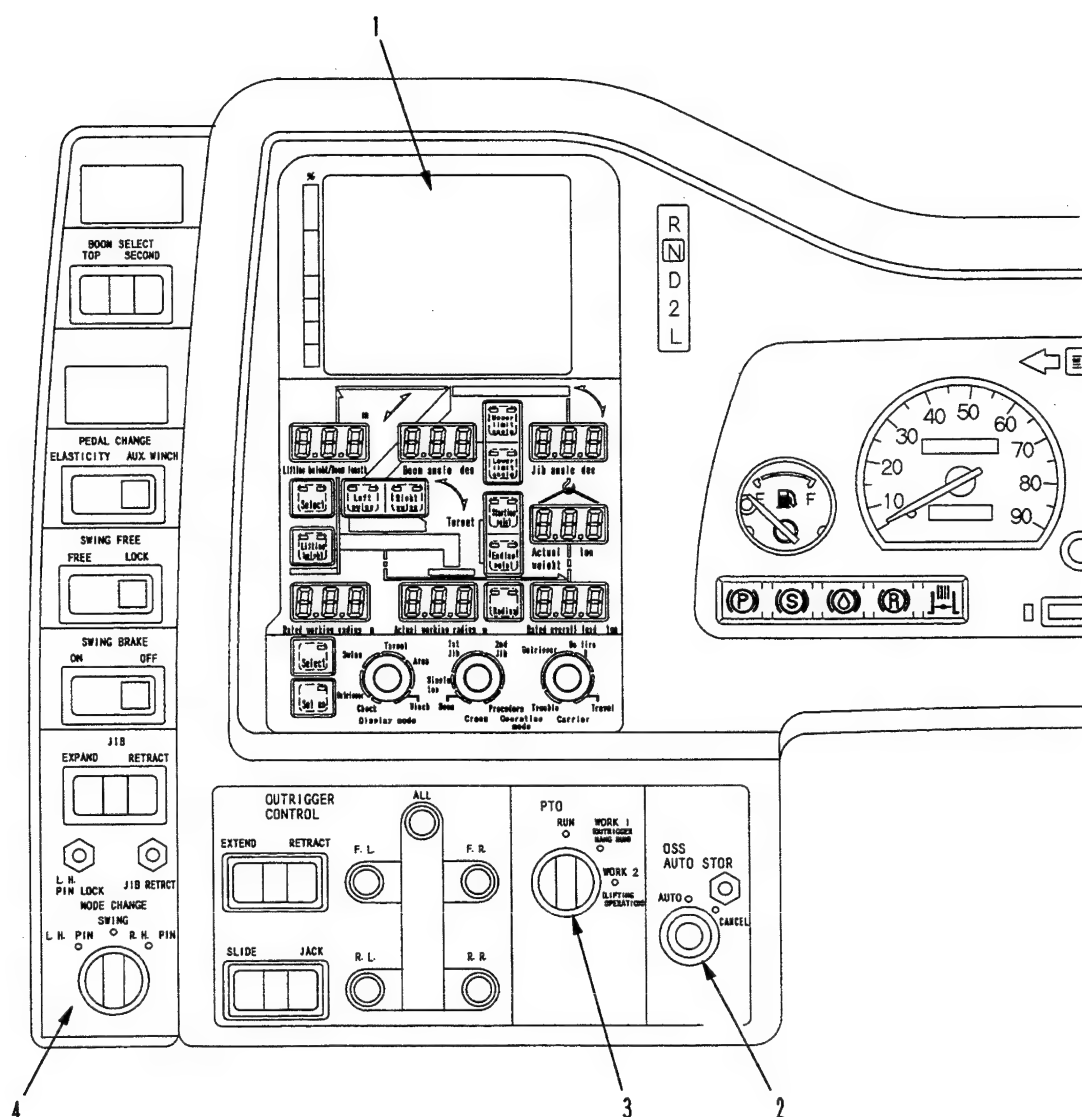
stop is carried out with the same algorithm. (For details, see "Automatic stop control table".)

In addition, for this kind of stop, warnings or alarms are output. (For details, see "Warning output chart".)

DETAILED FUNCTIONS OF OVERLOAD PREVENTION DEVICE

Explanation of controls

Setting and display of the operating condition is carried out on the moment limiter control panel. The control panel also contains the Travel/operation mode selector PTO switch, the automatic stop console switch for use in maintenance and in emergencies, and the controls for the automatic jib extension specifications machine.



SVL01683

1. Moment limiter control panel
2. Moment limiter cancel switch
3. PTO switch
4. Automatic jib extension controls

FUNCTIONS SET BY MOMENT LIMITER CONTROL PANEL

This explanation describes the detailed functions of the control panel and moment limiter using an explanation of the functions that are set and actuated by the switches on the control panel.

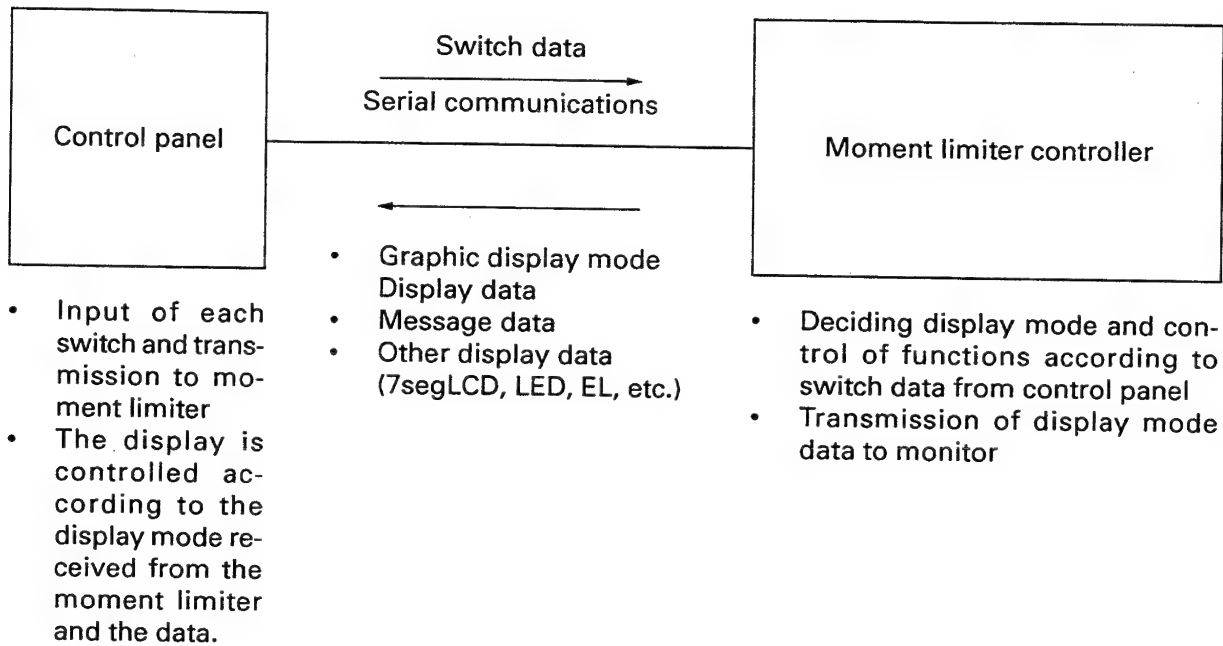


Figure Moment limiter control panel, controller functions
Outline of allocation of

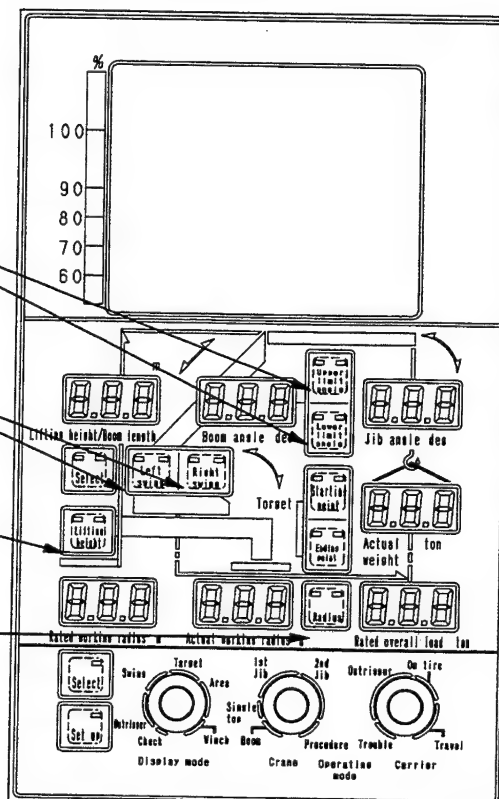
1. Working range limit functions

C, D Boom angle upper limit/lower limit set switches

E, F Left swing/right swing angle set switches

B Lifting height set switch

A Working radius set switch



SVL01684

Working range limit

After completion of setting the working mode, use the working range limit switches to set the working range limits. Just before the work equipment reaches the set value, a warning will be given, and if the work equipment goes beyond the set value, an alarm will sound and the work equipment will stop. (The stop function works for every movement except swing.)

Item	Method of setting	Method of canceling	Warning range	Alarm range
A Working radius	<ol style="list-style-type: none"> 1. If the radius switch is operated, the working radius calculated value R is saved as the set value. 2. The radius LED (green) lights up. 	<ol style="list-style-type: none"> 1. If the set value is saved, and the radius switch is operated, R is cleared. 2. The radius LED (green) goes out. 	<p>If the work equipment approaches the warning zone and actual working radius $R_a > R - dR$:</p> <ol style="list-style-type: none"> 1. [Warning! Radius limit] is displayed. 2. The radius LED (red) flashes. 	<p>If the work equipment reaches the danger zone and actual working radius $R_a \geq R$:</p> <ol style="list-style-type: none"> 1. [Stop! Radius limit] is displayed. 2. The radius LED (red) flashes. 3. The main unload is actuated.
B Lifting height	<ol style="list-style-type: none"> 1. If the lifting height switch is operated, the lifting height calculated value H is saved as the set value. 2. The lifting height LED (green) lights up. 	<ol style="list-style-type: none"> 1. If the set value is saved, and the lifting height switch is operated, H is cleared. 2. The lifting height LED (green) goes out. 	<p>If the work equipment approaches the warning zone and lifting height $H_a > H - dH$:</p> <ol style="list-style-type: none"> 1. [Warning! Lifting height limit] is displayed. 2. The lifting height LED (red) flashes. 	<p>If the work equipment reaches the danger zone and lifting height $H_a \geq H$:</p> <ol style="list-style-type: none"> 1. [Stop! Lifting height limit] is displayed. 2. The lifting height LED (red) flashes. 3. The main unload is actuated.
C Boom angle upper limit	<ol style="list-style-type: none"> 1. If the upper angle switch is operated, the boom angle calculated value θ_u is saved as the set value. 2. The upper angle LED (green) lights up. 	<ol style="list-style-type: none"> 1. If the set value is saved, and the upper angle is operated, θ_u is cleared. 2. The upper angle LED (green) goes out. 	<p>If the work equipment approaches the warning zone and actual boom angle $\theta_a > \theta_u - d\theta$:</p> <ol style="list-style-type: none"> 1. [Warning! Upper angle limit] is displayed. 2. The upper angle LED (red) flashes. 	<p>If the work equipment reaches the danger zone and actual boom angle $\theta_a \geq \theta_u$:</p> <ol style="list-style-type: none"> 1. [Stop! Upper angle limit] is displayed. 2. The upper angle LED (red) flashes. 3. The main unload is actuated.
D Boom angle lower limit	<ol style="list-style-type: none"> 1. If the lower angle switch is operated, the boom angle calculated value θ_l is saved as the set value. 2. The lower angle LED (green) lights up. 	<ol style="list-style-type: none"> 1. If the set value is saved, and the lower angle is operated, θ_l is cleared. 2. The lower angle LED (green) goes out. 	<p>If the work equipment approaches the warning zone and actual boom angle $\theta_a > \theta_l - d\theta$:</p> <ol style="list-style-type: none"> 1. [Warning! Lower angle limit] is displayed. 2. The lower angle LED (red) flashes. 	<p>If the work equipment reaches the danger zone and actual boom angle $\theta_a \geq \theta_l$:</p> <ol style="list-style-type: none"> 1. [Stop! Upper angle limit] is displayed. 2. The lower angle LED (red) flashes. 3. The main unload is actuated.
E Left swing	<ol style="list-style-type: none"> 1. If the left swing switch is operated, the boom angle calculated value ϕ_l is saved as the set value. 2. The left swing LED (green) lights up. 	<ol style="list-style-type: none"> 1. If the set value is saved, and the left swing switch is operated, ϕ_l is cleared. 2. The left swing LED (green) goes out. 	<p>If the work equipment approaches the warning zone and actual swing angle $\phi_a > \phi_l - d\phi$:</p> <ol style="list-style-type: none"> 1. [Warning! Left swing limit] is displayed. 2. The left swing LED (red) flashes. 	<p>If the work equipment reaches the danger zone and actual swing angle $\phi_a \geq \phi_l$:</p> <ol style="list-style-type: none"> 1. [Danger! Left swing limit] is displayed. 2. The left swing LED (red) flashes.
F Right swing	<ol style="list-style-type: none"> 1. If the right swing switch is operated, the boom angle calculated value ϕ_r is saved as the set value. 2. The right swing LED (green) lights up. 	<ol style="list-style-type: none"> 1. If the set value is saved, and the right swing switch is operated, ϕ_r is cleared. 2. The right swing LED (green) goes out. 	<p>If the work equipment approaches the warning zone and actual swing angle $\phi_a > \phi_r - d\phi$:</p> <ol style="list-style-type: none"> 1. [Warning! Right swing limit] is displayed. 2. The right swing LED (red) flashes. 	<p>If the work equipment reaches the danger zone and actual swing angle $\phi_a \geq \phi_r$:</p> <ol style="list-style-type: none"> 1. [Danger! Right swing limit] is displayed. 2. The right swing LED (red) flashes.

Note : There are cases where it does not work normally when an error message is given, so do not use crane.

i Buzzer alarm area of working range

Item	Warning range	Intermittent 2 Hz	Intermittent 4 Hz	Continuous	Automatic stop hysteresis width	Remarks
A	dR = 2m	2 – 1m	-1 – 0m	$R_a \geq R$	0.5m	Priority when alarm buzzer sounds for multiple problems Continuous V 4Hz V 2Hz
B	dH = 2m	2 – 1m	-1 – 0m	$H_a \geq H$	0.5m	
C	$d\theta = 10^\circ$	$10 - 5^\circ$	$5^\circ - 0^\circ$	$\theta_a \geq \theta_u$	1.5°	
D	$d\theta = 10^\circ$	$10 - 5^\circ$	$5^\circ - 0^\circ$	$\theta_a \geq \theta_u$	1.5°	
E	$d\theta = 10^\circ$	$15 - 8^\circ$	$8^\circ - 0^\circ$	$\phi_a \geq \phi_l$	0°	
E	$d\theta = 10^\circ$	$15 - 8^\circ$	$8^\circ - 0^\circ$	$\phi_a \geq \phi_r$	0°	

Automatic stop hysteresis width

- This is the width where the automatic stop remains actuated even when the sensor value changes because of movement of the sensor during the automatic stop operation.
- This function is necessary to prevent hunting.
- Once the automatic stop is carried out, it remains actuated until the work equipment returns by the hysteresis width or until the range limit is canceled.

ii. Automatic reset function

In the following cases, the working range limits are all canceled.

Automatic reset function	(1) If there is a change in the lower working mode (2) If the PTO mode is changed PTO → Travel (3) If more than 2 hours has passed since the key was turned OFF The system is reset if any of the above (1) – (3) occurs.
Remarks	

Caution when resetting	If there is a change in the lower working mode and the automatic reset is actuated: [Reset! Range limit] is displayed for 2 seconds, and at the same time, the alarm buzzer sounds.
Remarks	When resetting operating conditions, working conditions is displayed after completion of the resetting.

METHODS OF USING DISPLAY MODE

1. Check mode display

Set the display mode switch to CHECK to enter the check mode.

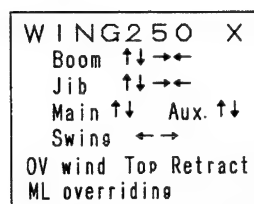
This load is the load for up carrying out checks before starting of the overload prevention system.

(For details, see TESTING AND ADJUSTING.)

- (1) Direction of operation of work equipment lever
- (2) Overwinding
- (3) Stowing top boom
- (4) Canceling automatic stop

When the appropriate signal is input, the appropriate item on the display screen is reverse highlighted.

<Display screen>



AD60625B

Figure Example of check mode graphic display
(X-type outrigger specification)

In the check mode, the automatic stop is always carried out when the following are operated.

- (1) Boom LOWER
- (2) Boom EXTEND
- (3) Jib LOWER
- (4) Main winch WIND-IN
- (5) Auxiliary winch WIND-IN

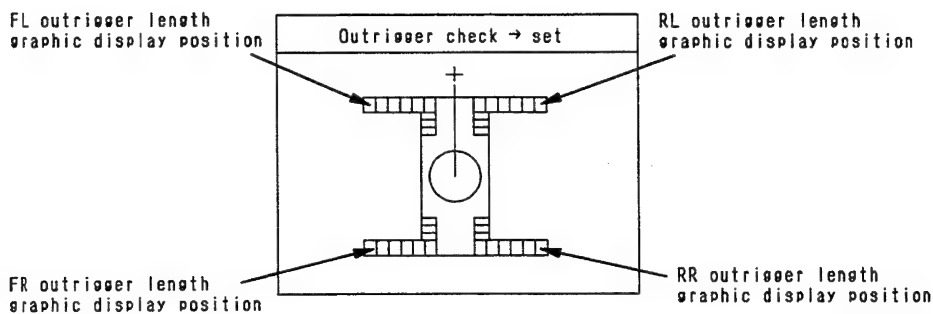
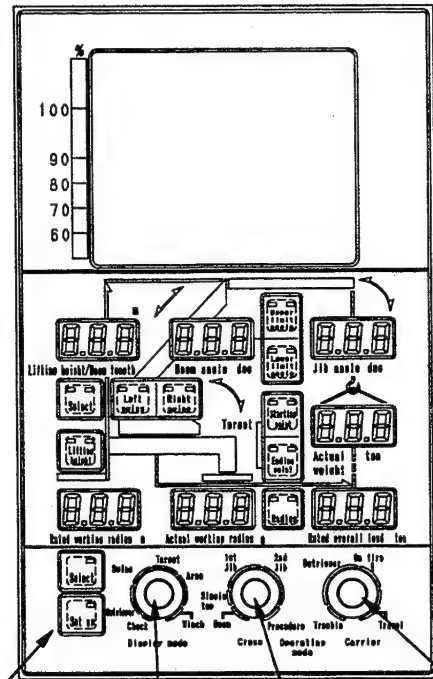
The display shows the model name and the H/X-type specification.

In the check mode, the 7segLCD, moment limiter buzzer, and alarm buzzer are all actuated for 3 seconds and all go OFF for 1 second. The graphic display becomes the top display.

2. Crane setting mode

Use the following procedure during the normal operation for extending the outriggers.

- 1) Set the PTO switch to PTO1. The opening screen for the graphic display on the moment limiter control panel is shown in Fig. 1. On this screen it is possible to extend and set the outriggers. Follow steps (1) – (7) to set the lower and upper work equipment.



Working mode set switch for outriggers Display mode set switch Upper working mode set switch Carrier working mode set switch

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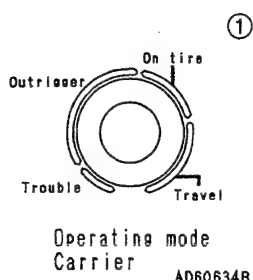
Fig. 1 (H-type outrigger specification)

Fig. 2

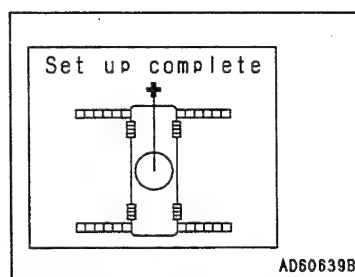
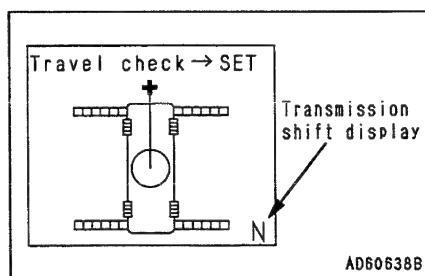
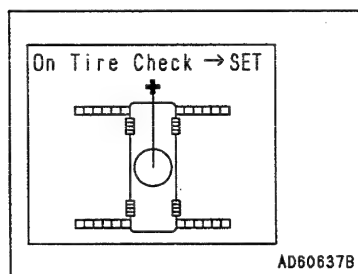
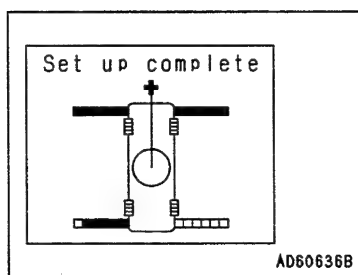
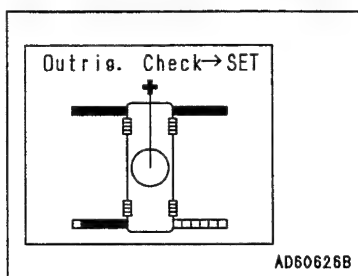
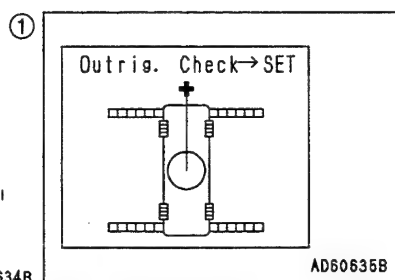
- (1) Set the upper working mode switch and lower working mode switch to the desired working mode. (Turn the rotary switch.)
- (2) Extend the outriggers.
The graphic display bar is filled in to show the extension width of the outrigger.
- (3) Check the extension width of the outrigger.
Check that the actual extension width and the graphic display are the same.
- (4) Press the set switch. (If the setting is accepted, the buzzer will sound and the display will change to Fig. 2.)
When the setting is made, if an impossible combination of the upper working mode switch and lower working mode switch is selected:
(For example, jib + on-tire), the buzzer will not sound. The display also will not change (impossible setting).

- (5) Set the number of loops of wire rope for the main hook.
 - If it is the same as the display, press the set switch.
 - If it is different from the display, press the selector switch and change the number of loops.
When it is the same as the display, press the set switch to complete the setting.
- (6) Set the display mode to the desired mode.
- (7) Set the PTO switch to PTO2. It is now possible to start operations.

2) Crane set display (there are 3 patterns depending on the carrier working mode setting)
X-type outrigger



Carrier operating mode switch



Opening screen for outrigger set display

Opening screen display when any of the following switches is operated

1. PTO switch operated to Work1
2. Display mode switch at outrigger position
3. Outrigger control switch operated
4. Outrigger working mode switch set to OUTRIGGER

Screen when outrigger is being operated

Display changes as outrigger slide is operated
Screen does not change when jack is operated

Press set switch

Screen when outrigger setting is completed

When the set switch is pushed, [Setting completed] lights up for 2 seconds

Next, if display mode switch is at any position except [Outrigger], shift to that position

If display mode switch is at [Outrigger], only completed display goes out at [Set]

Opening screen for on-tire set display

Opening screen display when any of the following switches is operated

1. PTO switch operated to Work1
2. Display mode switch at crane setting position
3. Outrigger control switch operated
4. Outrigger working mode switch set to ON-TIRE

Press set switch

Opening screen for running hang set display

Opening screen display when any of the following switches is operated

1. PTO switch operated to Work1
 2. Display mode switch at outrigger position
 3. Outrigger control switch operated
 4. Outrigger working mode switch set to RUNNING HANG
- Transmission shift position display

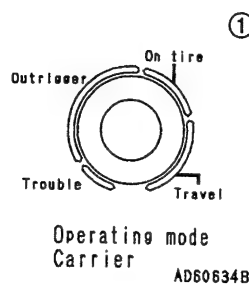
Press set switch

Screen when on-tire running hang setting is completed

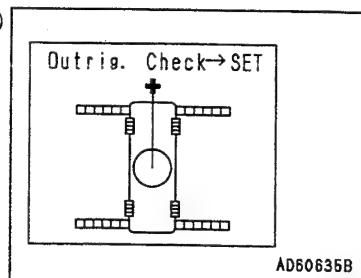
- Does not show outrigger standard display (Max., Min., etc.)
- Length of outrigger on graphic display corresponds to sensor input value

For any other position, the display is the same as when completing the outrigger setting.
(For running hang, the transmission shift position is displayed)

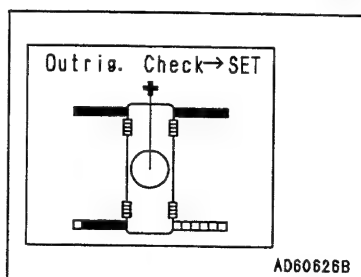
2) Crane set display (there are 3 patterns depending on the lower working mode setting)
H-type outrigger



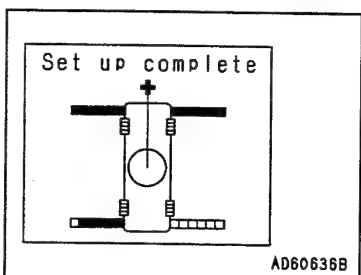
Carrier operating
mode switch



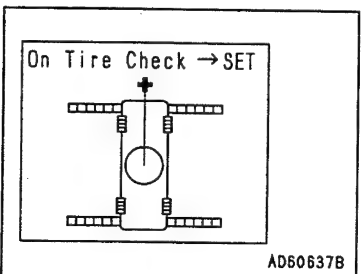
Opening screen for outrigger set display
Opening screen display when any of the following switches is operated
1. PTO switch operated to PTO1
2. Display mode switch at outrigger position
3. Outrigger control switch operated
4. Carrier working mode switch set to OUTRIGGER



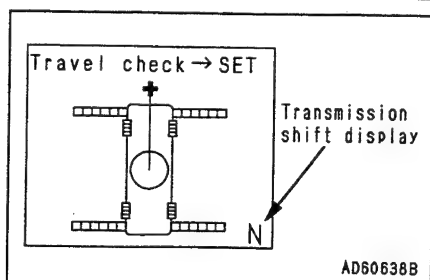
Screen when outrigger is being operated
Display changes as outrigger slide is operated
Screen does not change when jack is operated
Press set switch



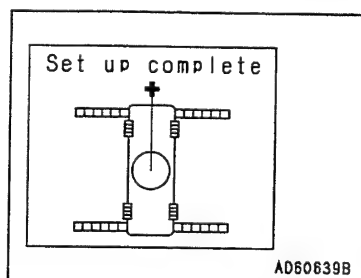
Screen when outrigger setting is completed
When the set switch is pushed, [Setting completed] lights up for 2 seconds
Next, if display mode switch is at any position except [Outrigger], shift to that position
If display mode switch is at [Outrigger], only completed display goes out at [Set]



Opening screen for on-tire set display
Opening screen display when any of the following switches is operated
1. PTO switch operated to ON
2. Display mode switch at outrigger position
3. Outrigger control switch operated
4. Carrier working mode switch set to ON-TIRE
Press set switch



Opening screen for running hang set display
Opening screen display when any of the following switches is operated
1. PTO switch operated to PTO1
2. Display mode switch at outrigger position
3. Outrigger control switch operated
4. Carrier working mode switch set to RUNNING HANG
Transmission shift position display
Press set switch

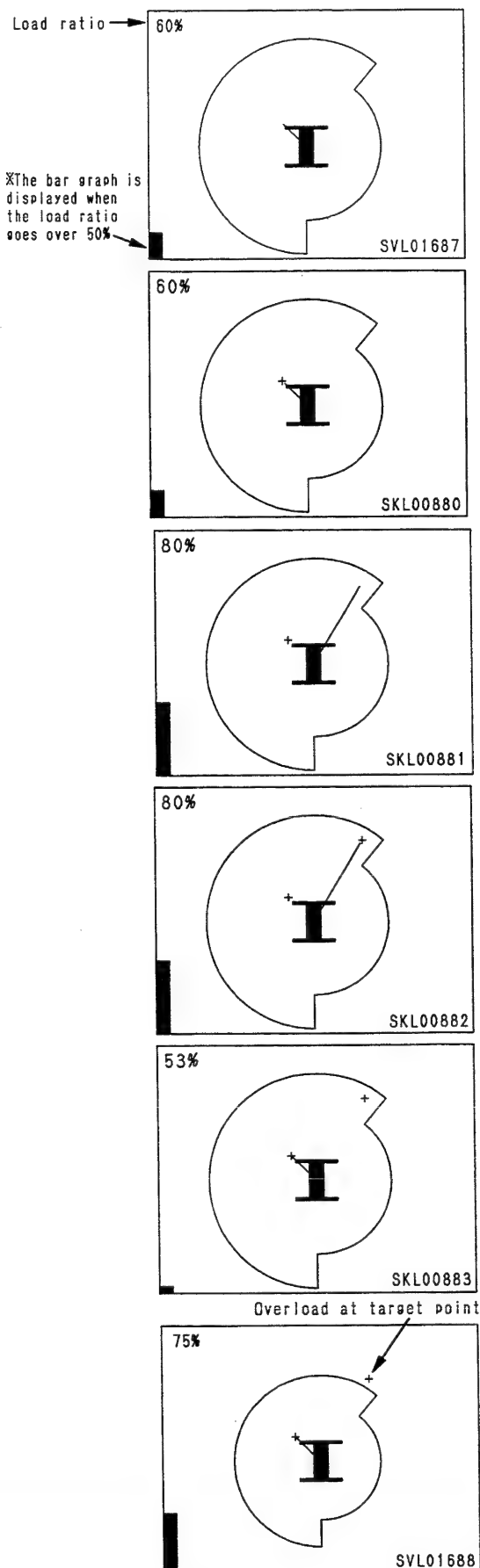


Screen when on-tire running hang setting is completed
<ul style="list-style-type: none"> Does not show outrigger standard display (Max., Min., etc.) Length of outrigger on graphic display corresponds to sensor input value
For any other position, the display is the same as when completing the outrigger setting.
(For running hang, the transmission shift position is displayed)

023S05

3. Swing range Carrier standard

1) Overload forecast display



Radial direction – Working radius
Polar coordinate display
Circumferential direction – Swing angle
(corresponds to conventional swing range display)

Normal swing display screen

- With present boom length, rated working radius line is changed according to load to show maximum working radius as maximum circle
- Position of boom tip shows present working radius

Setting target point

- It is possible to set the target. (beginning point or finishing point) with the switch

Movement of load

The screen moves according to any change in the position of the tip of the boom

Setting target point

It is possible to set 2 target points

Movement to target

Move to the target point with no load

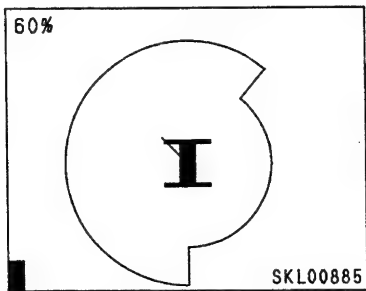
Forecasting overload

Lift new load

↓
The rated working radius changes according to the lifted load

↓
The target point goes outside the range, so it can be judged that there is overload.

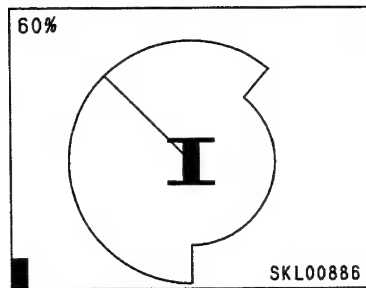
2) Swing range limit display



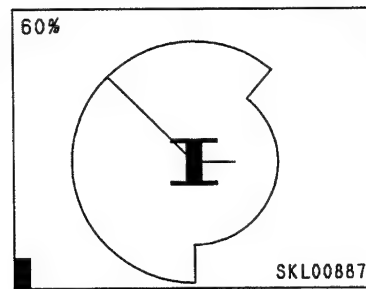
Rated radius
Swing limit
Working radius limit

Movable range display

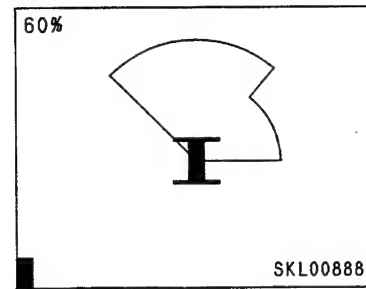
Normal screen for swing display
Same as when forecasting overload



Press left swing range limit switch
Draw a line from the present swing position to the maximum working radius point



Movement of swing

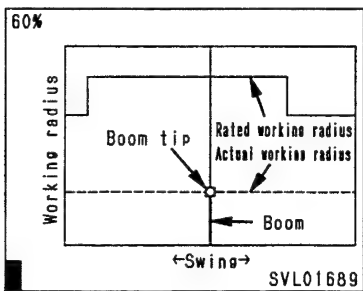


Press right swing range limit switch
If the left and right swing ranges are set, only the movable range is displayed

023S05

4. Target mode (orthogonal coordinates) operator (upper structure)

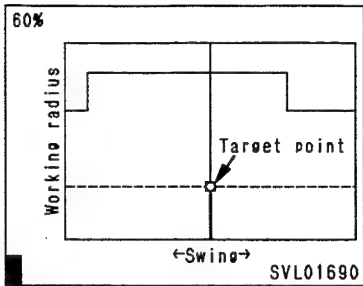
1) Target point set display



X-axis – swing direction orthogonal coordinate display
Y-axis – working radius

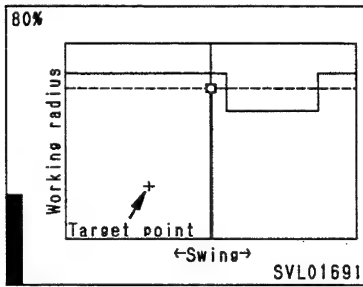
Normal display screen for target mode

Swing display given as orthogonal coordinates
The following shows operations that are the same as the swing display (overload for crust monitor)



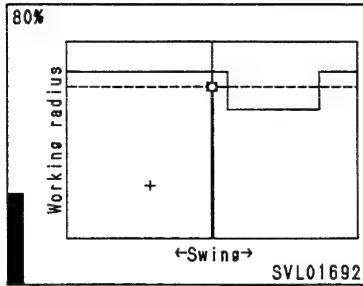
Setting target point

- Press the target point (starting point or finishing point) switch



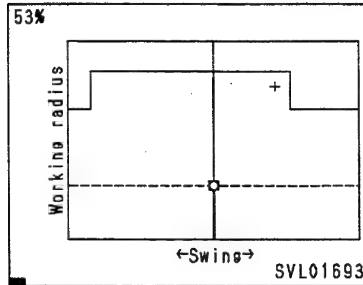
Movement of load

For the swing, the background display moves and for the actual working radius, the display for the position of the boom tip moves
(The rated working radius line changes when there are changes in the rated working radius caused by changes in the lifted load)



Setting target point

A maximum of two points can be set for the target point (press the opposite switch from the first point)

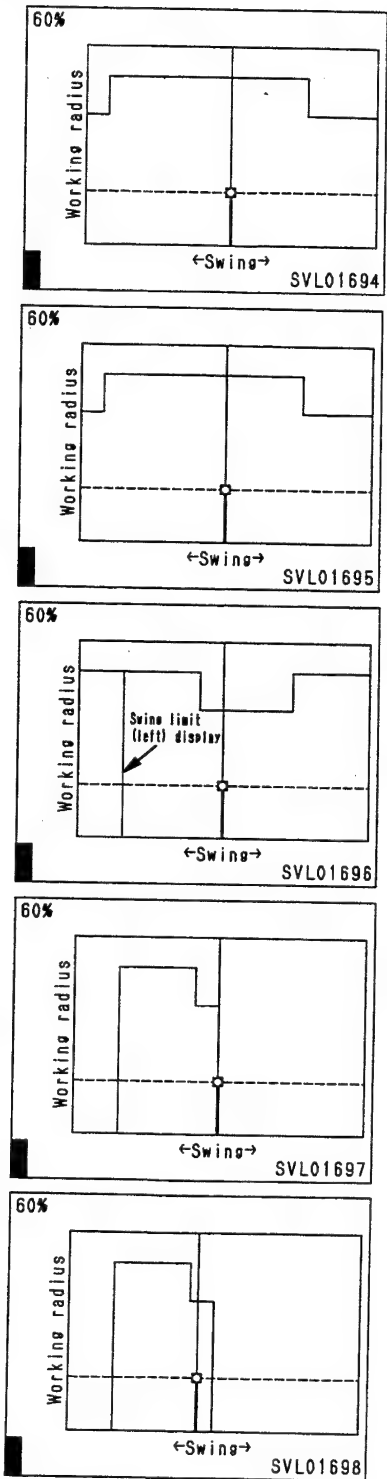


Movement to target point

The target point comes close to the boom tip display

023S05

2) Swing range limit



Rated radius
Swing limit
Working radius limit

Movable range display

Normal screen for swing display

When the swing range limit is carried out on the target mode screen the operation procedure is the same as for buzzer swing display

Press left swing range limit switch

When setting, push button lamp lights up

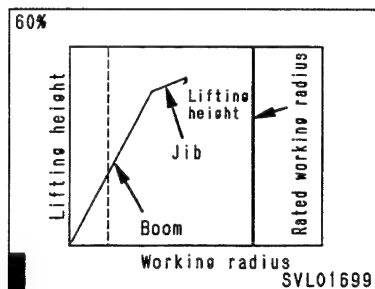
Movement of swing

When moving from the set swing angle, swing limit display appears

Press right swing range limit switch

023S05

5. Hoist display (working range limit)

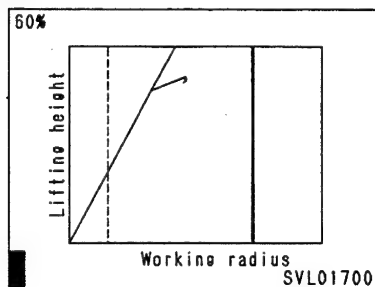


Rated radius
 Boom angle upper limit
 Boom angle lower limit
 Working radius limit
 Lifting height upper limit

Movable range display

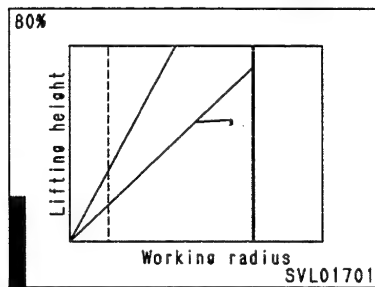
Normal screen for hoist display

Display is given based on maximum lifting height for present boom length (jib length)
 The rated working radius changes according to the lifted load



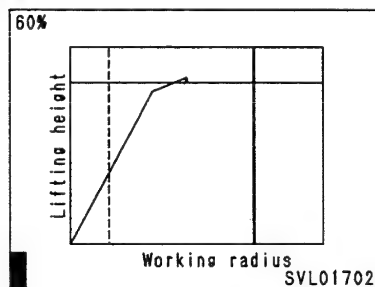
Press boom angle upper limit set switch

Boom angle upper limit line is displayed



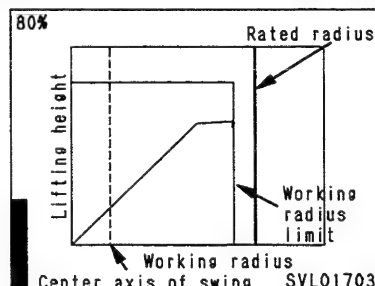
Press boom angle lower limit set switch

Boom angle lower limit line is displayed



Press lifting height upper limit set switch

Lifting height (boom height) upper limit line is displayed

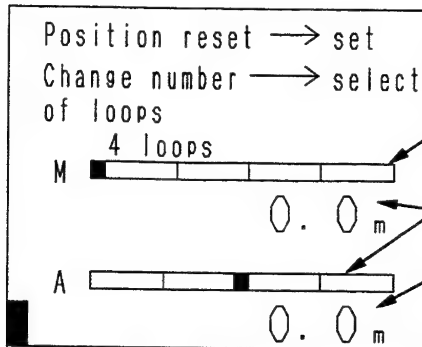


Press working radius limit set switch

Working radius upper limit line is displayed

The rated radius is displayed together with the range limit value, so it is easy to see the possible range of movement.

6. Winch mode display



With the main winch, if the hook moves 15mm-20mm/no. of loops, it will become out of position. It moves from left to right in synchronization with the movement of the hook.

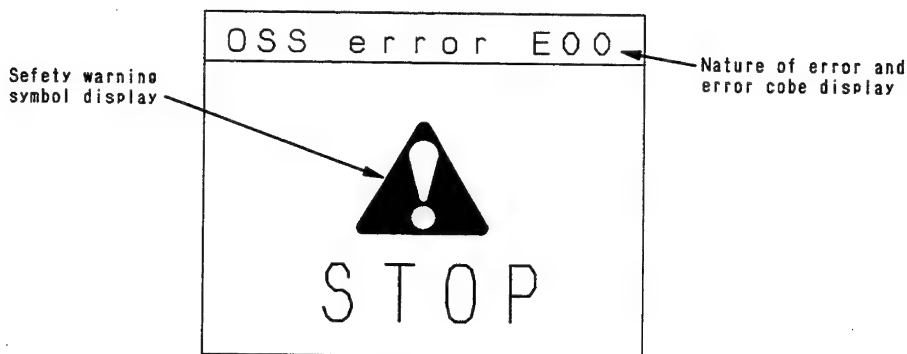
With the auxiliary winch, if the hook moves 15mm-20mm, it will become out of position. It moves from left to right in synchronization with the movement of the hook.

Amount of change in hook

lifting height: Displays feed-out length of wire rope from reset position (does not change according to boom length, boom angle) The above display has an error of approx. 15%, so use it as a guide during operations. When returning to 0, press the set switch and it will return.

SVL01704

7. Emergency stop error display



SVL01705

Abnormalities in transmission controller during travel, abnormalities in moment limiter controller during operations

If there ARE any abnormalities in the MDT upper or lower communications, and it becomes impossible (or almost impossible) to control the machine, the graphic display changes to the display shown above and the alarm buzzer sounds.

Stop travel and operations and investigate the condition of the failure.

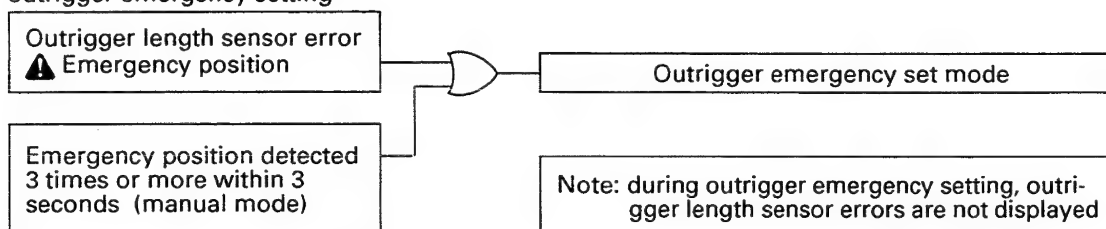
8. Outrigger emergency set mode

Details of control

Selection of load table	By emergency set operation
External warning lamp	Red lamp lights up
Outrigger extension width	By emergency set operation

- (1) When the lower working mode switch is set to the emergency set mode, it is taken as a change in the lower working mode (the display mode changes to the crane set mode).
- (2) In the emergency position, it is normally impossible to set the working mode. (Except when the conditions for making it possible to use the emergency set are fulfilled)
 - The outrigger set message is blank (no display)
 - The outrigger cannot be set
- (3) When the system enters the emergency setting, the message [Outrigger emergency setting] is displayed.
- (4) When the system enters the emergency setting because of an error, even if the abnormality is reset and the condition returns to normal, the emergency set mode is maintained.
- (5) If another error occurs during emergency setting, processing is carried out based on that error.
- (6) Even during the emergency setting, if an outrigger control signal is detected, the screen returns to the outrigger mode display screen (crane set mode) and the set value for the outrigger extension is also cleared.

Conditions for possible use of outrigger emergency setting



Method for outrigger emergency setting

No.	Operation command item	Content of message	Remarks
1	Outrigger emergency setting	Outrigger emergency setting	<ul style="list-style-type: none"> • [Outrigger emergency setting] displayed for 2 seconds • Conditions for possible use of outrigger emergency setting are as above • Except when conditions for possible use of outrigger emergency setting are fulfilled, emergency setting operation command message is blank • Select extension width with selector switch Maximum → Intermediate 1 → Intermediate 2 → Intermediate 3 → Intermediate 4 → Minimum (The default is Maximum) • Use the set key to move to the next step • Extension width is set in the following order: Front right → front left → rear right → rear left • The maximum extension display is the default for the graphic display • If the lower working mode switch is shifted to any position other than [Emergency], the extension width setting is cleared • [Setting completed] is displayed for two seconds

Note : At [Setting completed], the buzzer sounds for 2 seconds.

Overwind input

If the overwind LS input (CNC14-1) becomes OPEN (+24V), [Stop! Overwind] is displayed on the monitor in a blinking inverted display, and the automatic output (CNC11-5) and warning are output.

However, in the preparatory mode, this processing is not carried out.

(See automatic stop control chart and warning output chart)

Boom telescope selection

The boom telescope mode is determined by the combination of the boom select switch inputs (CNC14-4: top, 14: second). The boom telescope selector solenoid output (CNC11-17) and the display message to the panel are determined and output according to the combination of the pressure switch inputs (CNC13-2: EXTEND, 1: RETRACT) and the top boom stow LS input (CNC 14-2).

Mode Input	CNC14-14	CNC14-4	CNCB-2	CNCB-10	Second boom extension detection value	CNC14-2	Output CNC1-17	
Automatic telescope selection	24V	24V	24V∩GND (EXTEND)		Reset	24V	GND	[Warning! Boom telescope abnormal]
					Set	GND		
			GND∩GND Or GND∩24V (RETRACT • N)		Reset	24V	24V	[Warning! Boom telescope abnormal]
					Set	GND	GND	
					Reset	24V	24V	
					Set	GND	GND	
					Reset	24V	24V	
					Set	GND	GND	
Manual (2nd)	GND	24V	24V∩GND (EXTEND)		Reset	24V	GND	
					Set	GND		
			GND∩GND Or GND∩24V (RETRACT • N)		Reset	24V		[Boom telescope completed]
					Set	GND		
					Reset	24V		
					Set	GND		
					Reset	24V		
					Set	GND		
Manual (Top)	24V	GND	24V∩GND (EXTEND)		Reset	24V	24V	
					Set	GND		
			GND∩GND Or GND∩24V (RETRACT • N)		Reset	24V		
					Set	GND		
					Reset	24V		
					Set	GND		
					Reset	24V		
					Set	GND		
								[Boom telescope completed]

023S05

Second boom extension detection value (for automatic telescope selection)

The boom length sensor and boom telescope PPC pressure switch are used to judge if the second boom is completely extended, and the value is determined according to the condition.

Setting condition value (second boom fully extended):

Judgment is carried out from 13 cm or less from the point where the second boom is fully extended.

Boom EXTEND PPC pressure switch input (CNC13-2): 24V	} (EXTEND operation)
and	
Boom RETRACT PPC pressure switch input (CNC13-10): GND	
and	
Boom telescope selector solenoid output (CNC11-17): GND (second boom telescope)	
and	
Boom length sensor input deviation (CNC16-4): θ (No change in boom length sensor)	

Resetting condition value (second boom starting to retract)

Boom EXTEND PPC pressure switch input (CNC13-2): GND	} (RETRACT operation)
and	
Boom RETRACT PPC pressure switch input (CNC13-10): 24V	
and	
Boom telescope selector solenoid output (CNC11-17): 24V (second boom telescope)	
and	
Top boom stowing limit switch input (CNC14-2): GND (Top boom stow detected)	

PTO input

The PTO is switched between the Travel mode and the Operation mode according to the condition of the PTO input (CNC 14-8, 18).

Travel mode	Operation mode	
CNC14-8	24V	0V
CNC14-18	0V	24V

Over-front detection

In the on-tire mode or running hang mode, if the swing angle sensor detects $+_10$ to the front, it judges that the boom is in the over-front range and switches the rated load. In addition, if the display mode on the control panel is the outrigger mode, it

displays the over-front indicator on top of the chassis display.

Lever stand LS

If the PTO is in the Operations mode, and the lever stand LS input (CNC 14-12) is 24 V, the automatic stop solenoid output (CNC11-5) and the jib condition PPC solenoid output (CNC11-6) are set to 0V. (Work equipment stopped)

When this happens, the monitor displays the LEVER STAND LOWERED message.

Preparatory mode

(jib extension/stow operation mode)

When the upper working mode switch on the panel is set to PREPARATORY, the system enters the preparatory mode, and is different from the normal operation in the jib extension operation, so the error that is generated (boom angle sensor lower limit error, etc.) and automatic stop caused when there is overwinding are canceled. In addition, the red external display lamp lights up, and [**Warning!**] and [**No overwind automatic stop**] are displayed in turn.

For the extend/stow operation, the signals in the following table are output. (Power tilt specification only)

Conditions	Output
Panel upper working mode preparatory	CNC11-20 : 24V (jib extend/stow permitted)
Jib tilt angle $\geq 70^\circ$ and Boom angle $\leq 30^\circ$	CNC11-20 : 24V (swing out permitted)

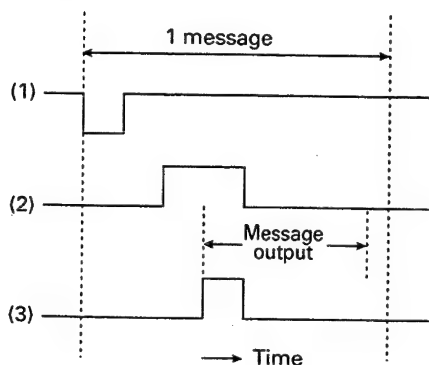
If the work equipment is not in the correct posture, the automatic stop and alarm and message are generated. (For details, see automatic stop chart and warning output chart.)

023S05

Automatic stop cancel prohibition relay (CNC11-7)

The automatic stop cancel prohibition switch is used when it is considered that the situation is dangerous if the automatic stop is canceled. (When the conditions do not permit the automatic stop to be canceled. See the automatic stop chart). When the switch is operated, the automatic stop cancel prohibition relay output is turned ON (24 V), the automatic stop cancel line is shut off, and the automatic stop cancel stops having effect. However, in the service mode, the cancel operation becomes possible for everything.

Voice alarm (option)



- (1) Voice alarm power source (CNC11-11): When there is 24 V output
With the voice alarm it is possible to output a message
It is possible to interrupt the message during the output by turning the voice alarm power OFF (0V).

- (2) Voice alarm
 0 (CNC12-4) } : Output for message
 1 (CNC12-14) } selection
 2 (CNC12-15)

	Voice alarm $\left(\begin{array}{l} \text{L : 0V} \\ \text{H : 24V} \end{array} \right)$			Message
	2	1	0	
1	L	L	L	Danger
2	L	L	H	Overload
3	L	H	L	Upper limit stop
4	L	H	H	Setting stopped
5	H	L	L	Stopping
6	H	L	H	Stop swing
7	H	H	L	Check working mode
8	H	H	H	Set outriggers

- (3) Voice alarm trigger (11-21): Start the message output.

Service mode

This mode is used when adjusting sensors, when carrying out troubleshooting, and when performing general service work.

In addition to a function which also observes the monitor code, it also has other functions such as a sensor adjusting function and a trouble data display.

For details, see TESTING AND ADJUSTING.

Automatic Stop Condition Table

Cause	Actuation conditions	Operation of work equipment	Main unload (O : Continuous / X: Not continuous Note 1)									
			Boom hoist		Boom telescope		Main winch		Auxiliary winch		Jib hoist	
			RAISE	LOWER	EX-TEND	RE-TRACT	WIND IN	WIND OUT	WIND IN	WIND OUT	RAISE	LOWER
Overload (Overturn danger angle) (Over-tension)	Overload $\geq 100\%$ or boom angle \leq overturn danger angle or tension (= W_a/N) $>$ line pull limit		O	X	X	O	X	O	X	O	O	X
Overwind	Overwind LS: OPEN		O	X	X	O	X	O	X	O	O	X
Boom angle upper limit	Boom angle $\geq 81.5^\circ$ Boom hoist cylinder at end of stroke		X	O	O	O	O	O	O	O	O	O
Jib tilt angle limit	Jib operation + tilt angle $\leq 5^\circ$ Jib operation + tilt angle $> 61^\circ$		O	O	O	O	O	O	O	O	X	O
Upper working mode Preparation (Fixed tilt specification: ※ only)	※ Boom length ≥ 11.6 m (Fixed tilt specification: 16 m)		O	O	X	O	O	O	O	O	X	X
	Boom angle $\geq 30^\circ$		X	O	O	O	O	O	O	O	X	X
	Boom angle $< 1^\circ$		O	O	X	O	O	O	O	O	O	O
	Boom length ≤ 103 m		O	O	O	O	O	O	O	O	O	X
	Left lock LS OPEN (not locked) (CNC14-5)		O	O	X	O	O	O	O	O	O	O
Jib extension connector connection (GND)	Boom length ≥ 11.6 m is not preparation mode + jib extension connector connected + left lock LS 24 V (locked)		O	O	X	O	O	O	O	O	O	O
Working range limit	Working radius	Actual working radius \geq set value	O	X	X	O	O	O	O	O	O	X
	Lifting height	Actual lifting height \geq set value	X	O	X	O	O	O	O	O	X	O
	Boom angle upper limit	Actual boom angle \geq set value	X	O	O	O	O	O	O	O	O	O
	Boom angle lower limit	Actual boom angle \leq set value	O	X	O	O	O	O	O	O	O	O
	Left swing	Swing angle \leq set value (when swinging left)	O	O	O	O	O	O	O	O	O	O
	Right swing	Swing angle \geq set value (when swinging right)	O	O	O	O	O	O	O	O	O	O
Rear stability	On-tire operations (stationary, traveling) + boom angle $\geq \alpha \times \text{boom length} \div \beta \times 2$		X	O	O	X	X	O	X	O	O	O
	Outrigger operations + boom angle $\geq \alpha \times \text{boom length} \div \beta \times 2$		O	O	O	O	O	O	O	O	O	O
Working mode limit	1. "Working mode combination defective" detected 2. Working mode combination check defective		O	X	X	O	X	O	X	O	O	X
	Working condition setting not completed 1. PTO Travel \rightarrow PTO1, PTO2 2. Outrigger operation detected 3. More than 2 hours since key OFF 4. Change in lower working mode 5. When outrigger set mode is entered in above condition		O	O	O	O	O	O	O	O	O	X
	Carrier working mode outrigger		O	O	O	O	O	O	O	O	O	O
	Carrier working mode on-tire stationary		O	O	O	O	O	O	O	O	O	O
	Carrier working mode running hang		O	O	O	O	O	O	O	O	O	O
	Crane working mode boom		O	O	O	O	O	O	O	O	O	O
	Crane working mode single top		O	O	O	O	O	O	O	O	O	O
	Crane working mode jib extension		O	O	O	O	O	O	O	O	O	O
	Crane working mode jib 1st stage, 2nd stage		O	O	O	O	O	O	O	O	O	O
	Carrier working mode outrigger/on-tire stationary \rightarrow running hang		O	O	O	O	O	O	O	O	X	X
	Carrier working mode outrigger/on-tire stationary \rightarrow PTO Travel											
	Display mode check		O	X	X	O	X	O	X	O	O	X
	Service mode											
Abnormality in boom telescope	2nd boom extension not completed + top boom stow LS OPEN		O	O	O	O	O	O	O	O	O	O
Lever stand travel	Lever stand LS: OPEN		X	X	X	X	X	X	X	X	X	X
Automatic stop when error occurs	See Troubleshooting		O	X	X	O	X	O	X	O	O	X

(1) Rear stability



(2) Boom angle upper limit

If (1) or (2) and any other boom LOWER prohibition occur together, boom LOWER is possible.

※2: Boom angle $\geq 1.564 \times \text{boom length} \div 63.01$ or boom angle $\geq 0.3274 \times \text{boom length} \div 77.19$

PPC unload jib LOWER

• Set to unload regardless of PPC pressure switch

Auto- matic stop cancel	PPC unload jib LOWER	Trans- mission shift position	Remarks
Possible	×		
Possible	×		
Possible	○		
Possible	○		
Possible	×		
Possible	×		
Possible	×		
Possible	○		
Im- possible	○		
Im- possible	○		
Possible	×		
Possible	×		
	×		Caution! Does not function normally when there is sensor error
Possible	○		During outrigger operations, if setting changes to on-tire operations with work equipment in same posture, and rear stability automatic stop conditions are fulfilled, outrigger operations are prohibited
Possible	×		
Possible	×		Condition is taken as on-tire operation and rated overall load is limited
Possible	○	N	Transmission set to N regardless of shift position
Possible	×	N	Transmission set to N regardless of shift position
Possible	×		Prevention of damage to jib caused by mistake in jib stowing operation
Possible	×		Prevention of damage to jib caused by mistake in jib stowing operation
Possible	×		Prevention of damage to jib caused by mistake in jib stowing operation
Possible	○		
Possible	○		
Possible	×	Safety	
		Safety	No OSS system output at PTO Travel 7seg. LCD all go out
Possible	○		
Possible	○		Condition exists before entering check mode, but automatic stop cancel is permitted for everything
Possible	○		Top boom stow LS: OPEN → upper limit (14.5 ton: ON) carried out for rated overall load
Im- possible	×		In lever stand Travel, always unload (PPC, main, jib LOWER power cut)
Possible	×		

Note 1: Main unload output algorithm

Elements of automatic stop		Main unload solenoid	
		○: Continuous ×: Not continuous	
None		○	
Yes	× operation of element that occurred	×	High
	○ operation of element that occurred	○	↑
	Lever neutral	×	Low

When an error occurs together with the automatic stop, the processing of the automatic stop (including overload) may not be carried out normally.

Therefore, when an error occurs together with the automatic stop, only the automatic stop related to overturning (※1) is carried out.

When an error occurs, be extremely careful and return to a safe posture.

※1

※1

If the gearshift lever is at any position other than N, there is danger that the machine may start off suddenly. For this reason, the N safety is applied (the machine does not move until the gearshift lever is returned to OFF).

Actuated regardless of mode

※1

023S05

Warning output chart

Condition \ Output		dot, LCD (message)	Message rank (priority)	OSS buzzer 1 CNC12-7 (high pitch)	OSS buzzer 2 CNC12-12 (low pitch)	External warning lamp (option)
Overload	Warning (90% – less than 95%)	Caution XX%! Overload (XX: Load ratio)	Warning		2Hz	Yellow
	Warning (95% – less than 100%)				4Hz	
	Alarm (over 100%)	Stop! Overload	Alarm		Continuous	Red
	Alarm (over 110%)					
Swing warning	Warning (less than 15°)	Caution! Swing	Warning		2Hz	
	Warning (less than 8°)				4Hz	
Overwind		Stop! Overwind	Alarm		Continuous	Red
Line pull limit		Line pull limit	Alarm		Continuous	Red
Boom angle upper limit	Warning (less than 5°)	Caution! Boom angle upper limit	Warning		2Hz	
	Warning (less than 2°)				4Hz	
	Alarm	Stop! Boom angle upper limit	Alarm		Continuous	
Boom angle lower limit (Jib mode) ※1	Warning (less than 10°)	Caution! Boom angle lower limit	Warning		2Hz	
	Warning (less than 5°)				4Hz	
Jib angle to ground $\angle \alpha \geq 0^\circ$	Warning (less than 8°)	Caution! Jib angle to ground	Warning		2Hz	
	Warning (less than 4°)				4Hz	
Jib tilt angle $\angle \alpha \geq 5^\circ$	Warning (less than 8°)	Caution! Jib tilt limit	Warning		2Hz	
	Warning (less than 4°)				4Hz	
	Alarm	Stop! Jib tilt limit	Alarm		Continuous	
Jib tilt angle 61°	Warning (less than 8°)	Caution! Jib tilt limit	Warning		2Hz	
	Warning (less than 4°)				4Hz	
	Alarm	Stop! Jib tilt limit	Alarm		Continuous	
Upper working mode preparation	Jib extension/stow mode	Caution! No automatic overwind stop	Alarm		Continuous	Red
	Jib length ≥ 11.6 m	Retract boom	Alarm		Continuous	
	Jib angle $\geq 30^\circ$	Lower boom	Alarm		Continuous	
Lever stand LS: OPEN		Lever stand lowered	Alarm			
Check before operation When starting switch is ON		System check	Warning			
Jib extension connector GND + boom length ≥ 11.6 m + not preparatory mode + left lock pin LS 24V (locked) + not preparatory mode		Check jib harness	Alarm		Continuous	

※1 : When boom is actuated : $\alpha = 20 + (\text{boom angle (deg)}) / 4$ [cm]
 Just before maximum rated radius : $\alpha / 2 - \alpha$ [cm] Warning 2Hz
 $0 - \alpha / 2$ [cm] Warning 4Hz

Voice alarm (option)	Remarks
Stopping	Voice alarm
Overload Overload/danger (continuous)	
Stop swing	Buzzer, alarm actuated if swing is operated in direction of danger
Danger	Message is highlighted
Stopping	Buzzer alarm actuated only when boom is operated to RAISE Boom angle LCD flashes (2Hz)
Upper limit stop	Boom angle LCD flashes (2Hz)
Stopping	Buzzer alarm actuated only when boom is operated to LOWER Boom angle LCD flashes (2Hz)
Stopping	Buzzer alarm actuated only when jib (boom) is operated to LOWER
Stopping	Buzzer alarm actuated only when jib is operated to RAISE
Stopping	Buzzer alarm actuated only when jib is operated to LOWER
Danger	
	Overwind automatic stop canceled

023S05

Condition \ Output			dot, LCD (message)	Message rank (priority)	OSS buzzer 1 (high pitch)	OSS buzzer 2 (low pitch)	External warning lamp (option)
Working range limit	Working radius limit	Warning (less than 2 m)	Caution! Radius limit	Warning		2Hz	
		Warning (less than 1 m)				4Hz	
		Alarm	Stop! Radius limit	Alarm		Continuous	
	Lifting height limit	Warning (less than 2 m)	Caution! Lifting height limit	Warning		2Hz	
		Warning (less than 1 m)				4Hz	
		Alarm	Stop! Lifting height limit	Alarm		Continuous	
	Angle upper limit	Warning (less than 8°)	Caution! Angle upper limit	Warning		2Hz	
		Warning (less than 4°)				4Hz	
		Alarm	Stop! Angle upper limit	Alarm		Continuous	
	Angle lower limit	Warning (less than 8°)	Caution! Angle lower limit	Warning		2Hz	
		Warning (less than 4°)				4Hz	
		Alarm	Stop! Angle lower limit	Alarm		Continuous	
	Left swing limit	Warning (less than 15°)	Caution! Left swing limit	Warning		2Hz	
		Warning (less than 8°)				4Hz	
		Alarm	Stop! Left swing limit	Alarm		Continuous	
	Right swing limit	Warning (less than 15°)	Caution! Right swing limit	Warning		2Hz	
		Warning (less than 8°)				4Hz	
		Alarm	Stop! Right swing limit	Alarm		Continuous	
Rear stability			Stop! Rear stability	Alarm		Continuous	Red
Boom telescope abnormality			Caution! Boom telescope abnormality	Alarm		Continuous 2 sec	
			Float reaction upper limit	Alarm		Continuous	
Automatic stop cancel			Automatic stop cancel actuated	Warning			Red
Automatic stop cancel prohibition			Danger! Cancel prohibition	Alarm		Continuous	Red
Outtrigger operation prohibition			Danger! Outtrigger operation	Alarm		Continuous	
Operating condition	When outriggers are not set		Outtrigger not set	Warning			Red
	Working mode combination check		Check again! Working mode	Alarm		Continuous 2 sec	
	Transmission N check		Check again! Shift position	Alarm		Continuous 2 sec	
	Operating condition not set		Outtrigger set command message	Alarm		Continuous 2 sec	
	Check mode		All light up for 3 sec → All go out for 1 sec	Alarm	All light up for 3 sec → All go out for 1 sec		
Neutral safety			N safety	Alarm		Continuous 2 sec	
Accumulator pressure drop			Accumulator pressure drop	Alarm			
Overrun			Overrun	Alarm			
Hydraulic oil temperature 70℃			Hydraulic oil temperature 70℃	Alarm			

Order of priority for messages: ①>②>③>④>⑤

- ① Error message
 - ② Alarm message
 - ③ Warning message
 - ④ Load ratio less than 90%
- If there are messages of the same rank, the display message flashes for 2 sec each.

Order of priority for buzzer output: ①>②>③>④>⑤

- ① Continuous (high pitch)
 - ② 1Hz (high pitch)
 - ③ Continuous (low pitch)
 - ④ 4Hz (low pitch)
 - ⑤ 2Hz (low pitch)
- Intermittent output:
Duty = 50%
 - Low pitch and high pitch can be output at the same time.

Voice alarm (option)	Remarks
Stopping	Buzzer alarm actuated only when boom (jib) is operated to LOWER, EXTEND Working radius limit LED (red) flashes
Setting stopped	Working radius LED (red) lights up
Stopping	Buzzer alarm actuated only when boom (jib) is operated to RAISE, EXTEND Lifting height limit LED (red) flashes
Setting stopped	Lifting height limit LED (red) lights up
Stopping	Buzzer alarm actuated only when boom is operated to RAISE Upper angle limit LED (red) flashes
Setting stopped	Upper angle limit LED (red) lights up
Stopping	Buzzer alarm actuated only when boom is operated to LOWER Lower angle limit LED (red) flashes
Setting stopped	Lower angle limit LED (red) lights up
Stopping swing	Buzzer alarm actuated only when swinging to left Left swing limit LED (red) flashes
Setting stopped	Left swing limit LED (red) lights up/ "Stop swing" given only when operating
Stopping	Buzzer alarm actuated only when swinging to right Right swing limit LED (red) flashes
Danger! Stop swing	Right swing limit LED (red) lights up/ "Stop swing" given only when operating
Upper limit stop	During on-tire stationary, running hang/outrigger operation when outrigger is operated (no voice alarm, no external warning lamp)
	Actuated only when automatic stop is canceled
	Actuated only when outrigger is operated (rear stability)
Check working mode	Display mode is outrigger mode regardless of position of display mode switch
Check working mode	When setting working condition in outrigger mode
Set outrigger	
	Returns to normal display after 4 sec

Order of priority for external warning lamp

Red>yellow>green

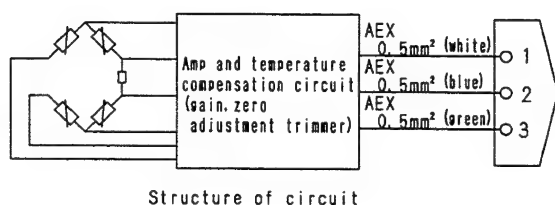
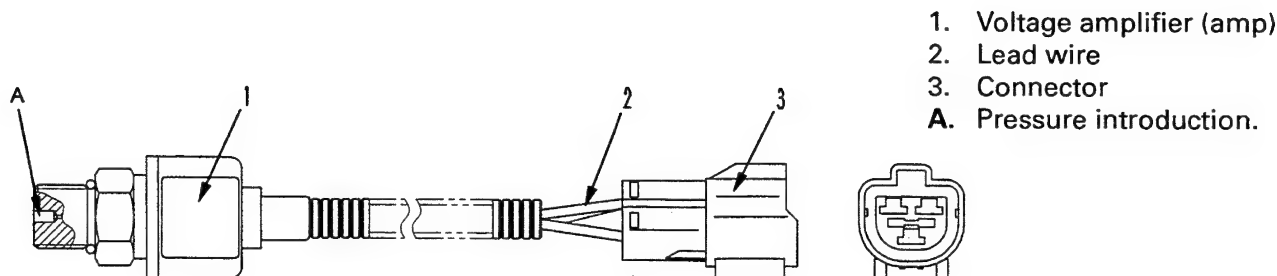
Green when there is no output for red or yellow

Order of priority for voice alarm

- The order of priority for voice alarm is the same as the message ranking

SENSORS

1. Cylinder pressure detection sensor



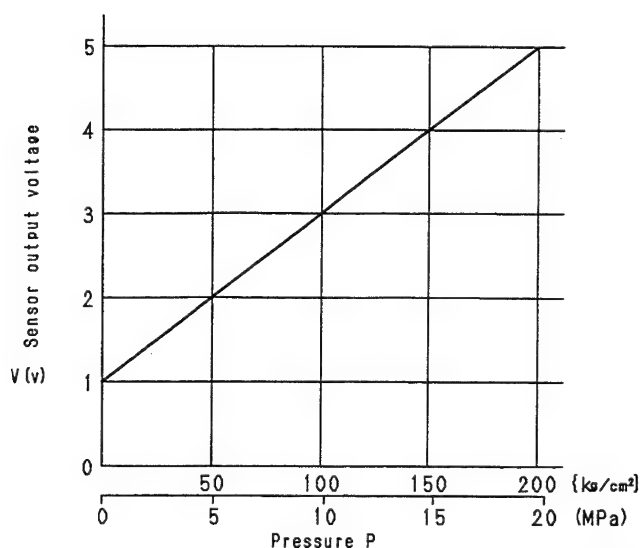
SVL01706

Outline

- The sensor converts the cylinder pressure to a voltage and sends a signal to the controller.

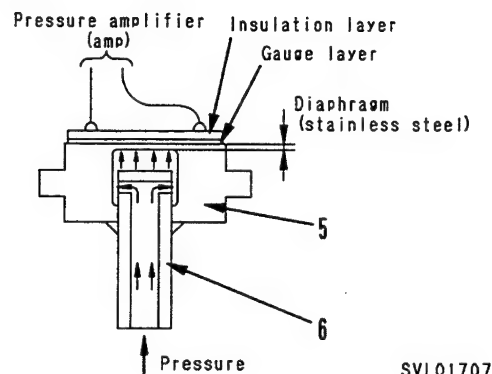
Function

- It outputs a voltage proportional to the pressure.



SVL01708

Operation



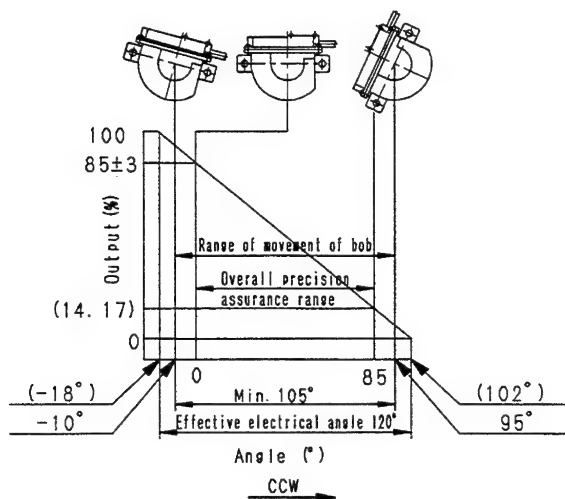
SVL01707

- When the pressure oil entering from pressure introduction port (A) is pressurized in the diaphragm portion of pressure detection module (5), the diaphragm deflects. A bridge is formed by a strain gauge on the facing surface of this diaphragm. The deflection of the diaphragm is converted from the resistance of the strain gauge to the bridge output voltage and is sent to the voltage amplifier.
- In the voltage amplifier, the voltage is amplified and output to the controller.

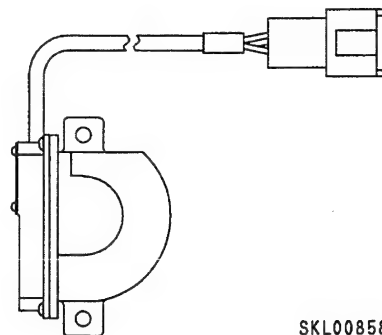
2. Boom angle detection sensor

- This sensor detects the angle of the boom from the horizontal. It consists of a potentiometer (an element that converts the angle of rotation to an electric signal) and a bob. The bob is always perpendicular regardless of the angle of the boom. The potentiometer is fixed to the boom, so the potentiometer shaft (which is fixed to the bob) rotates as the boom is raised or lowered. As a result, it is possible to pick up the angle of the boom from the horizontal as an electric output using the potentiometer.

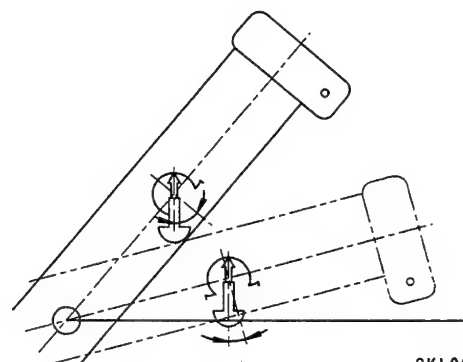
Characteristics of boom angle detection sensor



SVL01709



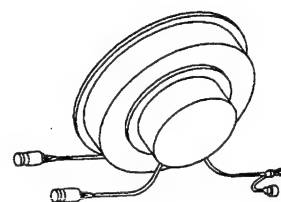
SKL00858



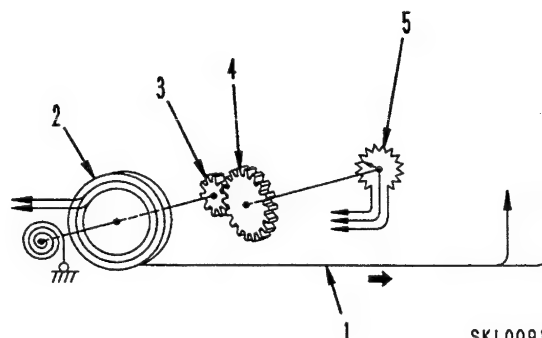
SKL00909

3. Boom length detection sensor

- This sensor detects the extension of the boom in relation to the base boom. Wire (1), which is fixed to the tip of the boom, is wound onto drum (2), and the drum rotates as the boom is extended. This rotation is transmitted through gears (3) and (4) to potentiometer (5). The length of the boom is picked up as an electric output by detecting the rotation of the potentiometer.
- Standard output (when 10V is impressed)
2.0V (0 m) – 7.04V (22 m)

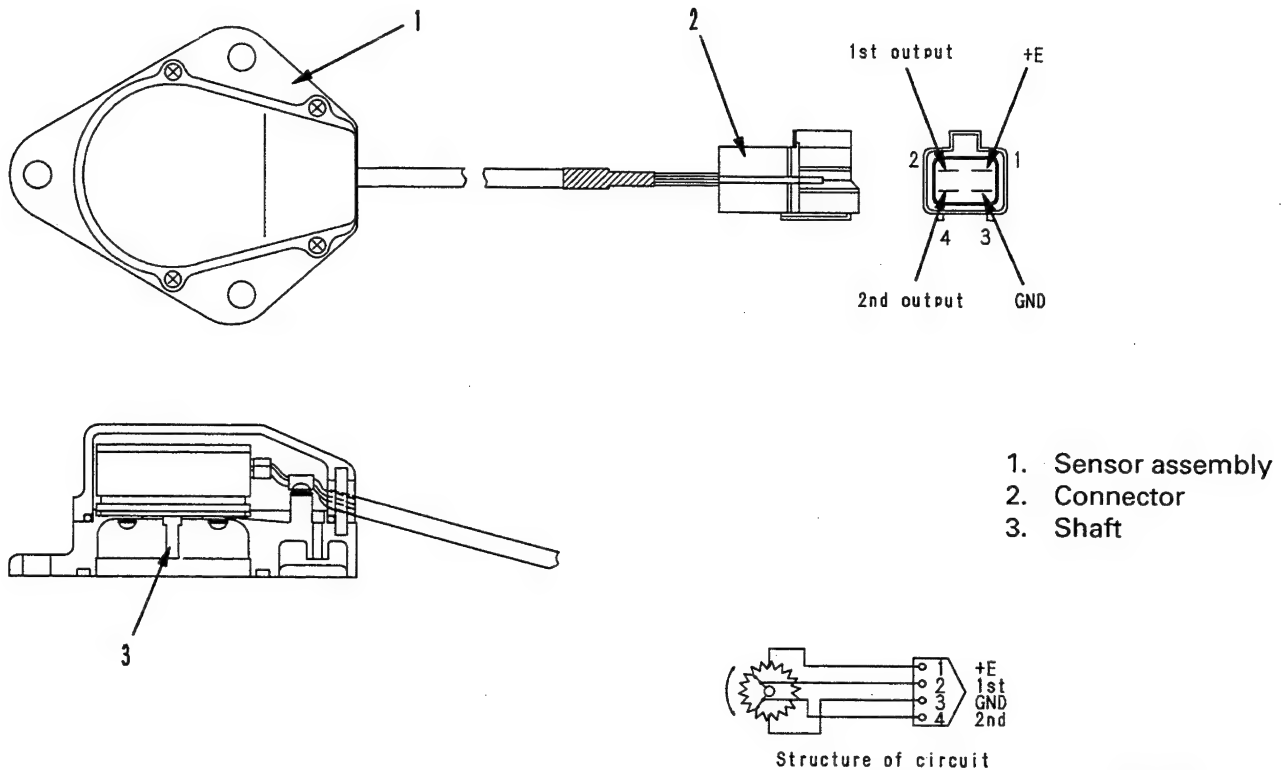


SLL00911



SKL00912

4. Swing angle detection sensor



SVL01710

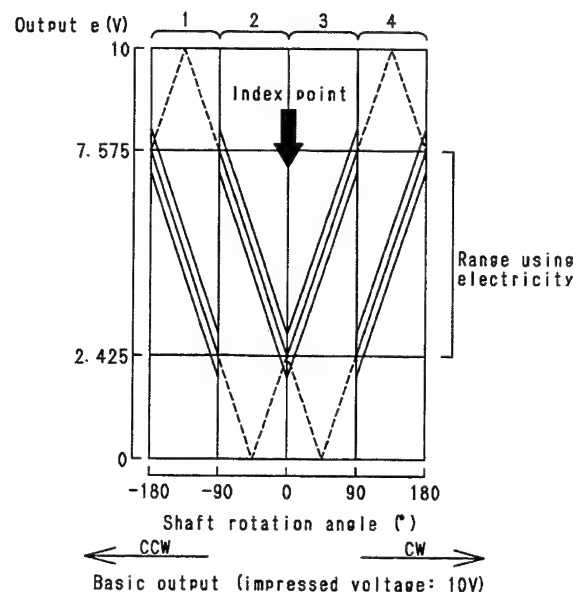
023S05

- The swing angle sensor is installed on top of the slip ring. Inside the sensors there is a variable resistance (a mechanism that changes the resistance according to the rotation of the shaft).

It sends an electrical signal to the controller and makes it possible to know electrically the angle of the upper structure to the chassis. (Inside there are two intersecting brushes and it is possible to detect the angle of the upper structure over a range of 360° from this output.)

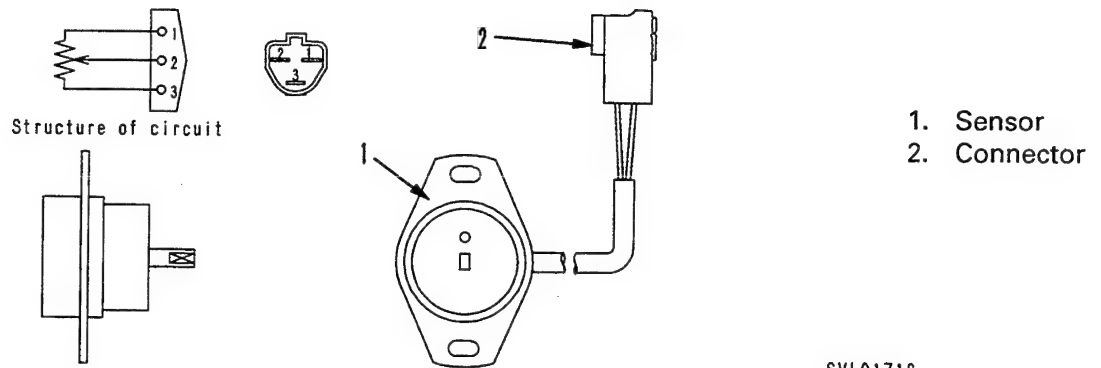
Characteristics of swing angle sensor

- 1, 3 : Range using 1st output
2, 4 : Range using 2nd output



SVL01711

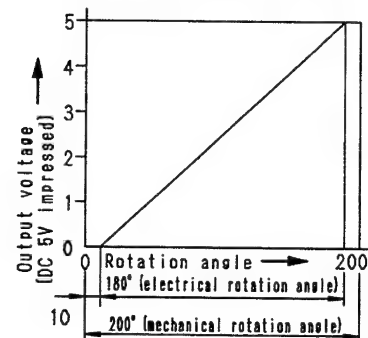
5. Jib angle detection sensor (power tilt jib machines)



SVL01712

- The jib angle sensor is installed to the tip of the boom. Inside the sensor there is a variable resistance (a mechanism that changes the resistance according to the rotation of the shaft). It sends an electrical signal to the controller and makes it possible to know electrically the angle of the jib.

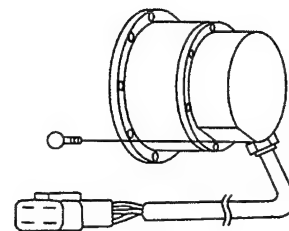
Characteristics of output



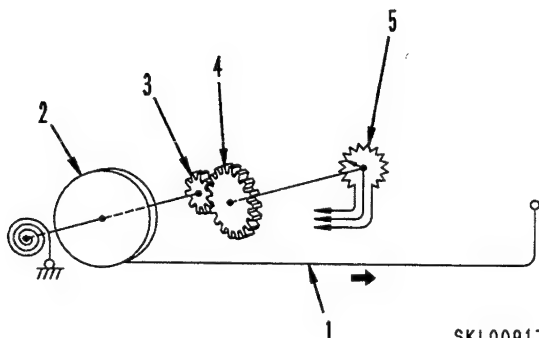
SVL01713

6. Outrigger length detection sensor

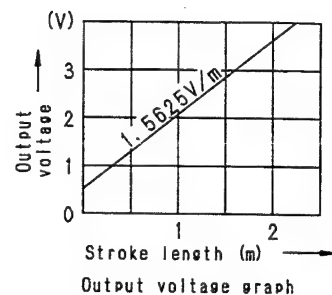
- This sensor detects the extension of the outrigger enough frame in relation to the outrigger outer frame. Wire (1), which is fixed to the tip of the outrigger, is wound onto drum (2), and the drum rotates as the outrigger is extended. This rotation is transmitted through gears (3) and (4) to potentiometer (5). The length of the outrigger is picked up as an electric output by detecting the rotation of the potentiometer.



SLL00915



SKL00917

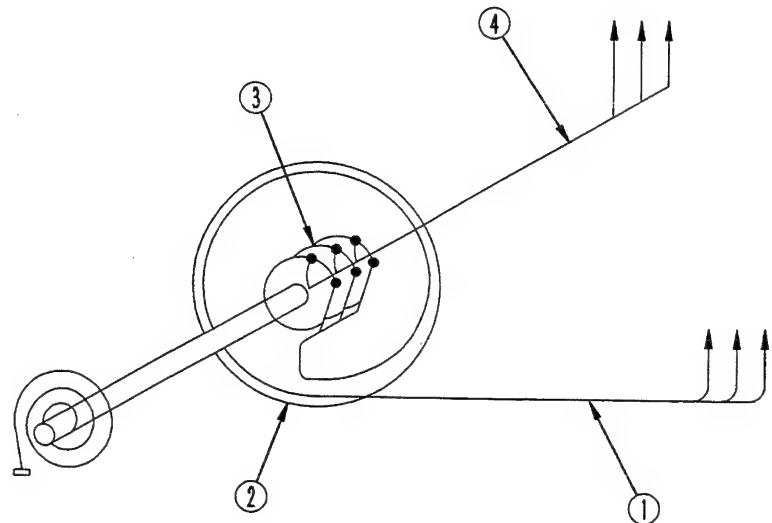


Output voltage graph

SVL01714

7. Jib angle cord reel (power tilt jib machines)

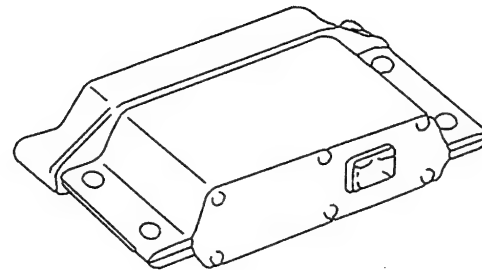
- This device is used to transmit the signal from the jib angle detector. Wire (1) fixed to the tip of the boom is wound onto drum (2), and the drum rotates as the boom is extended. The signal from the jib angle detector is transmitted through wire (1) and slip ring (3) to wire (4).



SLL01423

8. Transmission module (power tilt jib machines)

- The transmission module is installed on top of the boom. It receives the analog signal from the boom angle detection sensor and converts it to a digital value. The converted result is transmitted through the jib angle cord reel as a serial output to the moment limiter control panel inside the cab.



SLL01426

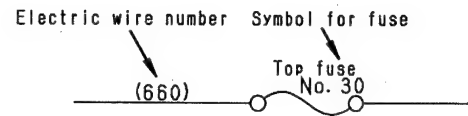
023S05

OUTLINE, OPERATION OF ELECTRIC CIRCUITS

METHOD OF READING DIAGRAMS EXPLAINING OPERATION

- The diagrams explaining the operation given here are taken from the LW250-5 electric circuit diagrams for the system used for starting and the system used for charging. The parts given are only the parts related to the operation and actuation of the sensors, solenoid valves, lamps, and switches. Other parts, such as the connectors, have been omitted.

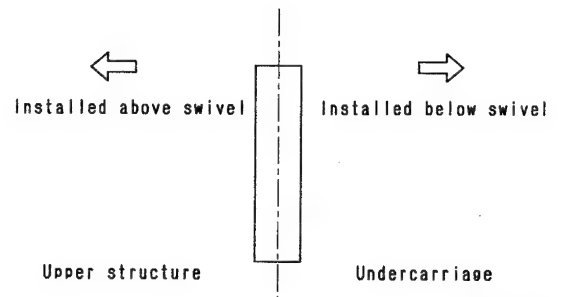
- The symbols for terminals, the numbers for the electric wiring, and the symbols and names given for the fuses in the circuit diagrams are all the same as those given in the electric circuit diagrams.
- The LW250-5 is divided electrically into two parts (the upper structure and the undercarriage) by the swivel joint (slip ring). Therefore, in the circuit diagram, the position of installation for each item of equipment is distinguished by a double dashed (short and long dash) line as shown in the diagram on the right: the left side of the dashed line indicates the upper structure, while the right side indicates the undercarriage.
- On the LW250-5, the number of electric wires between the upper structure and the undercarriage is extremely large, so a multi data transfer system (MDT unit) is used to send the electricity flowing through the many wires in bundles. In the circuit diagram, as shown in the diagram on the right, the MDT upper unit is on the left side of the swivel joint, while the MDT lower unit is on the right side. Electric wires No. 903 and No. 901 bundle the electricity at the upper unit, and send it through the swivel joint to the lower unit, while wires No. 904 and No. 902 bundle the electricity at the lower unit and send it through the swivel joint to the upper unit. To increase reliability, double wiring is used for each wire.



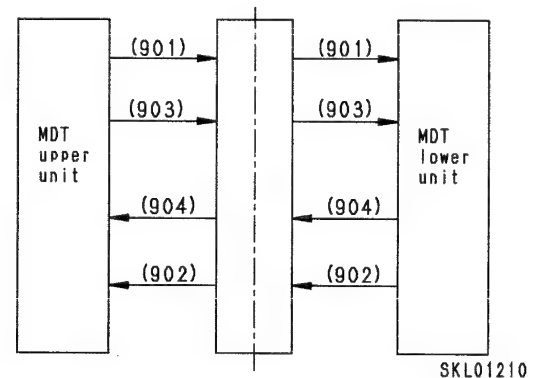
Working lamp switch

	1	2	3	4
O N				
OFF				

SKL01208



SKL01209



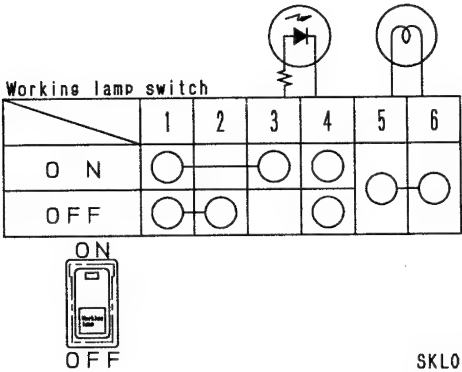
SKL01210

4. Details of manually operated switches other than the sensors are given in the switch connection table in the circuit drawing, and the connection of the contacts inside the switches is shown.

Example: Working lamp switch

When the top part of the working lamp switch is pressed, the internal contacts are connected, and electricity passes through terminals 1 – 3.

When the bottom of the working lamp switch is pressed, electricity passes through terminals 1 – 2.



SKL01211

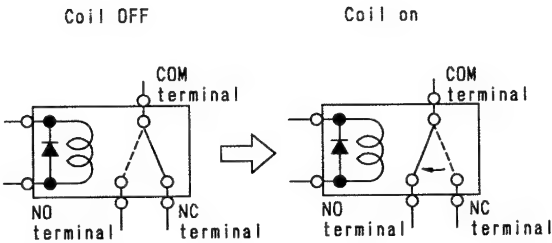
5. Operation of relay

Relays consist of one coil and one pair or several pairs of switches.

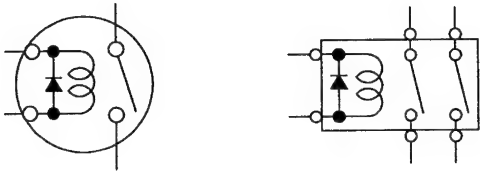
While there is no electric current flowing to the relay coil (de-energized), the reaction force of the leaf spring connects the points with the points on the far side from the coil. However, when electric current flows to the coil (excited) the magnetic force generated by the coil overcomes the reaction of the leaf spring, and connects to the terminal near the coil to switch the flow of the current.

The terminal which is connected when there is no electric current flowing to the coil is called the NC (Normally Closed) terminal, and the terminal which is not connected is called the NO (Normally Open) terminal.

The battery relay, emergency steering relay, and relay for the working lamp are connected only when electric current flows to the coil as shown in the diagram on the right.



SKL01212

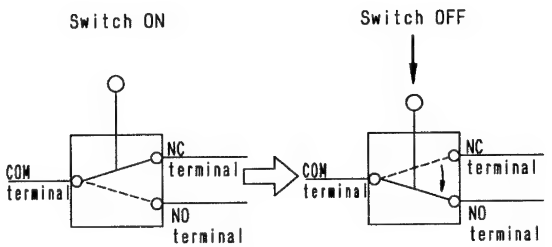


SKL00484

6. Operation of limit switch

Limit switches are mainly used to detect the condition of the machine. They transmit or switch the signals by turning ON/OFF.

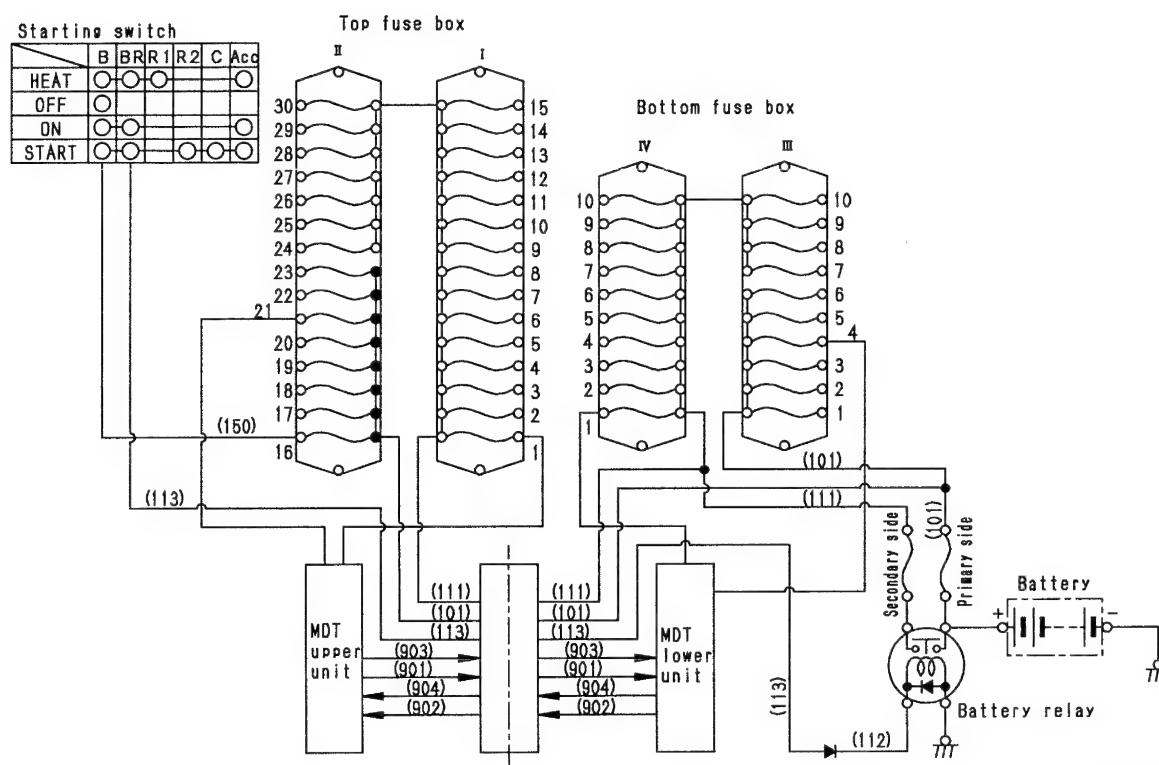
Limit switches are operated by external force: when there is no external force acting on them (in other words, when they are OFF), the COM terminal and NC (Normally Closed) terminal are connected; and when external force is acting on them (other words, when they are ON), the COM terminal and NO (Normally Open) terminal are connected.



SKL01213

023505

1. POWER SOURCE CIRCUIT



SKL01214

Outline

- The power source circuit is the circuit which provides electricity to all the electrical components. If there is a short circuit in the circuit and excessive current flows, the fuse blows and cuts the circuit to protect the electric wiring and equipment.
- In addition, there is a battery relay which turns the electricity in the whole electrical circuit OFF (except the primary power source) when the starting switch is turned to the OFF position.

The battery relay is actuated by electricity from terminal **BR** of the starting switch. One of the relay contacts (the primary side) is connected directly to the positive (+) terminal of the battery, and the other (the secondary side) supplies electricity to the electrical components, the overload safety system, and multi data transfer system (MDT unit).

Electricity is supplied directly from the battery (from the alternator when the engine is running) to terminal **B** of the starting switch, regardless of the action of the battery relay.

Outline

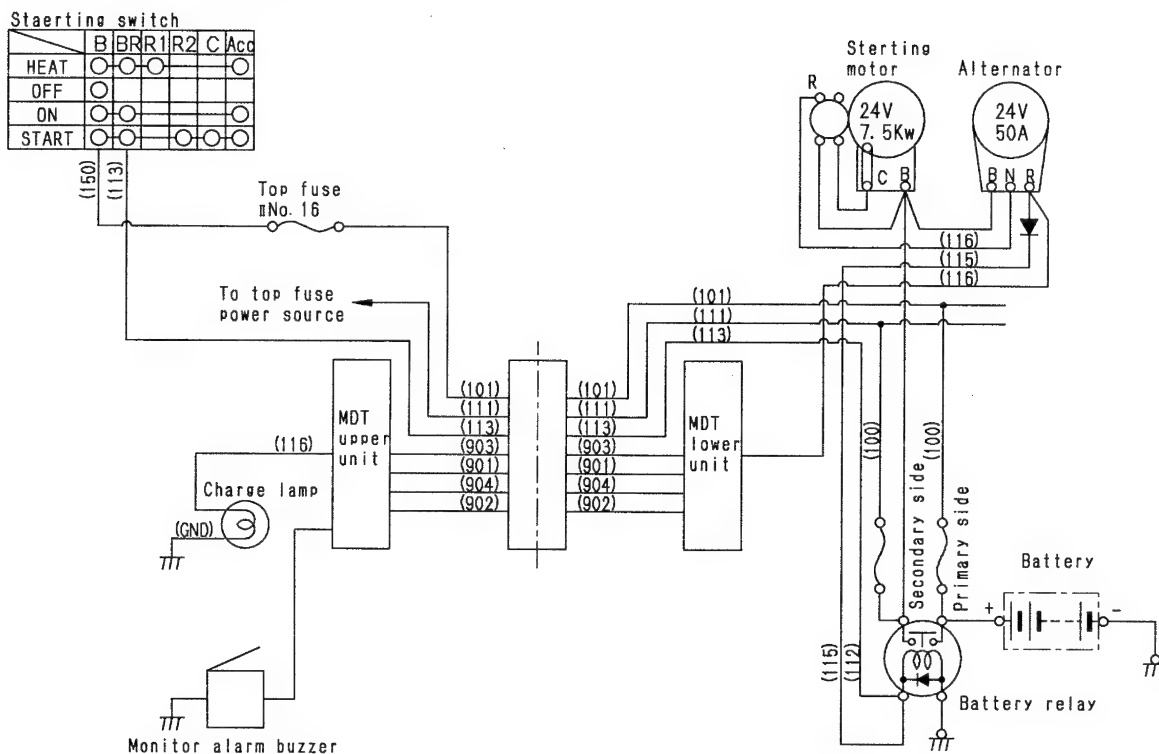
- The starting circuit is the circuit which cranks the starting motor and starts the engine. When the starting switch in the operator's compartment is turned to the START position, the starting motor in the undercarriage is actuated through the swivel joint by electricity from the battery.

Operation

- When the starting switch is turned to START, terminal **B**, terminal **C**, and terminal **BR** are connected. Terminal **B** of the starting switch is connected directly to the terminal of the battery through top fuse No. 1 and the swivel joint, so electricity flows from terminal **B** to terminal **C** and terminal **BR**.
The electricity leaving terminal **C** flows to the neutral safety relay.
At the same time, the electricity leaving terminal **BR** of the starting switch flows to the coil of the engine stop motor relay and the coil of the battery relay, and closes their contacts.
- When the contacts of the battery relay are closed, electricity from the battery goes to terminal **B** of the starting motor.
If the gear shift lever is at the **N** position, the electricity entering the neutral safety relay from terminal **C** of the starting switch passes from the relay contact, goes through the swivel joint, and flows to terminal **S** of the starting motor to make it possible to start the engine.
- When the contacts of the relay for the engine stop motor are closed, the engine stop motor is rotated by the electric power from bottom fuse III No. 1. The fuel cut lever on the fuel injection pump is moved back, and it becomes possible to operate the engine.
- With the operation of the above two relays, the engine will start.
When the engine starts and the alternator starts to generate electricity, the electricity flows to terminal **R** of the starting motor and stops the rotation of the starting motor.

023S05

3. CHARGING CIRCUIT



Outline

- When the engine is running, the alternator is driven by the power from the engine and generates electricity. The charging circuit is the circuit which charges the battery with this electricity or supplies it to the electrical components or the overload safety system or other electrical parts.

If the engine is stopped and the starting switch is at any position other than OFF, or when the voltage of the alternator shows an abnormal drop, the electric current to the electrical components flows from the battery, so the battery charge becomes low.

If this happens, the MDT unit lights up the charge lamp and the monitor alarm buzzer sounds.

Operation

1. When charging

The electricity generated by the alternator flows from terminal **B** of the alternator to terminal **B** of the starting motor, passes through the battery relay (secondary side) and flows to the other electrical component. It also flows to the battery and charges the battery. At the same time, some of the electricity leaving terminal **R** of the alternator passes through the diode and is connected to the coil of the battery relay. This prevents prob-

lems such as the charging load remaining open when the engine is running.

The rest of the electricity enters the MDT unit and turns off the charge lamp.

2. When discharged

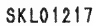
If there is an abnormal drop in the voltage of the alternator, the voltage of the electricity that was flowing from terminal **R** of the alternator to the MDT unit also drops. When it goes below approx. 10V, the MDT unit is actuated to light up the charge lamp and to sound the monitor alarm buzzer.

In this condition, if the starting switch is at any position other than OFF, the electricity from the battery flows to terminal **B** of the starting switch from the terminal on the primary side of the battery relay. It then flows from terminal **BR** to the coil of the battery relay and turns the relay contacts ON.

When this happens, the electricity from the battery flows to the secondary side of the battery relay, and then flows to terminal **B** of the starting motor or to the other electrical components. Some of the electricity flows from the top fuse through the MDT unit to the charge lamp to light up the lamp or to sound the monitor alarm buzzer.

SKL01216

023S05

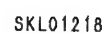


- The preheating circuit is a circuit which makes it easier to start the engine in cold weather by heating the air inside the engine intake manifold. It consists of a preheating ribbon and coil heater using an electrical heater and a heater relay which turns the large current flowing to the heater ON/OFF.

- When the starting switch is turned to the HEAT position, terminal **B** and terminal R1 are connected, so the electricity from the battery flows from terminal **B** to terminal **R1**. (Terminal **B** and terminal **BR** are connected at every position except OFF.)
Some of the electricity leaving terminal **R1** flows to the MDT unit, and flows to the coil of the heater relay to turn the contacts of the heater relay ON.
At the same time, it flows to the heater signal lamp to turn it ON.
The electricity leaving terminal **BR** of the starting switch passes through the swivel joint, flows to the coil of the battery relay, and turns the contacts of the battery relay ON.
When the contacts of both the heater relay and battery relay are turned ON, electricity flows from the battery, through each relay,

10-265

10-266



023S05

OUTLINE

- The lighting circuit is actuated by the combination switch at the right side of the steering wheel (lighting, dimmer, passing). It lights up the side lamps and head lamps, and is used when passing. (For details of the turn signal, see 6. Turn signal, hazard warning circuit)

OPERATION**1. Combination switch rotated one stage**

When the switch is rotated forward one stage, terminals **B1** and **B5** of the lighting combination switch are connected, and the electricity from top fuse No. 2 flows from terminal **B1** to terminal **B5**.

Some of the electricity leaving terminal **B5** lights up the meter panel, top panel switch, and front panel. At the same time, it flows to the boom top lamp. The rest of the electricity flows to the MDT unit, and then flows to the coil of the bottom side lamp relay, and connects relay terminals 3 and 5.

In addition, the electricity from top fuse I No. 4 flows to terminal 3 of the work side lamp relay, and when the PTO switch is in the "OPERATION 1" or "OPERATION 2" position, the electricity at switch terminal 3 excites the coil of the work side lamp relay, and connects terminals 3 and 5 of the relay. The electricity leaving terminal 5 of the relay lights up the panel switch, spirit level, and other work night lighting.

With the undercarriage, the electricity from bottom fuse III No. 2 flows from terminal 3 to terminal 5, goes to the lighting for the left and right side lamps, license lamp, and tachograph, and lights up these lamps.

In addition, the electricity leaving terminal 5 flows to the left and right tail lamps and lights them up.

2. Combination switch rotated two stages

When the switch is rotated two stages, terminal **B1** and terminals **B5** and **B2** are connected. The electricity from top fuse II No. 7 flows from terminal **B1** to terminals **B5** and **B2**.

The electricity leaving terminal **B5** flows in the same way as in Item 1 and lights up the side lamps.

At the same time, the electricity leaving terminal **B2** goes to the MDT unit.

In the MDT unit, the Hi/Lo beam is switched when the dimmer switch is turned ON.

When the dimmer switch is turned ON, dimmer switch terminals **B6** and **B4** are con-

nected, and the electricity leaving terminal **B4** enters the MDT unit. Depending on the number of times that the dimmer switch is operated, the MDT does as follows.

(1) If the count is an even number, the MDT turns the head lamp relay (Lo) ON and lights up the head lamps to the Lo setting (passing beam).

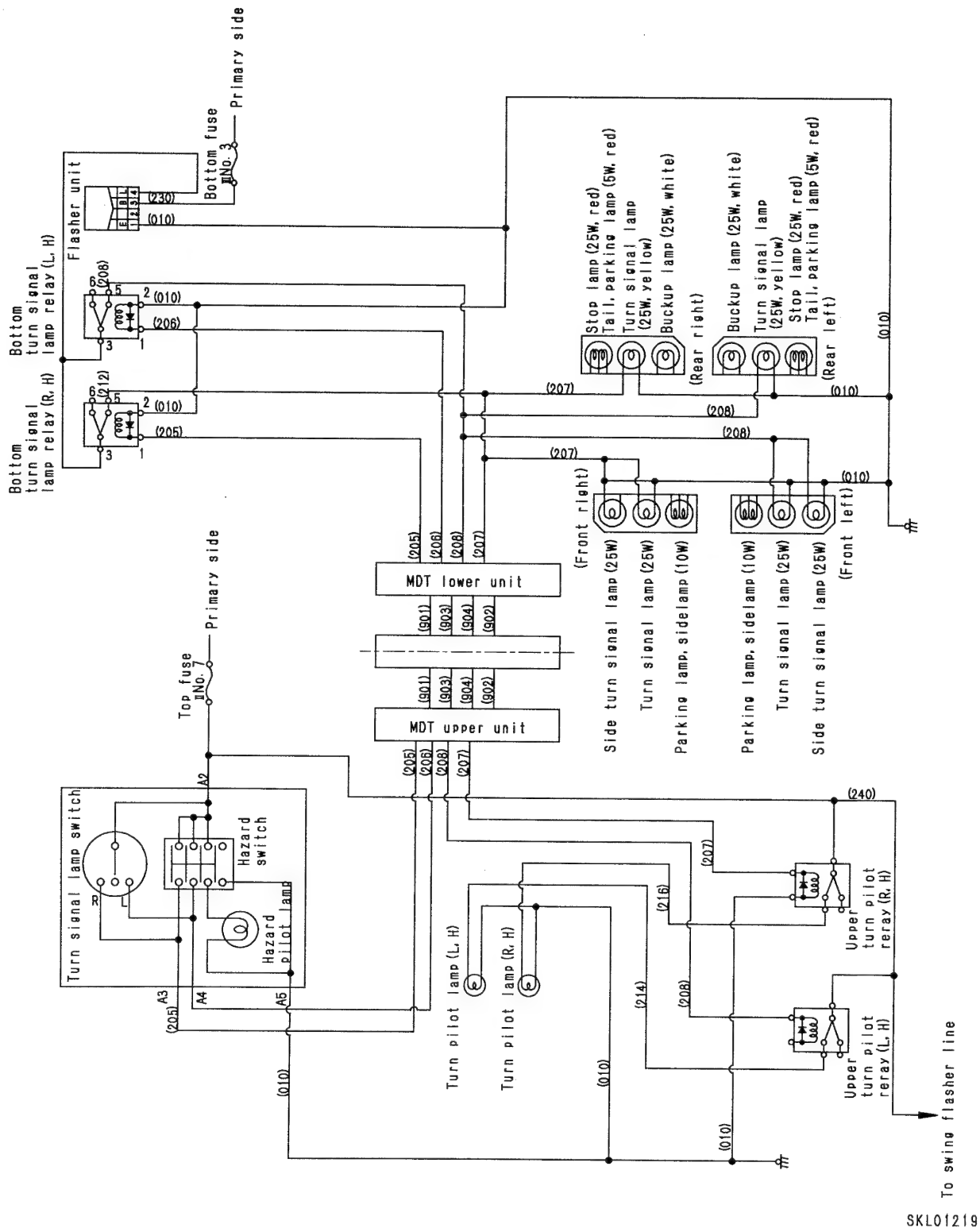
(2) If the count is an odd number, the MDT lights up the high beam indicator lamp, and also turns the head lamp relay (Hi) on and lights up the head lamps to the Hi setting (travel beam).

3. When lighting combination switch is OFF

When the dimmer switch is turned ON, the electricity from terminal **B4** enters the MDT and acts in the same way as in Step 2-(2) above.

The dimmer switch is an automatic return switch, so it lights up only when it is being actuated. (Passing function)

6. TURN SIGNAL, HAZARD WARNING CIRCUIT



023S05

SKL01219

OUTLINE

- The turn signal and hazard warning circuit is actuated by the combination switch (lighting, dimmer, passing, turn signal) on the right side of the steering wheel and the hazard switch in the center of the steering wheel, and makes the turn signal lamps flash.

OPERATION**1. When combination switch is operated to LEFT**

When the switch is operated to the LEFT (L), terminals **A2** and **A4** are connected, and electricity from top fuse II No. 17 flows from terminal **A2** to terminal **A4**.

The electricity leaving terminal **A4** flows to the MDT unit. It then flows to the coil of the bottom L.H. turn signal lamp relay, and connects relay terminals 3 and 5.

When this happens, the flasher receives the electricity from bottom fuse III No. 3, and the electricity from the flasher flows intermittently from terminal 3 to terminal 5. Part of the electricity flows to the front and rear left turn signal lamps to make them flash, while the rest of the electricity flows to the MDT unit, then flows to the coil of the top L.H. turn pilot relay, and connects terminals 3 and 5.

When this happens, the electricity from top fuse II No. 17 makes the left turn pilot lamp flash.

2. When combination switch is operated to RIGHT

When the switch is operated to the right (R), terminals **A2** and **A2** are connected, and electricity from top fuse II No. 17 flows from terminal **A2** to terminal **A3**.

The electricity leaving terminal **A3** flows to the MDT unit. It then flows to the coil of the bottom R.H. turn signal lamp relay, and connects relay terminals 3 and 5.

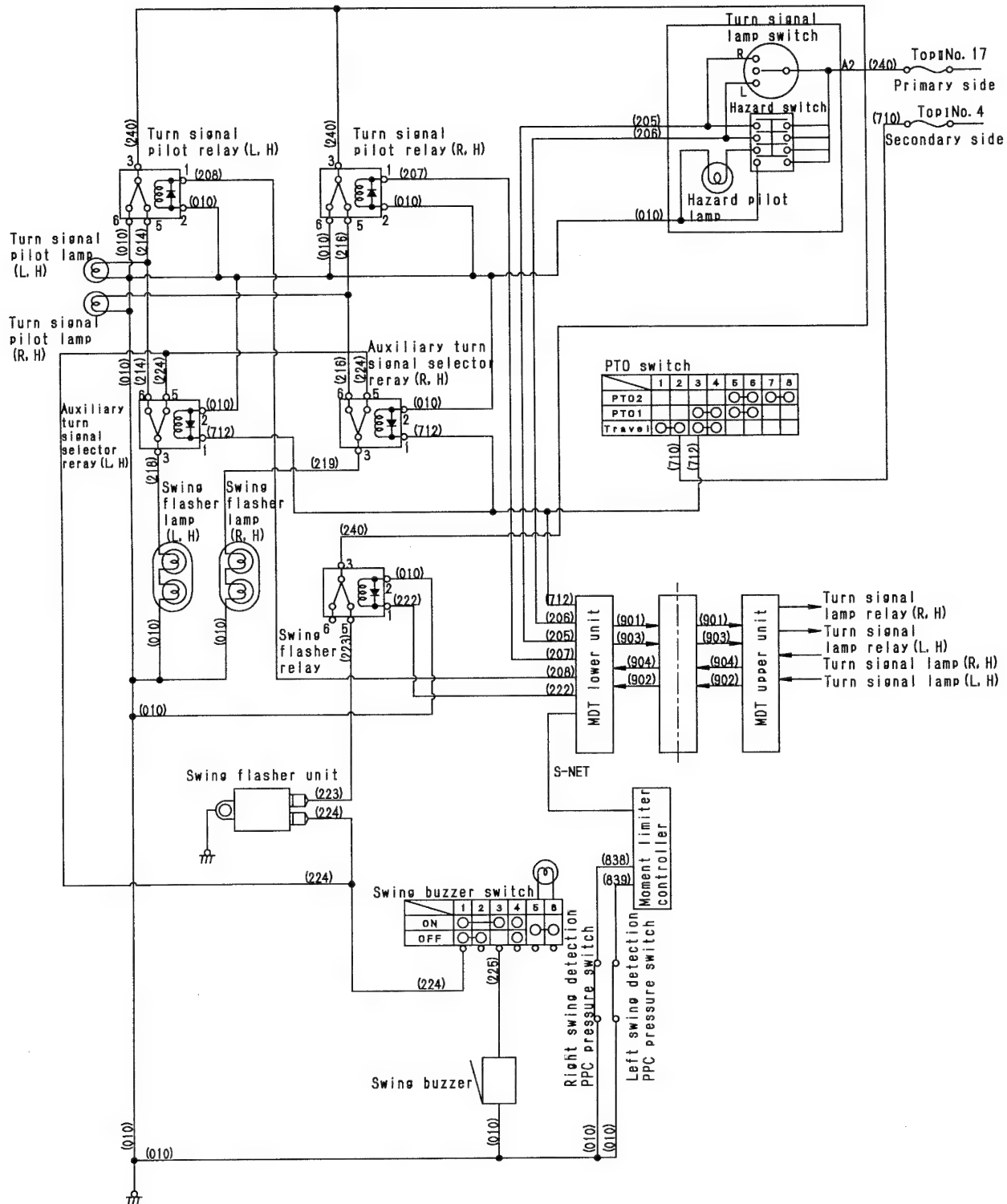
When this happens, the flasher receives the electricity from bottom fuse III No. 3, and the electricity from the flasher flows intermittently from terminal 3 to terminal 5. Part of the electricity flows to the front and rear right turn signal lamps to make them flash, while the rest of the electricity flows to the MDT unit, then flows to the coil of the top R.H. turn pilot relay, and connects terminals 3 and 5.

When this happens, the electricity from top fuse II No. 17 makes the right turn pilot lamp flash.

3. When hazard switch is ON

When the switch is turned ON, the hazard pilot lamp lights up, and the actuation in Items 1 and 2 is also carried out at the same time. The front and rear left and right turn signal lamps and the left and right pilot lamps all flash.

7. SWING FLASHER CIRCUIT



023S05

SKL01220

OUTLINE

- The swing flasher circuit makes the swing flasher lamps on the left and right of the revolving frame flash. At the same time, it sounds the swing horn intermittently. When the swing lever is operated to swing the upper structure, it functions as the swing warning lamp; and when traveling on public roads, it is interconnected with the other turn signal lamps, and functions as an auxiliary turn signal lamp. The function is switched according to the position of the PTO switch. When the switch is at the "OPERATION 1" or "OPERATION 1" position, it acts as the swing flasher lamp; when the switch is at the "TRAVEL" position, it acts as a turn signal lamp.

OPERATION**1. Swing flasher lamp**

If the PTO switch is set to the "OPERATION 1" or "OPERATION 2" position, terminals 5 and 6 are connected, electricity from top fuse No. 11 flows from terminal 5 to terminal 6, and excites the left and right auxiliary turn signal selector relays.

When the PTO switch is at the "OPERATION 1" or "OPERATION 2" position, and the right work equipment control lever stand is at RAISE, if the swing control lever is operated, the swing detection PPC pressure switch is changed from CLOSED to OPEN, and the lever swing operation is detected.

The swing signal is transmitted from the OSS controller to the MDT upper unit and excites the swing flasher relay. Relay terminals 3 and 5 are connected, and the electricity from top fuse II No. 17 flows from terminal 3 through terminal 5, and goes to the swing flasher unit. Therefore, the electricity from the turn signal pilot relay does not flow to the swing flasher lamp.

The electricity passing through the swing flasher unit becomes intermittent. The electricity flows from terminal 5 of the left and right auxiliary turn signal relays to terminal 3, then flows to the left and right swing flasher lamps, and makes them flash. At the same time, if the swing buzzer switch is ON, the swing buzzer sounds.

2. Auxiliary turn signal lamp

If the PTO switch is at the "TRAVEL" position, the left and right auxiliary turn signal selector relays are not excited, so relay terminals 3 and 6 are connected.

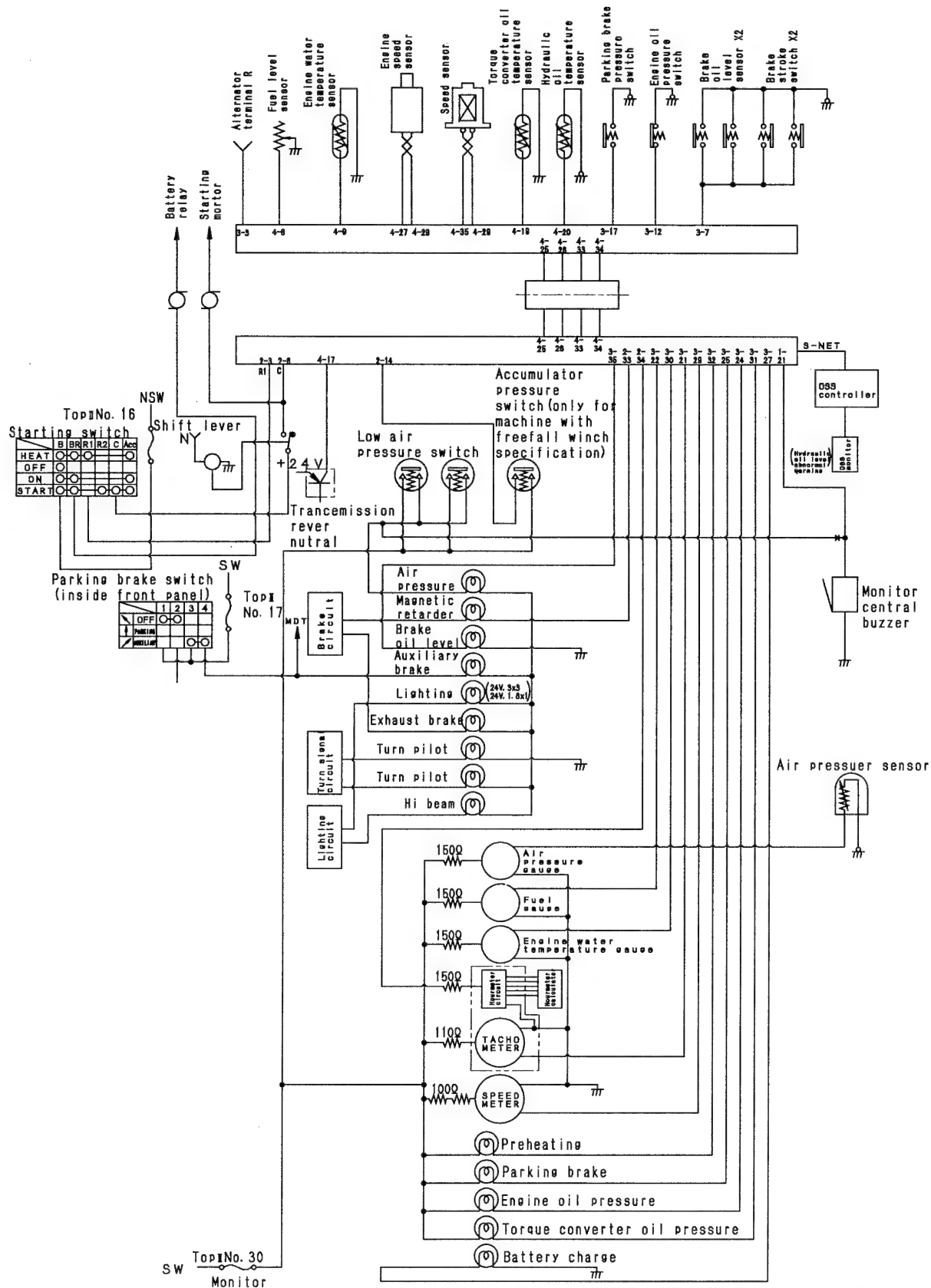
In this condition, if the turn signal switch or hazard switch is operated, the turn signal lamp on the undercarriage flashes, and at the same time, intermittent electricity is output as the pilot signal from the MDT upper unit. The electricity output as the pilot signal flows to the coil of the turn signal pilot relay, and relay terminals 5 and 3 are intermittently connected.

When this happens, the electricity from top fuse II No. 17 flows from relay terminal 5 to terminal 3, and some of the electricity flows to the turn pilot lamp and makes it flash.

The rest of the electricity flows from terminal 6 of the auxiliary turn signal relay to terminal 3, and makes the swing flasher lamp flash as an auxiliary turn signal lamp.

023S05

8. MONITORING CIRCUIT



023S05

SKL01221

OUTLINE

1. **Speedometer system**

The speed sensor detects the speed of rotation of the transmission output shaft, and moves the speedometer indicator to display the pulse signal.

The speed sensor is installed to the front output shaft end of the transfer case, and electrically detects the number of gear teeth that pass in front of it.

Magnetism is used to detect the number: a magnet and detection coil are assembled inside the sensor, and each time the gear teeth pass the front face of the sensor, a voltage is generated. The ON-OFF frequency of this voltage signal passes through the MDT unit and is informed to the speedometer.

The speedometer indicator moves in proportion to the frequency of this ON-OFF pulse.

The output of the speedometer sensor at a travel speed of 45 km/h is 218.7 Hz.

The MDT output to the speedometer at a travel speed of 45 km/h is 125.6 Hz.

2. **Tachometer system**

The tachometer sensor detects the engine speed, and moves the tachometer indicator to display the pulse signal.

The tachometer sensor is installed to the engine front cover and sends electricity when it is rotated.

The tachometer sensor switches the electricity ON-OFF in proportion to the rotating speed of the crankshaft, and informs the tachometer of this rotating speed through the MDT unit. The tachometer indicator moves in proportion to the frequency of this ON-OFF pulse.

The output of the tachometer and the MDT output to the tachometer are both 16 pulse/rev.

3. **Engine coolant temperature system**

The engine water temperature sensor detects the coolant temperature and the engine water temperature indicator moves to display this electric signal.

The engine water temperature sensor is installed to the engine thermostat case, and detects the coolant temperature as a resistance value.

4. **Torque converter oil temperature system**

The oil temperature sensor detects the torque converter oil temperature, and when the temperature is high, the torque converter oil temperature warning lamp lights up, and the monitor alarm buzzer sounds.

The torque converter oil temperature sensor

is installed to the torque converter case, and detects the torque converter outlet port oil temperature as a resistance value.

The lamp lights up when the oil temperature rises to approx. 120°C and goes out when the temperature drops to approx. 110°C.

The monitor buzzer sounds when the oil temperature rises to approx. 130°C and stops when the temperature drops to approx. 120 °C.

5. **Fuel level system**

The level of the fuel remaining inside the fuel tank is detected by the fuel level sensor, and the fuel gauge indicator moves to display this electric signal.

The fuel level sensor is installed to the fuel tank, and the float and potentiometer detect the fuel level as a resistance value.

6. **Air pressure system**

The pressure in the air circuit is detected by the air pressure sensor, and the air pressure gauge indicator moves to display this electric signal.

The air pressure sensor is installed to the piping at the bottom right of the dashboard, and detects the distortion of the diaphragm receiving the air pressure as a resistance value.

The electricity flows from top fuse II No. 30 through the air pressure gauge to the sensor resistor, and the change in the value of the electric current when this happens moves the air pressure gauge indicator.

7. **Engine oil pressure system**

The engine oil pressure sensor is installed to the left side of the engine cylinder block, and the diaphragm which receives the engine oil pressure opens and closes the contacts.

When the oil pressure goes below 0.05 MPa {0.5 kg/cm²}, the contacts close and are connected to the ground. When this happens, the MDT lights up the engine oil pressure warning lamp. It also sounds the monitor alarm buzzer.

8. Air pressure drop system

There is one low air pressure switch each installed to the piping at the bottom right of the dashboard and the outside of the cab. The diaphragm which receives the air pressure opens and closes the contacts.

When the oil pressure goes below 0.5 ± 0.04 MPa ($5 \pm 0.4 \text{ kg/cm}^2$), the contacts close, so the air pressure drop warning lamp lights up. The MDT also sounds the monitor alarm buzzer.

9. Brake fluid level system

The brake fluid level sensor is installed inside the brake oil reservoir, and the lead switch inside the float opens and closes the points according to the oil level.

When the level is low, the contacts close and are connected to the ground, so the MDT lights up the brake fluid level warning lamp. It also sounds the monitor alarm buzzer.

When the brake oil starts to overheat and the displacement of the push rod of the brake booster becomes large, the warning lamp and buzzer are also actuated.

Once the lead switch closes and is connected to the ground, the MDT maintains the warning lamp and alarm buzzer even if the lead switch opens again.

To reset the warning lamp and alarm buzzer, turn the starting switch OFF and then back ON again.

10. Hydraulic oil temperature system

With the hydraulic oil temperature gauge, the oil temperature gauge sensor detects the hydraulic oil temperature. In accordance with this electric signal, the MDT sends a signal through the moment limiter controller and displays the HYDRAULIC OIL TEMPERATURE 70°C warning on the monitor panel.

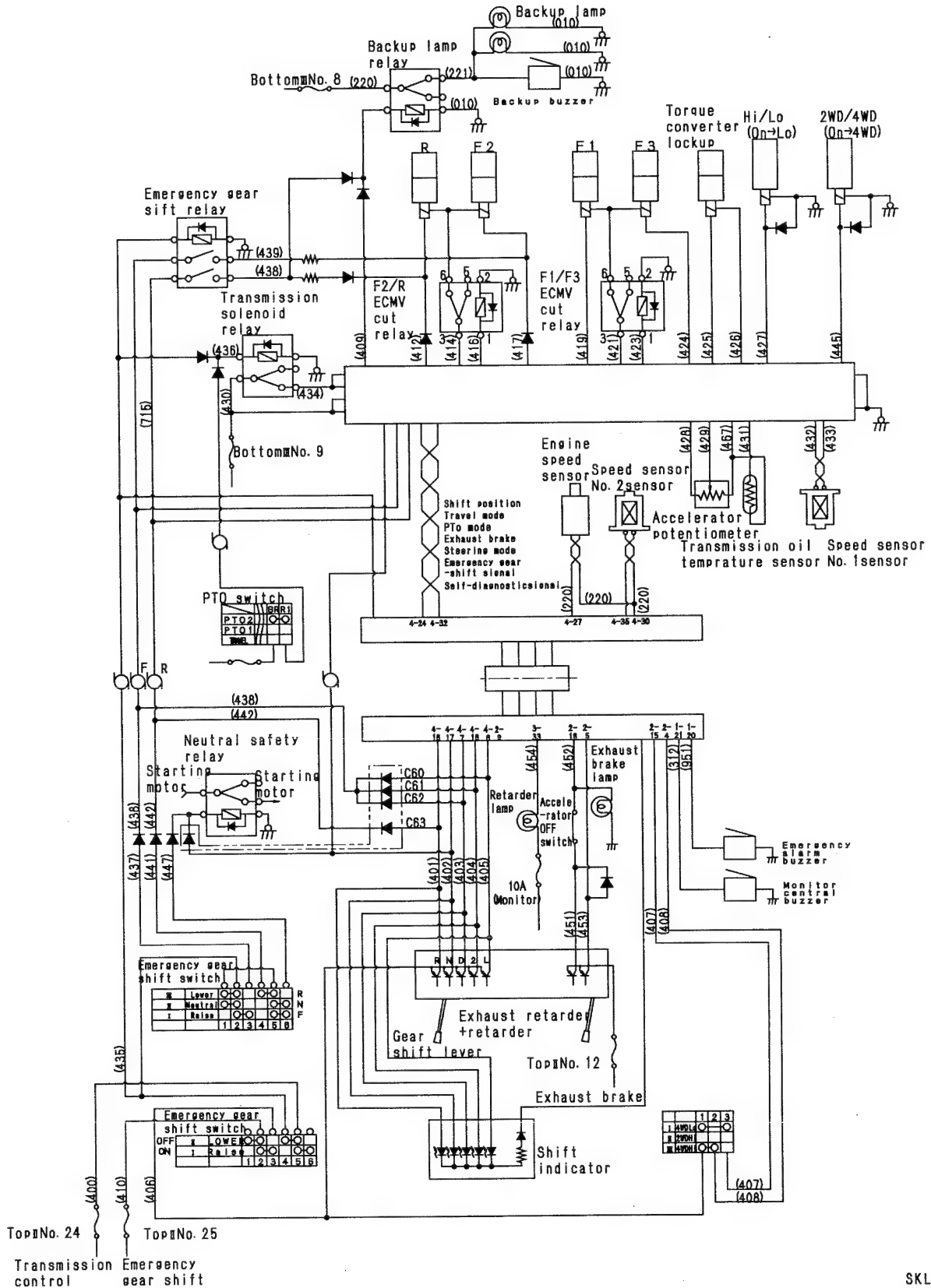
The oil temperature sensor is installed to the hydraulic tank return port of the return tube, and detects the hydraulic oil temperature as a resistance value.

11. Hourmeter system

The hourmeter display advances in accordance with the time that the engine is turning.

When the engine is started and begins to turn, the engine oil pressure rises, the contacts of the engine oil pressure sensor open, and the MDT drives the hourmeter.

9. GEAR SHIFTING CIRCUIT



SKL01222

Outline

- In the gear shift circuit, the position of the gear shift lever is transmitted to the upper MDT by the five types of signals (**R, N, D, 2, L**). The upper MDT transmits this and other transmitted mode signals to the transmission controller. The all-range electronic modulation control type transmission controller determines the suitable speed range from these signals and the speed sensor signal, exhaust brake signal, and the accelerator potentiometer signal. It outputs the speed range to the gear shift solenoid valve of the transmission valve.

The gear shift operation is always carried out after the PTO switch has been set to the "TRAVEL" or "PTO1" position.

Operation

- If the emergency gear shift selector switch is at the OFF position, the electricity from top fuse II No. 24 passes from terminal 5 of the emergency gear shift switch through terminal 4 and becomes the power source of the gear shift lever.

- When the gear shift lever is operated, the signal enters the upper MDT. The upper MDT sends this signal together with the various mode signals and exhaust brake signal through the slip ring and lower MDT to the automatic gear shift controller.

The automatic gear shift controller uses these signals and the signals from the speed sensor and accelerator potentiometer to determine the optimum speed range, and outputs this to one of the gear shift modulating solenoid.

- When the controller outputs the signal, it converts the electric current to analog and controls the gear shift modulation solenoid. With this modulation control, the hydraulic pressure at the clutch for the selected gear shift range is reduced smoothly when shifting gear (when shifting up or shifting down), and pressure is applied smoothly to the newly selected gear range.

In this way, the shock when shifting gear is reduced and acceleration is applied smoothly without turning the torque off.

- If two or more clutches in the transmission are completed engaged, the gears will grate and there is danger that they will break. To prevent this problem, there is an ECMV cut relay at the feedback end (GND end) of each modulation solenoid. If the automatic gear

shift controller detects any abnormality, it excites the coil of the ECMV cut relay and cuts the flow of electricity in the modulation solenoid.

- If the gear shift lever is at REVERSE, in addition to the flow of electricity described above, electricity also flows to the coil of the backup lamp relay and connects relay terminals 3 and 5.

When this happens, electricity from bottom fuse III No. 8 flows from terminal 3 to terminal 5, then flows to the backup lamp and buzzer to light up the lamp and sound the buzzer. The gear shift lever signals are collected as three signals (F, N, R) at the top, then pass through the slip ring and are sent directly to the automatic gear shift controller.

The automatic gear shift controller compares these signals with the signals sent through the upper and lower MDTs and determines the gear shift range. This increases the reliability and eliminates any delay in gear shifting resulting from the time taken communication.

- If the PTO switch is at the PTO2 position, the power source from top fuse I No. 4 passes through the slip ring and excites the transmission solenoid power source relay at the bottom. This separates the connection of terminal 3 and terminal 6, so the power source from bottom fuse III No. 9 to the automatic gear shift controller is cut.

Therefore, if the PTO switch is not at the TRAVEL or PTO1 position, the gear shift circuit is not actuated.

- If the gear shift lever is at any position other than neutral, the 24V output for the neutral signal is not given, so the NEUTRAL relay is not actuated, and the flow of electricity to terminal C of the starting motor is cut.

Therefore, if the gear shift lever is not at the NEUTRAL position, it is impossible to start the engine.

- Gear shift lever output table
 - ★ The ○ mark indicates 24V output; in all other cases, the output is 0V.

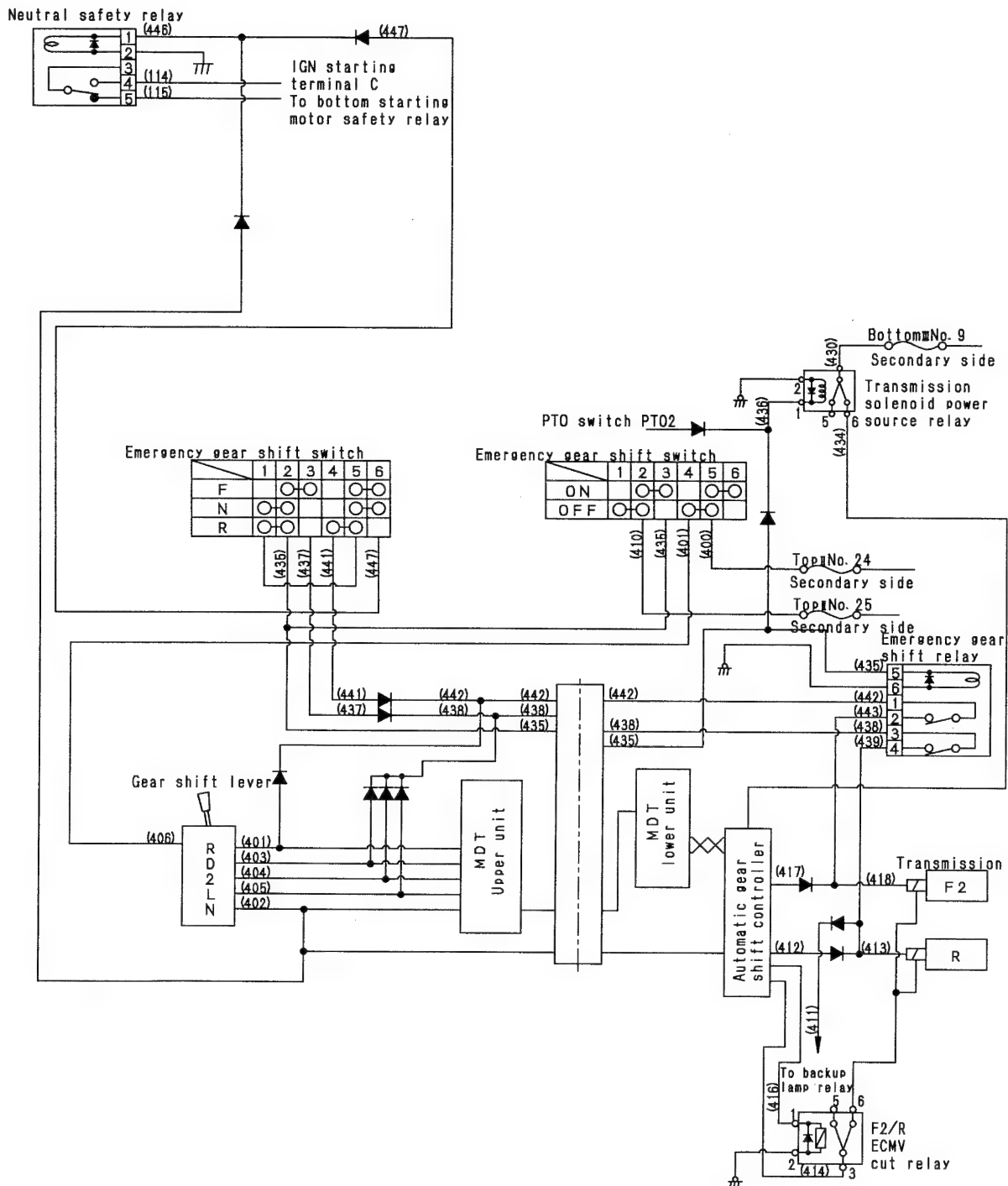
Lever position	Output signal				
	R	N	D	2	L
R	○				
N		○			
D			○		
2				○	
L					○

- Table of combinations of electrical continuity for gear shift solenoid valves
 - ★ The ○ mark shows that electricity is passing through the solenoid.

Continuity of solenoid	Speed range			
	F1	F2	F3	R
F3			○	
F2		○		
F1	○			
N				
R				○

023S05

10. EMERGENCY GEAR SHIFT CIRCUIT



SKL01223

023S05

OUTLINE

- The emergency gear shift circuit is used when a failure occurs in the gear shifting system and it is difficult for the machine to travel. The special direct switch creates the **F** or **R** signal without using the gear shift lever, and this passes through the slip ring and goes to the gear shift solenoid valve of the transmission valve to shift the transmission to **F2** or **R**.

When the emergency gear shift selector switch is turned ON, the automatic gear shift controller power source is turned OFF.

When the emergency gear shift switch is set to **N**, the engine can be started.

OPERATION**1. When emergency gear shift selector switch is at ON**

When the emergency gear shift selector switch is turned ON, terminals 2 and 3 are connected. At the same time, terminals 4 and 5 are disconnected, and the following operations are carried out.

- 1) It cuts the power source of the gear shift solenoid of the automatic gear shift controller.
- 2) The emergency gear shift relay is actuated, and this makes it possible to shift the gear using the emergency gear shift switch.
- 3) The power source is supplied to terminal 2 of the emergency gear shift switch and becomes the F-R gear shift signal. Furthermore, if the emergency gear shift switch is at the **N** position, electricity flows from terminal 6 through the coil of the neutral relay inside the monitor controller and then goes from terminal 1 to terminal 2.

When this happens, the neutral relay is actuated, connects relay terminals 3 and 5, then connects terminal **C** of the starting switch and terminal **S** of the starting motor, and makes it possible to start the engine.

2. When emergency gear shift switch is operated

When the emergency gear shift switch is placed at the **F** position, terminals 2 and 3 and terminals 5 and 6 are connected.

When this happens, the electricity from the emergency gear shift selector switch flowing to terminal 2 leaves terminal 3 and passes

through the slip ring and emergency gear shift relay. It then flows to the current limit resistor and gear shift modulation solenoid **F** and actuates it, switches the hydraulic circuit, and sets the speed range to **F2** (the 1st and 3rd solenoids are OFF, so it selects 2nd).

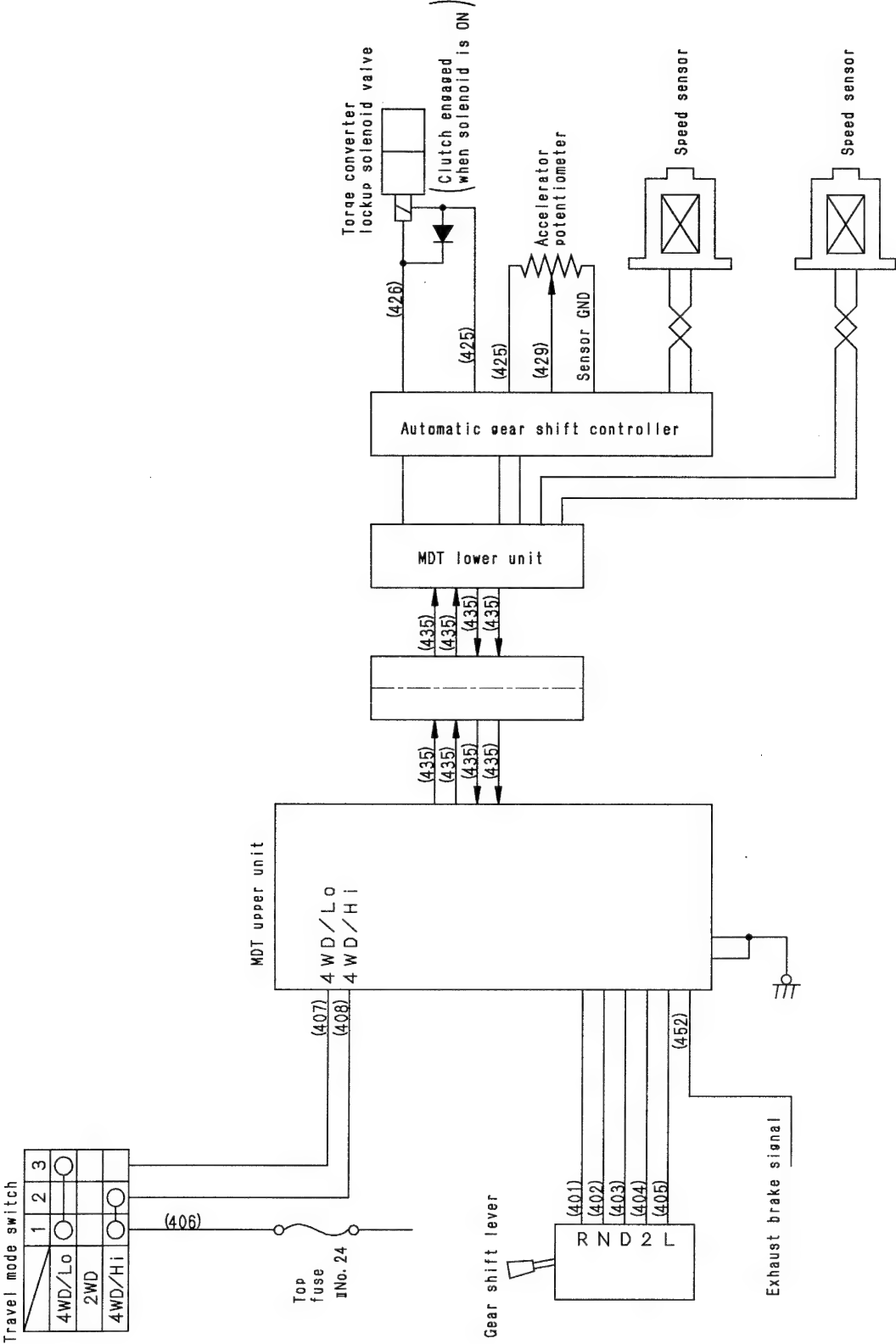
When the emergency gear shift switch is placed at the **R** position, terminals 2 and 1 and terminals 5 and 4 are connected.

When this happens, the electricity from the emergency gear shift selector switch flowing to terminal 2 leaves terminal 4 and passes through the slip ring and emergency gear shift relay. It then flows to the current limit resistor and gear shift modulation solenoid **R** and actuates it, switches the hydraulic circuit, and sets the speed range to **R**.

If the emergency gear shift switch is set to the **F** or **R** position, the connection of terminal 6 (the 24V output of the neutral relay) is separated, so the engine cannot be started.

Therefore, if any failure occurs in the gear shifting system, the emergency gear shift switch must always be placed at the **N** position when starting the engine.

11. TORQUE CONVERTER LOCKUP CIRCUIT

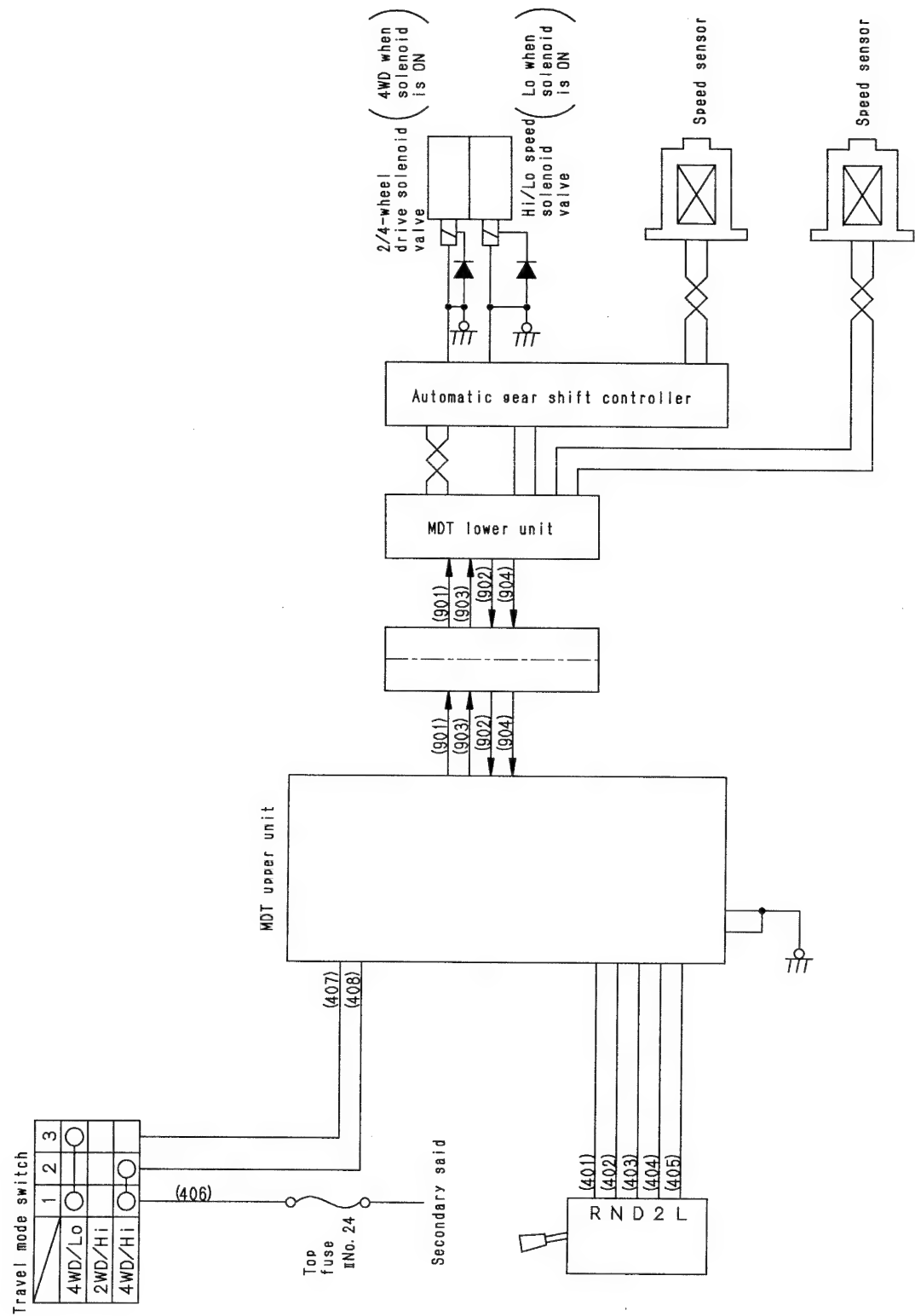


023S05

Outline

- The torque converter lockup circuit switches ON-OFF the torque converter lockup function built into the automatic gear shift controller according to the operation of the travel mode switches for 2WDHi/4WDHi/4WDLo, and the signals for the exhaust brake, the travel speed, and the amount the accelerator pedal is depressed. The lock-up modulation solenoids are actuated by the action of the controller to switch between torque converter drive and direct drive.
The controller carries out the output to the solenoid valves according to the speed range signal from the gear shift lever and the speed signal from the speed sensor.

12. TRAVEL MODE SELECTOR CIRCUIT



023S05

Outline

- The travel mode selector circuit operates the travel mode switch, actuates the solenoid valve, switches the hydraulic circuit, operates the two sets of shifters at the transfer, and switches the output of the transmission.
- When the drive selector switch is at the 4WD/Hi and 4WD/Lo positions, the 2/4-wheel drive solenoid valve is excited and sets the machine to 4-wheel drive.
- When the travel speed switch is at the 4WD/Lo position only, the Hi/Lo solenoid valve is excited and the machine is set to low speed travel.

However, if the Hi/Lo speed selector switch is operated when the machine is traveling, in other words, when the transmission output shaft is rotating, the gears will grate and not mesh. To prevent this, the switching of the output of the automatic gear shift controller can only be carried out if the speed signal from the speed sensor is less than 3 km/h and the gear shift lever is at the **N** position. (Hi/Lo inhibit function)

Operation**1. When travel mode switch is at 4WD/Hi (4-wheel drive high speed)**

When the travel mode switch is set to 4WD/Hi (right side), terminals 1 and 2 are connected, and the electricity from top fuse II No. 24 flows from terminal 1 to terminal 2, and enters the MDT upper unit.

The MDT upper unit transmits this as a signal through the slip ring and MDT lower unit to the automatic gear shift controller.

The automatic gear shift controller excites the 2/4 wheel drive solenoid, actuates the valve, switches the hydraulic circuit, and operates the 4-wheel drive shifter to set the machine to 4-wheel drive high speed.

2. When travel mode switch is at 2W/Hi (2-wheel drive high speed)

When the travel mode switch is set to 2W/Hi (center position), no terminals are connected to send any output. Therefore, no electricity flows to the 4-wheel drive solenoid, so the valve switches the hydraulic circuit, returns the shifter, and sets the machine to 2-wheel drive high speed.

3. When travel mode switch is at 4WD/Lo (4-wheel drive low speed)

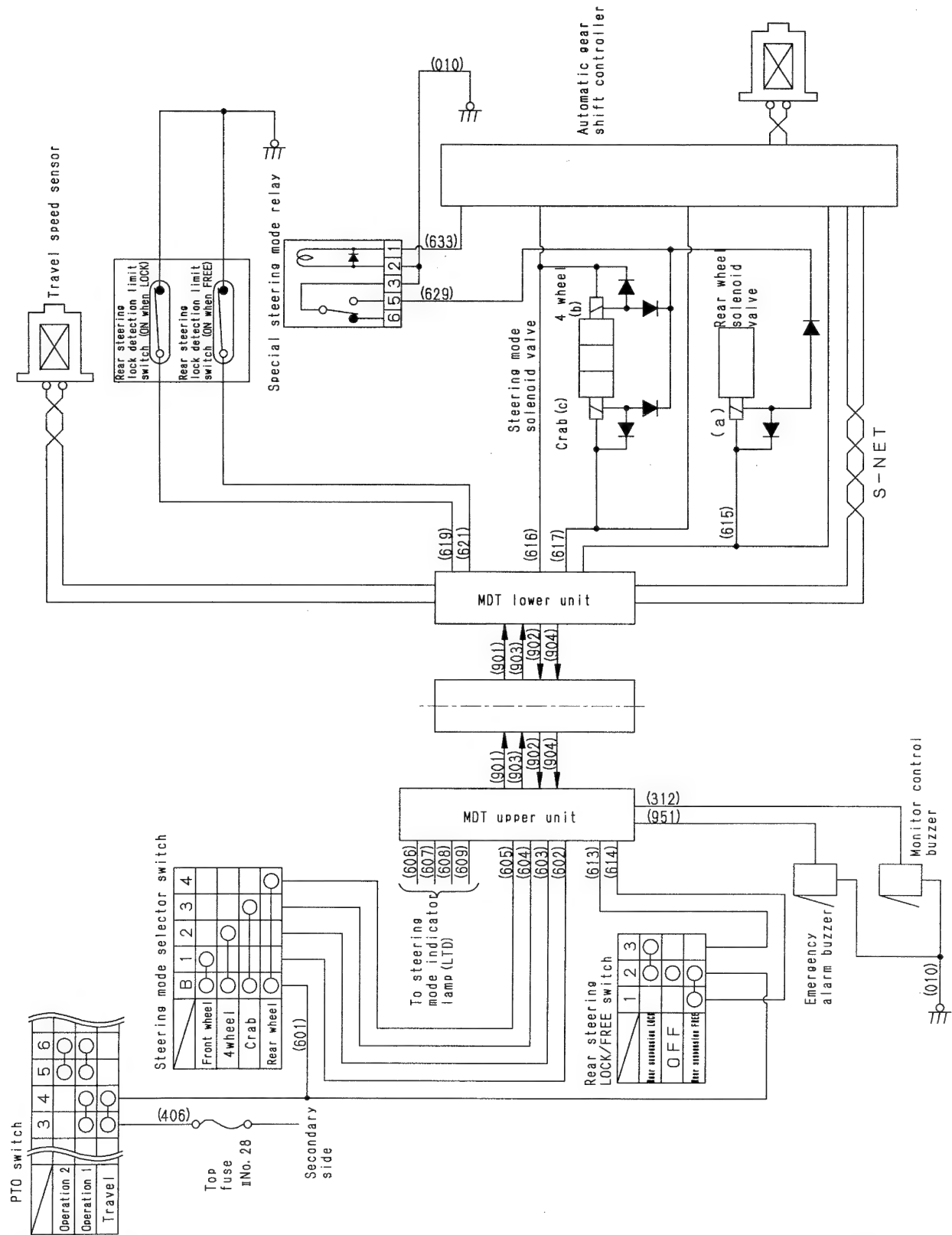
When the travel mode switch is set to 4WD/Lo (left side), terminals 1 and 3 are connected and the electricity from top fuse 9 goes from terminal 3 to the MDT upper unit.

The MDT upper unit transmits this as a signal through the slip ring and MDT lower unit to the automatic gear shift controller.

The automatic gear shift controller excites the 2/4-wheel drive solenoid and high/low speed solenoid at the same time.

The 2/4-wheel drive solenoid and high/low speed solenoid switch the hydraulic circuit and operate the 4-wheel drive shifter and high/low speed selector shifter respectively and set the machine to 4-wheel drive low speed.

13. STEERING MODE SELECTOR CIRCUIT



023S05

Outline

- When the rear steering lock is released, the steering mode selector circuit actuates the solenoid valve according to the operation of the steering mode switch, switches the hydraulic circuit, and determines the steering mode. The steering mode selector circuit supplies the power source when the PTO switch is at the PTO1 or "Travel" position.

Operation

- When the PTO switch is at the PTO1 or "Travel" position, some of the electricity leaving terminal 4 of the PTO switch enters terminal B of the steering mode selector switch. It is then output to the MDT upper unit from terminal 1, terminal 2, terminal 3, or terminal 4 respectively according to whether the steering mode selector switch is at the FRONT WHEEL, 4 WHEEL DRIVE, CRAB, or REAR WHEEL position.

The electricity also enters terminal 2 of the rear steering LOCK/FREE switch, and is output to the MDT upper unit from terminal 1 or terminal 3 according to whether it is at the LOCK or FREE position.

The MDT upper unit transmits the condition of the steering mode selector switch and rear steering LOCK/FREE switch to the MDT lower unit. The MDT lower unit then communicates this to the automatic gear shift controller.

1. When steering mode selector switch is at FRONT WHEEL

When the MDT lower unit receives the signal, it stops the impression of voltage to steering mode solenoids (a), (b), and (c). At the same time, the automatic gear shift controller de-energizes the special steering mode relay and cuts the connection of terminal 3 and terminal 5 of the relay. Therefore, steering mode solenoids (a), (b), and (c) are all de-energized, and the steering mode is set to front wheel steering by the hydraulic circuit.

The rear steering LOCK and FREE can function in this mode. (See Rear steering lock circuit)

2. When steering mode selector switch is at 4 WHEEL

If the steering mode selector switch is set to 4 WHEEL and the rear steering detection limit switch is at FREE, the MDT lower unit applies the power source to steering mode solenoid (b).

At the same time, the automatic gear shift

controller excites the special steering mode relay and excites steering mode solenoid (b).

Steering mode solenoids (a) and (c) are de-energized, so this combination of actuation switches the hydraulic circuit and sets to 4 WHEEL steering.

3. When steering mode selector switch is at CRAB

If the steering mode selector switch is set to CRAB and the rear steering detection limit switch is at FREE, the MDT lower unit applies the power source to steering mode solenoid (c).

At the same time, the automatic gear shift controller excites the special steering mode relay and excites steering mode solenoid (c).

Steering mode solenoids (a) and (b) are de-energized, so this combination of actuation switches the hydraulic circuit and sets to CRAB steering.

4. When steering mode selector switch is at REAR WHEEL

If the steering mode selector switch is set to REAR WHEEL and the rear steering detection limit switch is at FREE, the MDT lower unit applies the power source to steering mode solenoids (a) and (b).

At the same time, the automatic gear shift controller excites the special steering mode relay and excites steering mode solenoids (a) and (b).

Steering mode solenoid (c) is de-energized, so this combination of actuation switches the hydraulic circuit and sets to REAR WHEEL steering.

Table of control switch settings and actuation of steering mode solenoids

Control switch		MDT lower unit			Solenoid valve			
Re-verse steering switch	Steering mode switch	Crab wire No. 617	4 wheel wire No. 616	Re-verse steering wire No. 615	Rear wheel a	4 wheel b	Crab c	Re-verse steering d
Normal (OFF)	Front wheel	X	X	X	X	X	X	X
	Rear wheel	○	○	X	○	○	X	X
	4 wheel	X	○	X	X	○	X	X
	Crab	○	X	X	X	X	○	X
Re-verse (ON)	Front wheel	X	X	○	X	X	X	○
	Rear wheel	○	○	○	○	○	X	○
	4 wheel	X	○	○	X	○	X	○
	Crab	○	X	X	X	X	○	X

○ : 24V

X : 0V

It is possible to shift to the 4-WHEEL, CRAB, and REAR WHEEL steering modes (special steering modes) only when the MDT and automatic gear shift controller judge that the travel speed is less than 5 km/h. At the same time, in the 4-WHEEL, CRAB, and REAR WHEEL steering modes (special steering modes), the MDT and automatic gear shift controller change the shift pattern to the PTO mode. This makes it impossible to shift above second, and restricts the travel speed.

In this case, the maximum speed is approx. 25 km/h.

If any attempt is made to press the steering mode selector switch to 4 WHEEL, CRAB, or REAR WHEEL, when the necessary conditions are not correct (travel speed less than 5 km/h and rear steering detection limit switch is at FREE), the MDT and automatic gear shift controller forcibly maintain the setting at the mode in use before the switch was pressed. Because of this, a difference will occur between the switch that was pushed (the steering mode operated by the operator) and the condition of the machine (the steering mode forcibly maintained). In this case,

1. The steering mode indicator lamp (LED) of the mode in use before the switch was pressed lights up, and at the same time, the indicator lamp of the steering mode that was pressed flashes.

2. The monitor central buzzer sounds intermittently to warn the operator. This warning continues until the steering mode selector switch for the mode previously being used is pressed again.

When changing the steering mode selector switch, if the switch is not pressed in properly, all the switches may be canceled.

If this happens, the steering mode indicator lamp (LED) of the mode previously being used lights up, and at the same time, all the other steering mode indicator lamps (LED) flash and the monitor central buzzer sounds intermittently.

In addition, the MDTU error EEA is displayed on the moment limiter monitor.

Note: The MDTU error EEA is displayed when all the steering mode switches are turned OFF or if two or more switches are ON at the same time. (Steering mode switch not selected error)

Note: If the starting switch is turned ON when all the steering mode switches are OFF, the default setting is front 2-wheel steering.

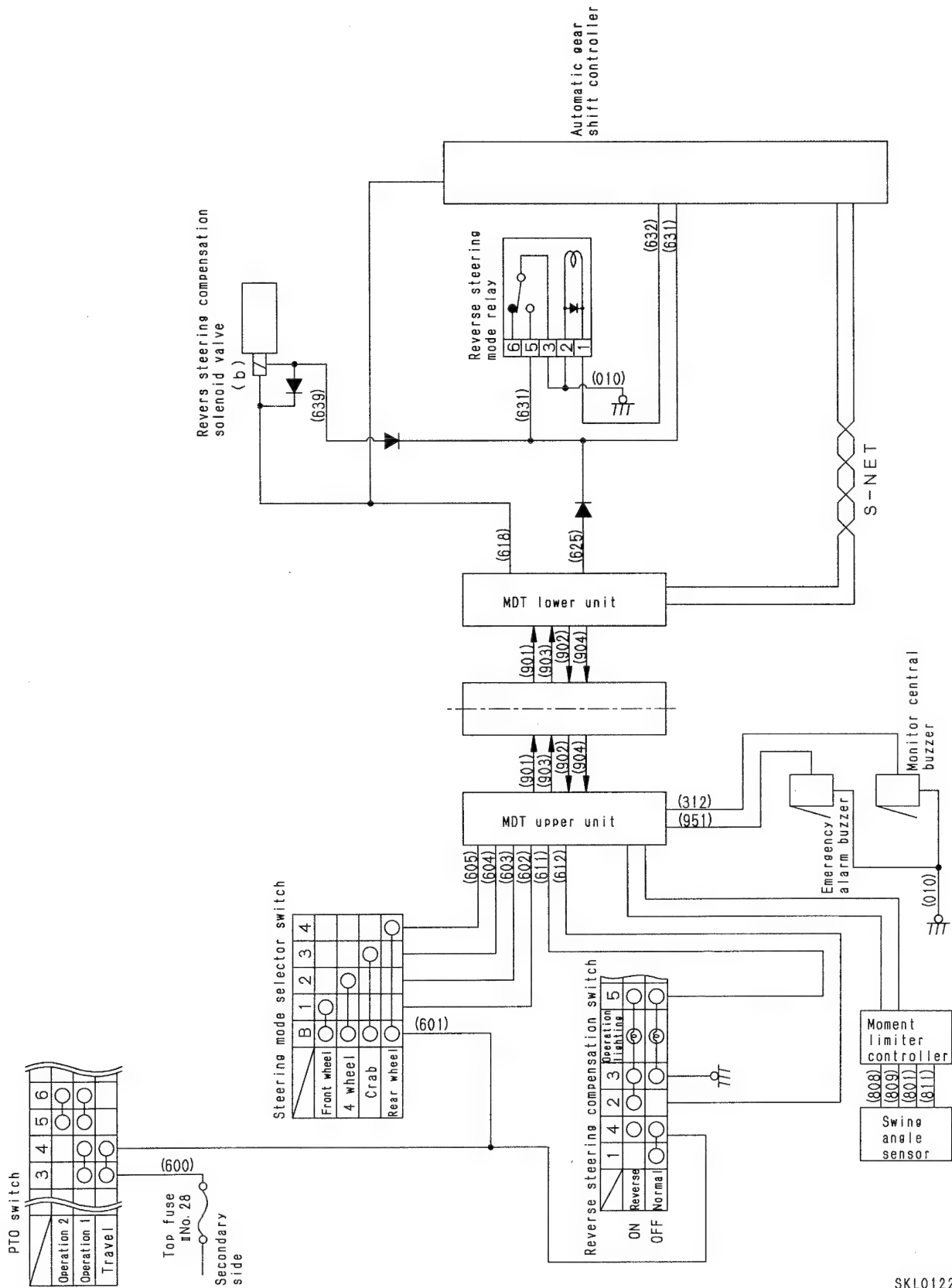
The signal output from the MDT lower unit to the solenoid is divided and is input to the automatic gear shift controller.

In addition, the MDT also communicates the steering mode that it has output to the automatic gear shift controller through the S-NET. The automatic gear shift controller checks if the signal output to the solenoid is the same as the signal communicated by the MDT. This increases the reliability. If the signals are not the same, it stops the output of the special steering mode

relay coil, shuts off the power source being supplied to the steering solenoids (a, b, c), and forcibly changes the machine condition to front 2-wheel steering.

In addition, the MDT sends the abnormal signal to the moment limiter monitor through the moment limiter controller, and an error code is displayed on the moment limiter monitor. In addition, it also sounds the emergency alarm buzzer.

14. REVERSE STEERING COMPENSATION CIRCUIT



SKL01227

023S05

Outline

- This machine consists of the upper structure and undercarriage. When the cab is facing the front, the relationship between the direction in which the steering wheel is turned and the direction in which the wheels turn is the reverse of the situation when the cab is facing the rear.

The reverse steering compensation circuit is used when the cab is facing the rear. When the reverse steering compensation switch is operated, the solenoid is actuated to switch the hydraulic circuit. This reverses the relationship between the direction in which the steering wheel is turned and the direction in which the wheels turn, and makes it the opposite from the condition when the cab is facing the front. As a result, when the cab is facing the rear, it is possible to turn the machine by turning the steering wheel in the same direction as when facing the front.

Operation

- A swing angle sensor is installed to this machine to detect the swing angle of the upper structure. The value detected by the swing angle sensor is sent through the moment limiter controller to the MDT. With the reverse steering compensation circuit, this swing angle sensor is actuated only when it detects that the upper structure is within a range of $\pm 5^\circ$ to the rear (180° to the rear of the machine).

1. If the upper structure is within a range of $\pm 5^\circ$ to the rear and the reverse steering compensation switch is ON:

The electricity from top fuse II No. 28 passes through PTO switch terminal 3 and 4 and goes to the steering mode switch. At the same time, electricity is also output from terminal 2 through terminal 4 of the reverse steering compensation switch.

The MDT upper unit transmits this as a signal to the MDT lower unit and automatic gear shift controller.

When this happens, if the steering mode selector switch is at FRONT WHEEL, 4 WHEEL, or REAR WHEEL, the MDT impresses the power source on the reverse steering compensation solenoid valve, and at the same time, the automatic gear shift controller excites the reverse steering mode relay, and terminal 3 and terminal 5 of the relay are connected, so the reverse steering compensation solenoid valve is excited. When the reverse

steering compensation solenoid valve is excited, the hydraulic circuit is switched, and the flow of oil to the steering cylinder port is reversed. As a result, the relationship between the direction in which the steering wheel is turned and the direction in which the wheels turn is also reversed.

2. If the upper structure is outside a range of $\pm 5^\circ$ to the rear and the reverse steering compensation switch is turned ON:

The MDT and automatic gear shift controller forcibly keep the steering at the NORMAL steering mode. (The reverse steering mode relay is de-energized.)

In addition, if the MDT recognizes that the input from the reverse steering compensation switch is different from the actual mode, the following action is taken to warn the operator.

- 1) The reverse steering indicator inside the reverse steering switch flashes.
- 2) The emergency alarm buzzer sounds intermittently.

This alarm condition continues until the reverse steering compensation switch is operated again and returns the steering to NORMAL steering.

3. If the upper structure goes outside a range of $\pm 5^\circ$ to the rear after switching to reverse steering:

The MDT and automatic gear shifting controller forcibly return the steering to NORMAL steering. (The reverse steering mode relay is de-energized.)

In addition, the MDT takes the following action to warn the operator.

- 1) The reverse steering indicator inside the reverse steering switch flashes.
- 2) The central monitor buzzer sounds intermittently.

This alarm condition continues until the reverse steering compensation switch is operated again and returns the steering to NORMAL steering.

4. When the steering mode is CRAB, the reverse steering indicator does not light up. Whether the cab is facing the front or the rear, the relationship between the direction in which the steering wheel is turned and the direction in which the wheels turn is not reversed, so there is no reverse steering compensation function provided.
5. When the reverse steering is actuated, there is no function to reverse the following actions.

- (1) Transmission shift lever (reversed FORWARD ↔ REVERSE)
- (2) Turn signal indicator (reversed left ↔ right)
- (3) Outrigger switches (reversed left ↔ right)

The signal output from the lower MDT to the solenoid is divided and is input to the automatic gear shift controller.

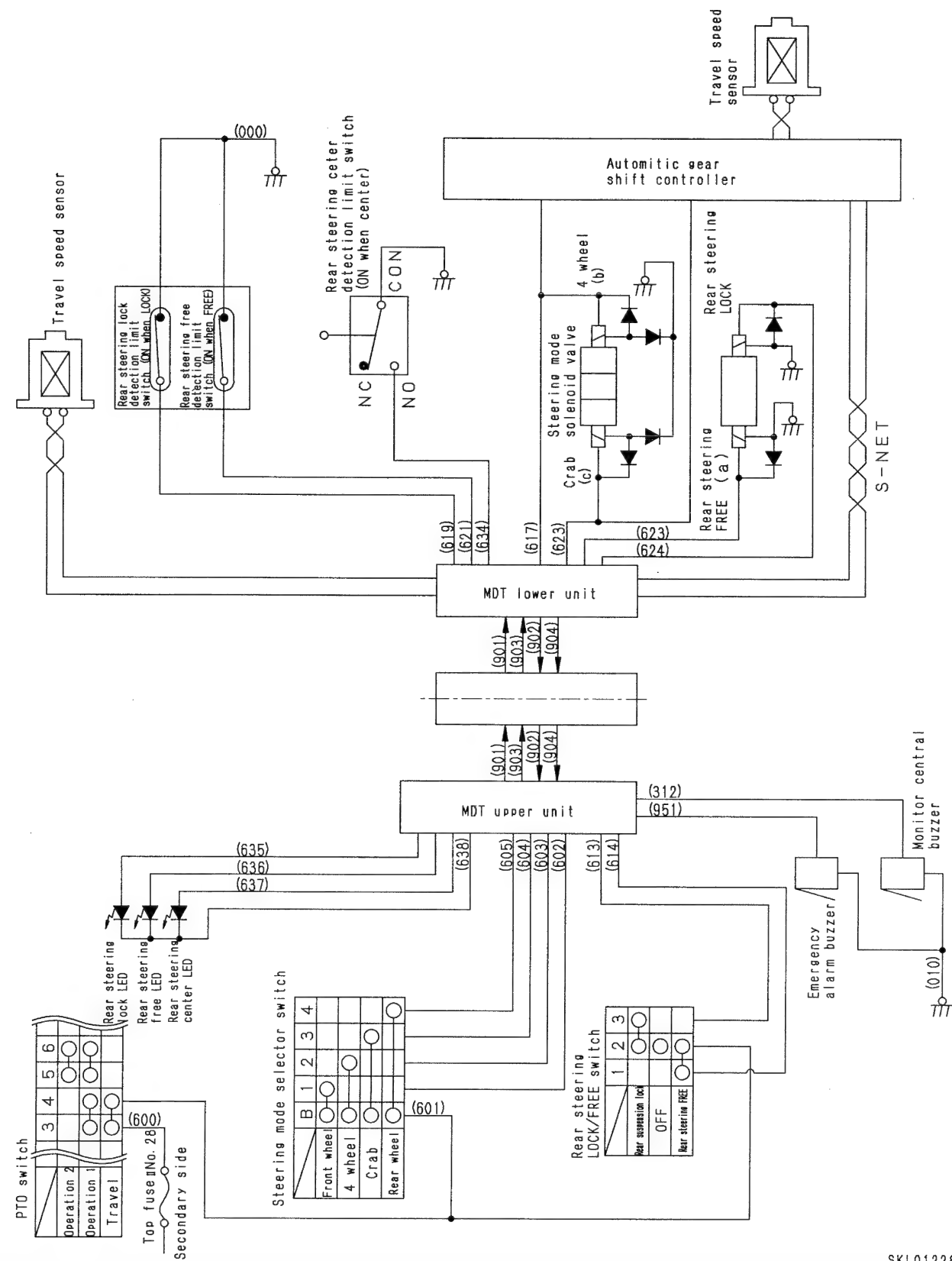
In addition, the MDT sends NORMAL/REVERSE steering signal to the automatic gear shift controller through the S-NET.

The automatic gear shift controller checks if the signal output to the solenoid is the same as the signal communicated by the MDT. This increases the reliability. If the signals are not the same (when there is electricity flowing in the reverse steering solenoid but the machine is supposed to be set to normal steering), it stops the output of the reverse steering coil, shuts off the power source being supplied to the reverse steering solenoid (d), and forcibly changes the machine condition to NORMAL steering.

The MDT sends the abnormal signal to the moment limiter monitor through the moment limiter controller, and an error code is displayed on the moment limiter monitor.

In addition, it also sounds the emergency alarm buzzer.

15. REAR STEERING LOCK CIRCUIT



023S05

Outline

- For normal travel operations, when the rear steering LOCK/FREE switch is operated, the rear steering lock circuit actuates the rear steering lock valve. This switches the air circuit, and the rear wheel steering mechanism is locked by the rear steering lock cylinder to ensure safety when traveling. In addition to the above valves, the rear steering lock circuit consists of three limit switches and three indicators. The rear steering lock operation can be carried out from the operator's compartment. If the PTO switch is not at the "OPERATION 1" or "TRAVEL" position, no power is sent to the rear steering lock circuit. When the steering mode switch condition input to the MDT is FRONT WHEEL, the MDT excites the rear steering lock solenoid and free solenoid.

Operation**1. When rear steering is operated to LOCK**

- Center position detection
Set the mode switch to the 4 WHEEL position, turn the steering wheel and set the rear wheels facing correctly to the front and rear. When this is done, the center detection switch detects center, so the condition becomes "NO-COM connected" and it is connected to the ground. When this happens, the MDT lights up the rear steering LED. In addition, the rear steering detection switch is set to FREE, and is connected to the ground, so the MDT lights up the rear steering FREE LED.
- Lock switch at LOCK
When the mode switch is at the FRONT WHEEL position and the rear steering center detection switch is at CENTER, if the rear steering LOCK/FREE switch is set to LOCK, the MDT excites the rear steering lock solenoid, switches the air circuit, and extends the lock cylinder. At the same time, the 4 WHEEL steering mode solenoid valve is excited, so even in the front wheel mode, if the rear steering LOCK/FREE switch is at the LOCK position, it is possible to steer the rear wheels with the steering wheel.
- Lock completed
When the cylinder extends and completes the lock operation, the lock detection

switch is set to LOCK and is connected to the ground.

At the same time, the free detection switch is turned OFF, so the MDT lights up the rear steering LOCK LED and turns off the rear steering FREE LED.

In addition, if the LOCK condition is detected, the excitation of the 4-wheel steering mode valve is stopped at the same time, and steering can be carried out only for the front wheels.

2. When rear steering is operated to FREE

- FREE switch ON
When the mode switch is at FRONT WHEEL, if the rear steering lock switch is set to FREE, the MDT excites the rear steering solenoid, switches the air circuit, and retracts the lock cylinder. At the same time, the MDT excites the 4-wheel steering solenoid valve, so even in the front wheel mode, if the rear steering LOCK/FREE switch is at the FREE position, it is possible to steer the rear wheels with the steering wheel.
- Lock cancel completed
When the cylinder is retracted and the cancel operation is completed, the free detection switch becomes FREE, and is connected to the ground. At the same time, the lock detection switch is turned OFF, so the MDT lights up the rear steering FREE LED and turns off the rear steering LOCK LED.

The table below shows the abnormality modes which are displayed by the combination of the three lamps.

△ : LED flashes ○ : LED ON

Condition No.	Steering mode input	Command switch		Limit switch input			Condition	Judgement
		Lock command	Free command	Center limit switch	Center limit switch	Free limit switch		
A-1	Front 2-wheel mode						LOCK/FREE simultaneous not detected (pin catching) (when not at center)	—
-2						○	Travel without rear steering locked (when not at center)	—
-3					○		Rear steering locked when not at center	Failure, operator error (travel possible)
-4					○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-5				○			LOCK/FREE simultaneous not detected (pin catching) (when at center)	—
-6				○		○	Travel without rear steering locked	—
-7				○	○		Travel with rear steering locked	Normal
-8				○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-9			○				FREE operated when not at center	A-3 restore in operation
-10			○			○	FREE operated when not at center	A-3 restore in operation
-11			○		○		FREE operated when not at center	A-3 restore in operation
-12			○		○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-13			○	○			Rear steering FREE in operation	Normal
-14			○	○		○	Rear steering FREE in operation	Normal
-15			○	○	○		Rear steering FREE in operation	Normal
-16			○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-17		○					LOCK operated when not at center	Operator error
-18		○				○	LOCK operated when not at center	Operator error
-19		○			○		Rear steering locked when not at center	Failure, operator error (travel possible)
-20		○			○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-21		○		○			Rear steering lock in operation	Normal
-22		○		○		○	Rear steering lock in operation	Normal
-23		○		○	○		Rear steering lock in operation	Normal
-24		○		○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-25		○	○				Impossible simultaneous operation input	Failure
-26		○	○			○	Impossible simultaneous operation input	Failure
-27		○	○		○		Impossible simultaneous operation input	Failure
-28		○	○		○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-29		○	○	○			Impossible simultaneous operation input	Failure
-30		○	○	○		○	Impossible simultaneous operation input	Failure
-31		○	○	○	○		Impossible simultaneous operation input	Failure
-32		○	○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
B-1	4-wheel mode						LOCK/FREE simultaneous not detected (pin catching) (when not at center)	—
-2						○	Travel without rear steering locked (when not at center)	Normal
-3					○		Rear steering locked when not at center	Failure (steering lock)
-4					○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-5				○			LOCK/FREE simultaneous not detected (pin catching) (when at center)	—
-6				○		○	Travel without rear steering locked	Normal
-7				○	○		Travel with rear steering locked	Failure (steering lock)
-8				○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-9			○				FREE operated when not at center	Operator error
-10			○			○	FREE operated when not at center	Operator error
-11			○		○		FREE operated when not at center	Failure (steering lock)
-12			○		○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-13			○	○			Rear steering FREE in operation	Operator error
-14			○	○		○	Rear steering FREE in operation	Operator error
-15			○	○	○		Rear steering FREE in operation	Failure (steering lock)
-16			○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-17		○					LOCK operated when not at center	Operator error
-18		○				○	LOCK operated when not at center	Operator error
-19		○			○		Rear steering locked when not at center	Failure (steering lock)
-20		○			○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-21		○		○			Rear steering LOCK in operation	Operator error
-22		○		○		○	Rear steering LOCK in operation	Operator error
-23		○		○	○		Rear steering LOCK in operation	Failure (steering lock)
-24		○		○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-25		○	○				Impossible simultaneous operation input	Failure
-26		○	○			○	Impossible simultaneous operation input	Failure
-27		○	○		○		Impossible simultaneous operation input	Failure (steering lock)
-28		○	○		○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-29		○	○	○			Impossible simultaneous operation input	Failure
-30		○	○	○		○	Impossible simultaneous operation input	Failure
-31		○	○	○	○		Impossible simultaneous operation input	Failure (steering lock)
-32		○	○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)

023S05

△ : LED flashes ○ : LED ON

Indicator lamp			Buzzer	Display	Memory	Steering mode output	Remarks (processed by other controller)
Center lamp	LOCK lamp	FREE lamp					
		△				Front 2-wheel mode	
		△				Front 2-wheel mode	
	△					Front 2-wheel mode	
	△	△	○	○	○	Front 2-wheel mode	
○						Front 2-wheel mode	
○		△				Front 2-wheel mode	
○	○					Front 2-wheel mode	
○	△	△	○	○	○	Front 2-wheel mode	
		△				4-wheel mode	
		△				4-wheel mode	
	△					4-wheel mode	
	△	△	○	○	○	4-wheel mode	
○						4-wheel mode	
○		△				4-wheel mode	
○	○					4-wheel mode	
○	△	△	○	○	○	4-wheel mode	
						4-wheel mode	Does not output LOCK command
		△				4-wheel mode	Does not output LOCK command
	△					Front 2-wheel mode	Does not output LOCK command
	△	△	○	○	○	Front 2-wheel mode	
○						4-wheel mode	
○		△				4-wheel mode	
○	○					Front 2-wheel mode	
○	△	△	○	○	○	Front 2-wheel mode	
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
		△	○	○	○	4-wheel mode	
		○				4-wheel mode	
	△		○	○	○	Front 2-wheel mode	
	△	△	○	○	○	Front 2-wheel mode	
		△	○	○	○	4-wheel mode	
○		○				4-wheel mode	
△	△		○	○	○	Front 2-wheel mode	
○	△	△	○	○	○	Front 2-wheel mode	
			○			4-wheel mode	Does not output LOCK/FREE command
		○	○			4-wheel mode	Does not output LOCK/FREE command
	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
			○			4-wheel mode	Does not output LOCK/FREE command
○		○	○			4-wheel mode	Does not output LOCK/FREE command
○	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
			○			4-wheel mode	Does not output LOCK/FREE command
		△	○			4-wheel mode	Does not output LOCK/FREE command
	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○			○			4-wheel mode	Does not output LOCK/FREE command
○		○	○			4-wheel mode	Does not output LOCK/FREE command
○	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	4-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	4-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	4-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	4-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command

023S05

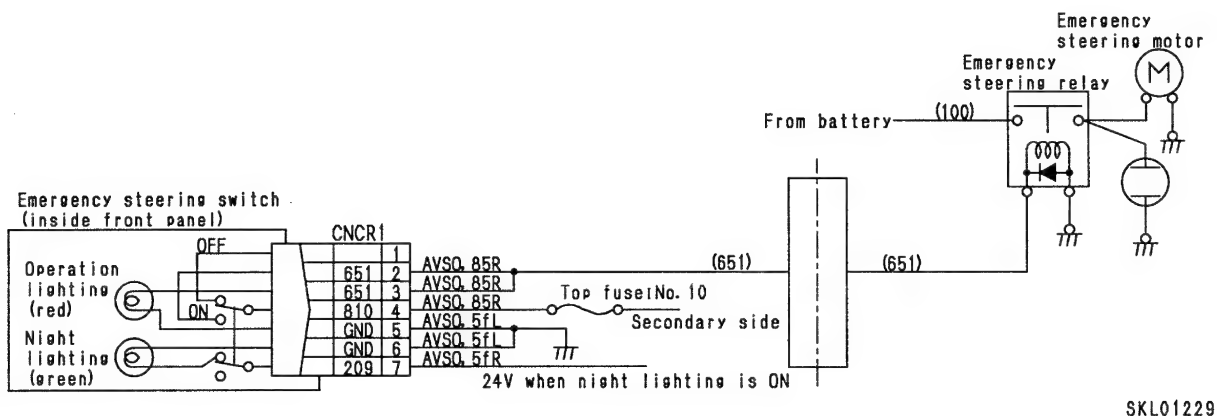
△ : LED flashes ○ : LED ON

Condition No.	Steering mode input	Command switch		Limit switch input			Condition	Judgement
		Lock command	Free command	Center limit switch	Center limit switch	Free limit switch		
C-1	Crab steering						LOCK/FREE simultaneous not detected (pin catching) (when not at center)	——
-2						○	Travel without rear steering locked (when not at center)	Normal
-3					○		Rear steering locked when not at center	Failure (steering lock)
-4					○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-5				○			LOCK/FREE simultaneous not detected (pin catching) (when at center)	——
-6				○		○	Travel without rear steering locked	Normal
-7				○	○		Travel with rear steering locked	Failure (steering lock)
-8				○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-9			○				FREE operated when not at center	Operator error
-10			○			○	FREE operated when not at center	Operator error
-11			○		○		FREE operated when not at center	Failure (steering lock)
-12			○		○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-13			○	○			Rear steering FREE in operation	Operator error
-14			○	○		○	Rear steering FREE in operation	Operator error
-15			○	○	○		Rear steering FREE in operation	Failure (steering lock)
-16			○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-17		○					LOCK operated when not at center	Operator error
-18		○				○	LOCK operated when not at center	Operator error
-19		○			○		Rear steering locked when not at center	Failure (steering lock)
-20		○			○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-21		○		○			Rear steering LOCK in operation	Operator error
-22		○		○		○	Rear steering LOCK in operation	Operator error
-23		○		○	○		Rear steering LOCK in operation	Operator error
-24		○		○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-25		○	○				Impossible simultaneous operation input	Failure
-26		○	○			○	Impossible simultaneous operation input	Failure
-27		○	○		○		Impossible simultaneous operation input	Failure (steering lock)
-28		○	○		○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-29		○	○	○			Impossible simultaneous operation input	Failure
-30		○	○	○		○	Impossible simultaneous operation input	Failure
-31		○	○	○	○		Impossible simultaneous operation input	Failure (steering lock)
-32		○	○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
C-1	Rear steering						LOCK/FREE simultaneous not detected (pin catching) (when not at center)	——
-2						○	Travel without rear steering locked (when not at center)	Normal
-3					○		Rear steering locked when not at center	Failure (steering lock)
-4					○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-5				○			LOCK/FREE simultaneous not detected (pin catching) (when at center)	——
-6				○		○	Travel without rear steering locked	Normal
-7				○	○		Travel with rear steering locked	Failure (steering lock)
-8				○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-9			○				FREE operated when not at center	Operator error
-10			○			○	FREE operated when not at center	Operator error
-11			○		○		FREE operated when not at center	Failure (steering lock)
-12			○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-13			○	○		○	Rear steering FREE in operation	Operator error
-14			○	○	○		Rear steering FREE in operation	Operator error
-15			○	○	○		Rear steering FREE in operation	Failure (steering lock)
-16			○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-17		○					LOCK operated when not at center	Operator error
-18		○				○	LOCK operated when not at center	Operator error
-19		○			○		Rear steering locked when not at center	Failure (steering lock)
-20		○			○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-21		○		○			Rear steering LOCK in operation	Operator error
-22		○		○		○	Rear steering LOCK in operation	Operator error
-23		○		○	○		Rear steering LOCK in operation	Operator error
-24		○		○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure
-25		○	○				Impossible simultaneous operation input	Failure
-26		○	○			○	Impossible simultaneous operation input	Failure
-27		○	○		○		Impossible simultaneous operation input	Failure (steering lock)
-28		○	○		○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
-29		○	○	○			Impossible simultaneous operation input	Failure
-30		○	○	○		○	Impossible simultaneous operation input	Failure
-31		○	○	○	○		Impossible simultaneous operation input	Failure (steering lock)
-32		○	○	○	○	○	LOCK/FREE simultaneously detected (impossible to judge machine condition)	Failure (steering lock?)
	4 wheel Crab-Rear						Rear steering LOCK/FREE detection limit switch are both OFF, steering mode switched SPECIAL ↔ SPECIAL	——

△ : LED flashes ○ : LED ON

Indicator lamp			Buzzer	Display	Memory	Steering mode output	Remarks (processed by other controller)
Center lamp	LOCK lamp	FREE lamp					
		△	○	○	○	Crab steering mode	
		○				Crab steering mode	
	△		○	○	○	Front 2-wheel mode	
	△	△	○	○	○	Front 2-wheel mode	
○		△	○	○	○	Crab steering mode	
○		○				Crab steering mode	
△	△		○	○	○	Front 2-wheel mode	
○	△	△	○	○	○	Front 2-wheel mode	
			○			Crab steering mode	Does not output LOCK/FREE command
		○	○			Crab steering mode	Does not output LOCK/FREE command
	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○			○			Crab steering mode	Does not output LOCK/FREE command
○		○	○			Crab steering mode	Does not output LOCK/FREE command
○	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
			○			Crab steering mode	Does not output LOCK/FREE command
		△	○			Crab steering mode	Does not output LOCK/FREE command
	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○			○			Crab steering mode	Does not output LOCK/FREE command
○		○	○			Crab steering mode	Does not output LOCK/FREE command
○	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
			○			Crab steering mode	Does not output LOCK/FREE command
		△	○			Crab steering mode	Does not output LOCK/FREE command
	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○			○			Crab steering mode	Does not output LOCK/FREE command
○		○	○			Crab steering mode	Does not output LOCK/FREE command
○	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
			○			Rear steering mode	Does not output LOCK/FREE command
		○				Rear steering mode	
	△		○	○	○	Front 2-wheel mode	
	△	△	○	○	○	Front 2-wheel mode	
○		△	○	○	○	Rear steering mode	
○		○				Rear steering mode	
△	△		○	○	○	Front 2-wheel mode	
○	△	△	○	○	○	Front 2-wheel mode	
			○			Rear steering mode	Does not output LOCK/FREE command
		○	○			Rear steering mode	Does not output LOCK/FREE command
	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○			○			Rear steering mode	Does not output LOCK/FREE command
○		○	○			Rear steering mode	Does not output LOCK/FREE command
○	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
		△	○			Rear steering mode	Does not output LOCK/FREE command
	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○			○			Rear steering mode	Does not output LOCK/FREE command
○		○	○			Rear steering mode	Does not output LOCK/FREE command
○	△		○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
○	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Rear steering mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Rear steering mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Rear steering mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Rear steering mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
△	△	△	○	○	○	Front 2-wheel mode	Does not output LOCK/FREE command
		△	○	○	○	Keeps mode before switching	Does not output LOCK/FREE command

16. EMERGENCY STEERING CIRCUIT



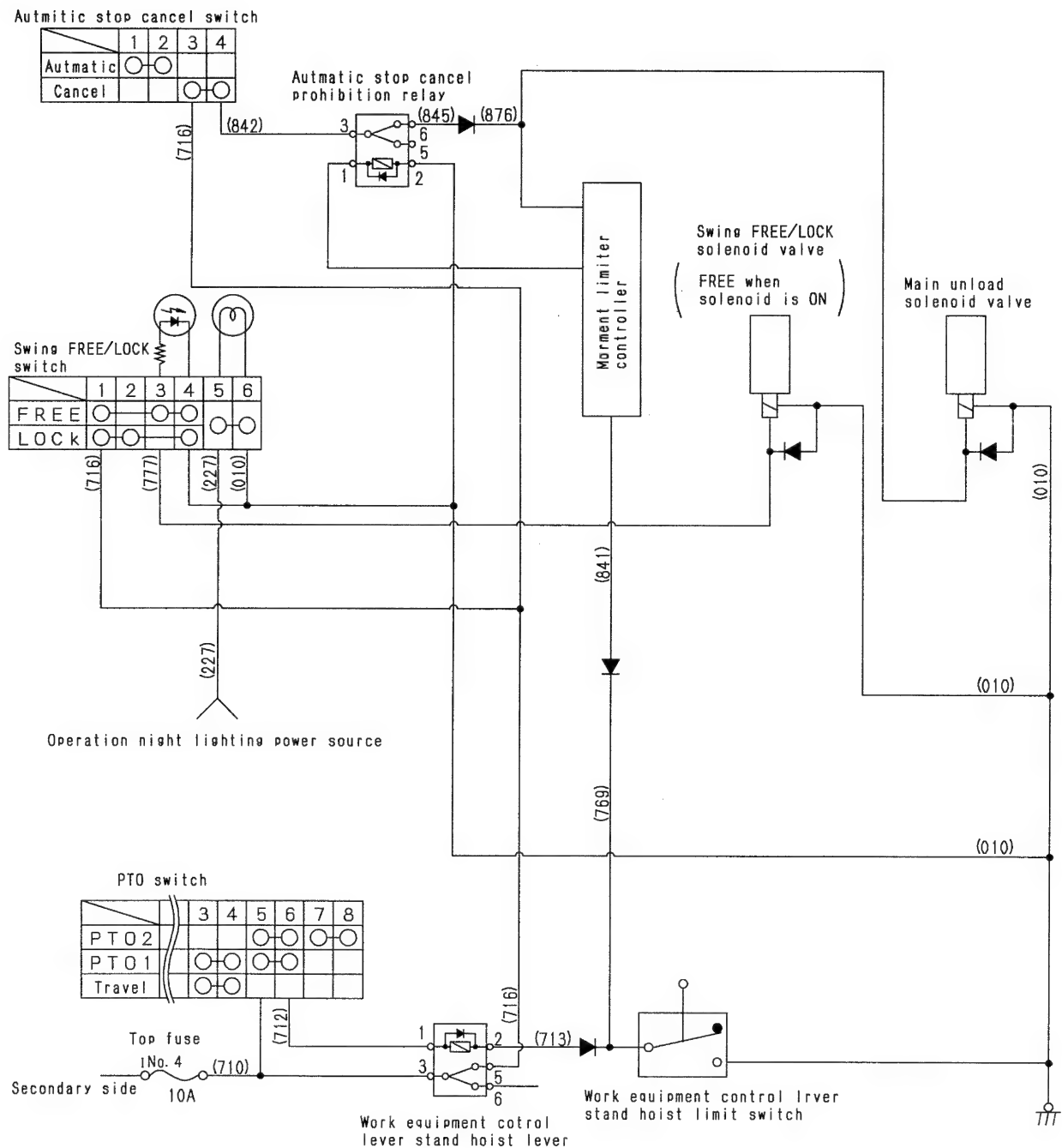
Outline

- If any failure should occur in the engine or steering pump when the machine is traveling, the oil will not flow to the steering cylinder and it will be impossible to operate the steering.
- With the emergency steering circuit, if such a problem occurs, the emergency steering switch can be operated to turn the steering motor (pump) and supply oil to make it possible to operate the steering.
- The maximum limit for operation of the emergency steering motor is 5 minutes.

Operation

- When the emergency steering switch is turned ON, the switch contacts are connected and electricity flows from top fuse I No. 10 through the swivel joint to the coil of the emergency steering relay, and connects the relay terminals.
- When this happens, the electricity from the battery flows to the motor and turns the motor.
- The electricity from top fuse I No. 10 also flows to the indicator lamp inside the switch and lights it up.
- The emergency steering switch has two lamps built in: the operation lighting lamp (red) and the night lighting lamp (green).
- During the day
 - When the switch is ON, the operation lighting lamp (red) lights up.
 - When the switch is OFF, the lamp does not light up.
 - At night (when the side lamps are ON)
 - When the switch is ON, the operation lighting lamp (red) lights up.
 - When the switch is OFF, the night lighting lamp (green) lights up.

17. SWING FREE/LOCK CIRCUIT



023S05

SKL01230

Outline

- With the swing FREE/LOCK circuit, the swing FREE/LOCK switch is operated to actuate the solenoid valve and to switch the hydraulic circuit. When a load is being lifted, this system enables the upper structure to move (swing) freely to a place immediately above the load. With the swing FREE/LOCK circuit, the PTO switch must be at the PTO1 or PTO2 position, and the work equipment control lever stand at RAISE. When this condition is fulfilled, power is supplied.

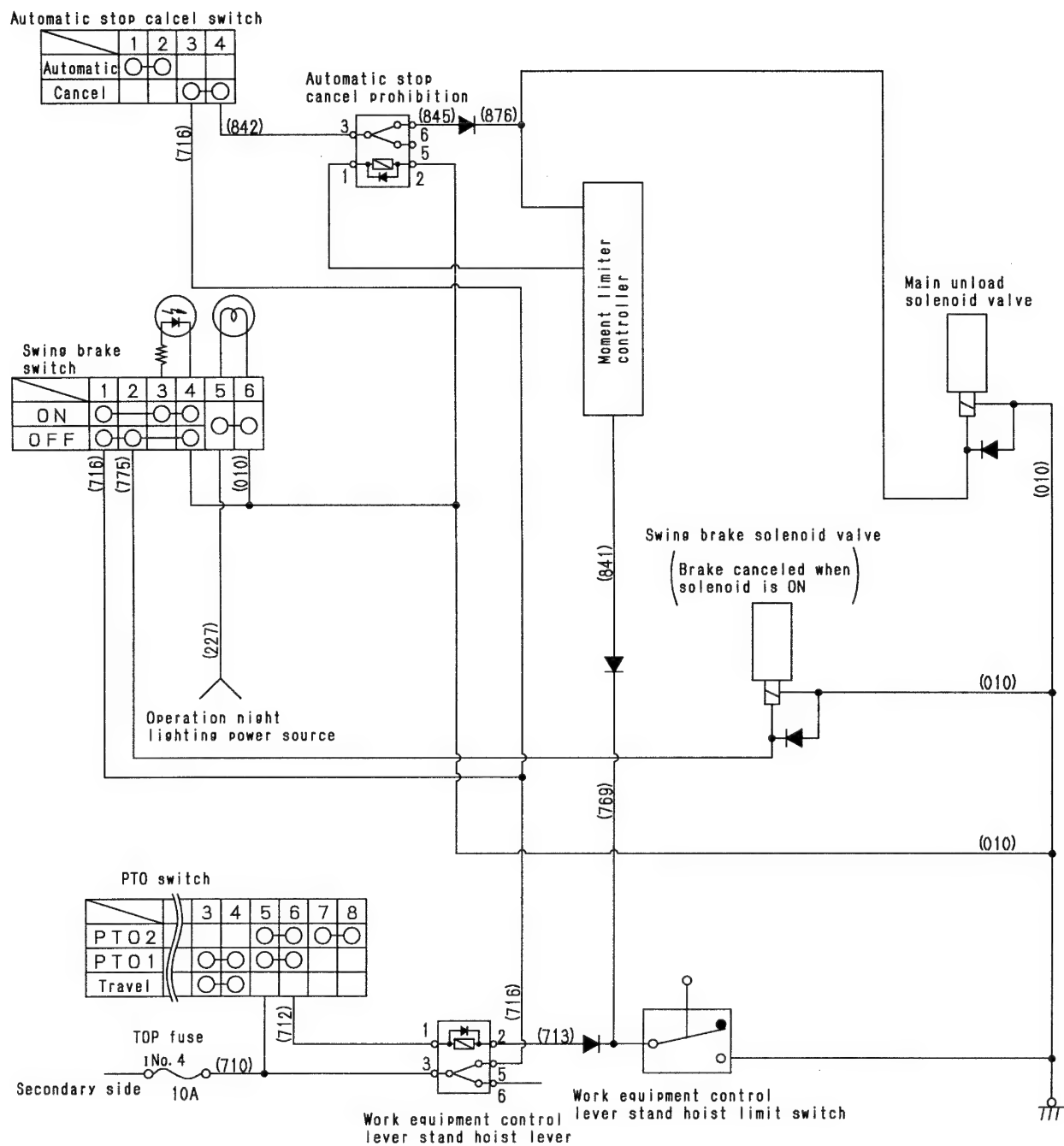
Operation

- When the swing FREE/LOCK operation is carried out, first, set the PTO switch to the PTO1 or PTO2 position. Terminals 5 and 6 are connected, and electricity from top fuse I No. 4 flows from terminal 5 to terminal 6. The electricity leaving PTO switch terminal 6 excites the work equipment control lever stand RAISE relay, and connects terminal 3 and terminal 5 of the relay, so the electricity from top fuse I No. 4 flows from relay terminal 3 to terminal 5. In addition, the electricity leaving relay terminal 5 becomes the power source for terminal 1 of the swing FREE/LOCK switch in the operator's compartment
1. **When swing FREE/LOCK switch is at LOCK**
When the switch is set to the LOCK position, no electricity flows to the solenoid, so the valve does not switch the hydraulic circuit. Therefore, the upper structure moves only when the normal swing operation is carried out.
In other words, when the swing free solenoid is excited, it is set to FREE, and when it is de-energized, it is set to LOCK.

2. **When swing FREE/LOCK switch is at FREE**
When the switch is set to the FREE position, terminals 1 and 3 are connected, and the electricity from the work equipment control lever stand relay flows from terminal 1 to terminal 3.
The electricity leaving terminal 2 flows to the solenoid and actuates the valve. This switches the hydraulic circuit, reduces the holding pressure at the back pressure port of the swing motor brake valve, and makes it possible for the upper structure to be pulled by the weight of the load to a position directly above the load.

023S05

18. SWING BRAKE CIRCUIT



023S05

SKL01231

Outline

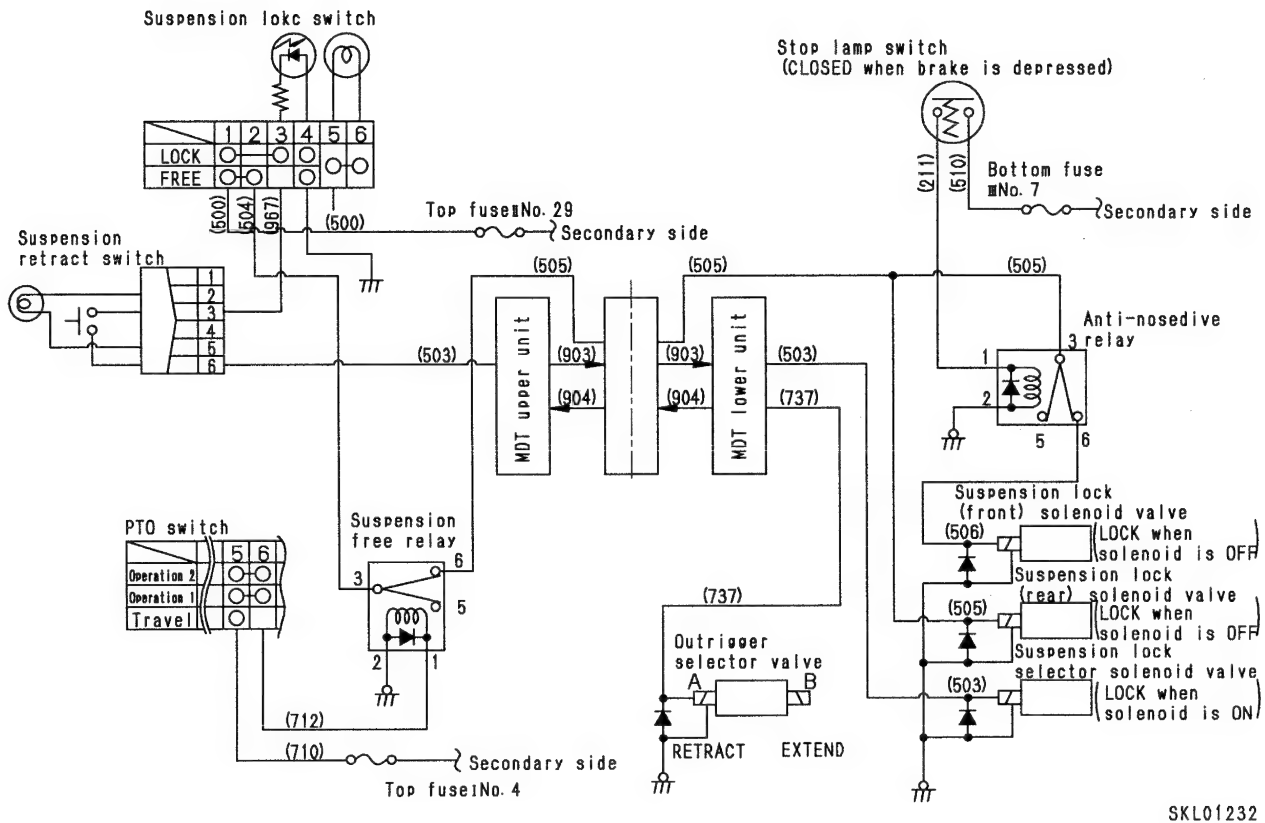
- With the swing brake circuit, the swing brake switch is operated to actuate the solenoid valve and to switch the hydraulic circuit. The rotation of the swing motor is then stopped mechanically by the swing holding brake. With the swing brake circuit, the PTO switch must be at the PTO1 or PTO2 position, and the work equipment control lever stand at RAISE. When this condition is fulfilled, power is supplied.

Operation

- When the PTO switch is set to the PTO1 or PTO2 position, terminals 5 and 6 are connected, and electricity from top fuse I No. 4 flows from terminal 5 to terminal 6. The electricity leaving PTO switch terminal 6 excites the work equipment control lever stand RAISE relay, and connects terminal 3 and terminal 5 of the relay, so the electricity from top fuse I No. 4 flows from relay terminal 3 to terminal 5. The electricity leaving relay terminal 5 becomes the power source for terminal 1 of the swing brake switch in the operator's compartment. When the switch is turned to the ON position, the solenoid is not excited, so the hydraulic circuit is not switched. Therefore, the swing motor is held by the force of the spring inside the swing holding brake cylinder, and the brake is applied. In other words, when the swing brake solenoid is excited, it is set to RELEASED, and when it is de-energized, it is set to APPLIED. If the switch is turned to the OFF position, the solenoid is excited and switches the hydraulic circuit. The pressurized oil overcomes the force of the spring inside the swing holding brake cylinder, and pushes the cylinder. As a result, the rotation of the swing motor is not held, and the brake is released.

023S05

19. SUSPENSION LOCK CIRCUIT



SKL01232

023S05

Outline

- With the suspension lock circuit, if on-tire operations are carried out without extending the outriggers, the suspension lock switch and suspension RETRACT switch are operated to actuate the solenoid valve. This switches the hydraulic circuit and lifts or locks the suspension lock cylinder. The front suspension lock solenoid valve is connected to the suspension lock switch through the anti-nosedive relay (actuated by the stop lamp switch). This system locks the front suspension lock cylinder and prevents the front of the machine from going down (nose diving) because of inertia if the brakes are applied when the machine is traveling.

Operation

1. When suspension lock switch is at LOCK

If the switch is set to the LOCK position, terminals 3 and 1 are connected, and the electricity from top fuse II No. 29 flows from terminal 1 to terminal 3.

The electricity leaving terminal 3 lights up the suspension lock indicator lamp inside the switch.

When the switch is at this position, no electricity flows to any solenoid. Therefore, the valve does not switch the hydraulic circuit so the suspension lock cylinder is locked.

2. When suspension lock switch is at FREE (PTO switch at "Travel")

If the switch is set to the FREE position, terminals 2 and 1 are connected, and the electricity from top fuse II No. 29 flows from terminal 1 to terminal 2.

The electricity leaving terminal 2 enters terminal 3 of the suspension FREE relay. When this happens, if the PTO switch is at the "TRAVEL" position, terminal 5 and terminal 6 of the switch are not connected, so the suspension FREE relay is de-energized and relay terminal 3 and terminal 6 are connected.

Therefore, the electricity leaving the suspension lock switch and entering terminal 3 of the suspension FREE relay, passes through terminal 6, goes through the swivel joint, and is divided into two. One part flows to the rear suspension lock solenoid, and the other part flows from terminal 3 of the anti-nosedive relay to terminal 6, and goes to the front suspension lock solenoid. The valves are actuated to switch the hydraulic circuit and set the suspension lock cylinder in the FREE position (it extends and retracts under external force).

3. When suspension lock switch is at FREE (PTO switch at PTO1, PTO2)

If the PTO switch is set to the PTO1 or PTO2 position, terminal 5 and terminal 6 of the PTO switch are connected and the suspension FREE relay is excited.

Therefore, relay terminal 3 and terminal 6 are not connected, and even if the suspension lock switch is set to the FREE position it does not become free. However, in this condition, suspension lock indicator lamp goes out.

4. When suspension lock switch is at LIFT

If the switch is set to the LIFT position, the electricity from top fuse II No. 29 flows from terminal 1 through terminal 3 to terminal 3 of the suspension RETRACT switch.

If the suspension RETRACT switch is set to LIFT, terminal 3 and terminal 6 of the switch are connected, and the electricity entering the suspension RETRACT switch flows from terminal 6 through the MDT and excites the suspension lock selector solenoid valve. At the same time the electricity also flows to the EXTEND solenoid of the outrigger selector valve, and actuates the valve. The two valves switch the hydraulic circuit and retract the suspension lock cylinder.

When the suspension is at LIFT, the same hydraulic power source is used through the outrigger selector valve as during outrigger operations, so the suspension lift operation and outrigger operation cannot be carried out at the same time.

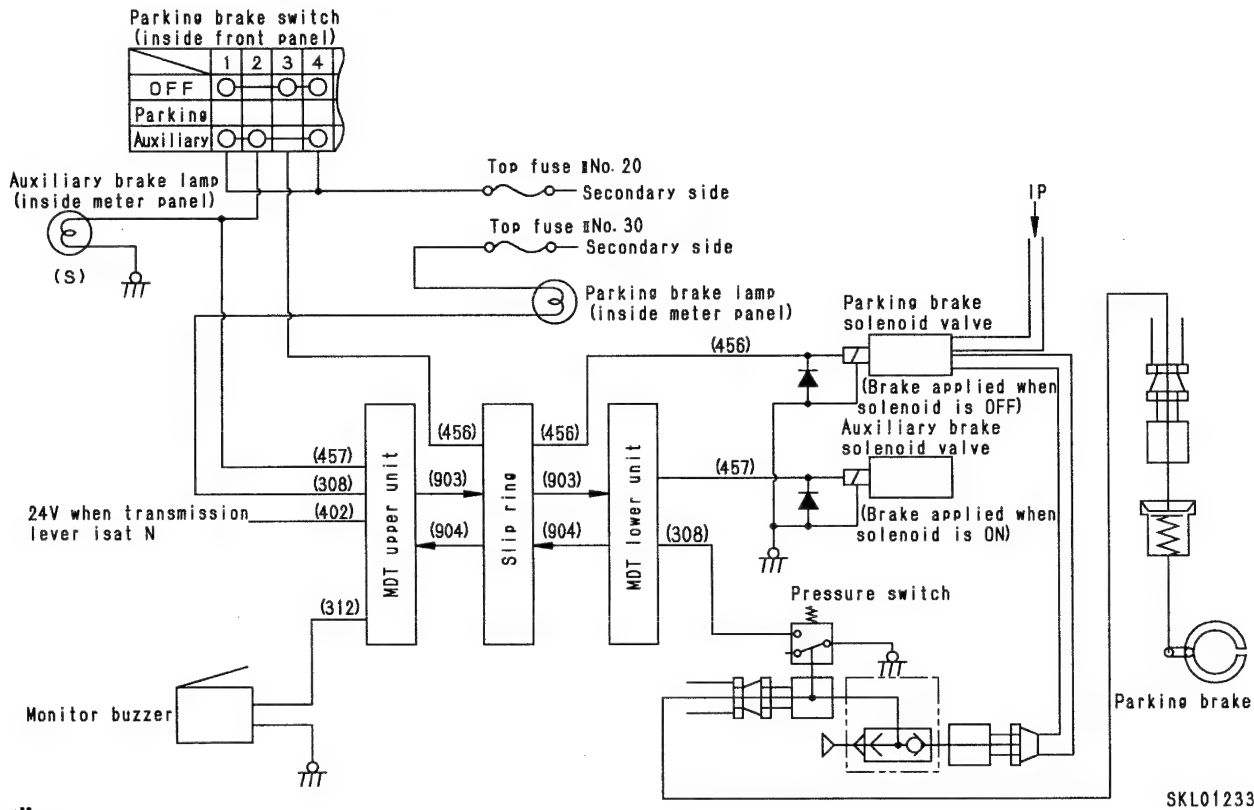
If it is attempted to operate them at the same time, priority is given to the suspension lift signal, and the outrigger does not move.

5. When brake pedal is depressed

If the switch is at the FREE position, the PTO switch is at the "TRAVEL" position, and the brake pedal is depressed, the contacts of the stop lamp switch in the air circuit are connected. Electricity from bottom fuse III No. 7 flows to the coil of the anti-nosedive relay, and connects relay terminals 3 and 5.

When this happens, the connection between terminals 3 and 6 is separated, so the flow of electricity to the front suspension lock solenoid is shut off. As a result, only the front hydraulic circuit is switched to lock the front suspension lock cylinder.

20. PARKING BRAKE CIRCUIT



Outline

- When the parking brake switch is operated, the parking brake circuit actuates two sets of solenoid valves to switch the air circuit and apply the parking brake and rear brake.

Operation

1. When parking brake switch is at OFF

When the switch is turned OFF, terminals 3 and 1 are connected, and the electricity from top fuse II No. 20 flows from terminal 1 to terminal 3.

The electricity leaving terminal 3 passes through the swivel joint and flows to the parking brake solenoid to actuate the valve. This switches the air circuit and sends high-pressure air to the brake chamber to release the parking brake.

In other words, when the parking brake solenoid is excited, the brake is released; when it is de-energized, the brake is applied.

2. When parking brake switch is at PARKING

If the switch is set to the PARKING position, electricity from top fuse II No. 20 stops flowing to terminal 2. The parking brake solenoid valve is turned OFF, and the parking brake is applied.

When this happens, a pressure switch detects

that the pressure in the air pressure line of the parking brake has been cut, so the parking brake lamp on the top meter panel lights up.

No electricity flows to the parking brake solenoid valve, so the parking brake is applied.

3. When parking brake switch is at AUXILIARY BRAKE

When the switch is set to the AUXILIARY BRAKE position, the parking brake is applied in the same way as in Item 2. At the same time, terminals 1 and 2 are connected, and the electricity from top fuse II No. 20 flows to terminals 1 and 2.

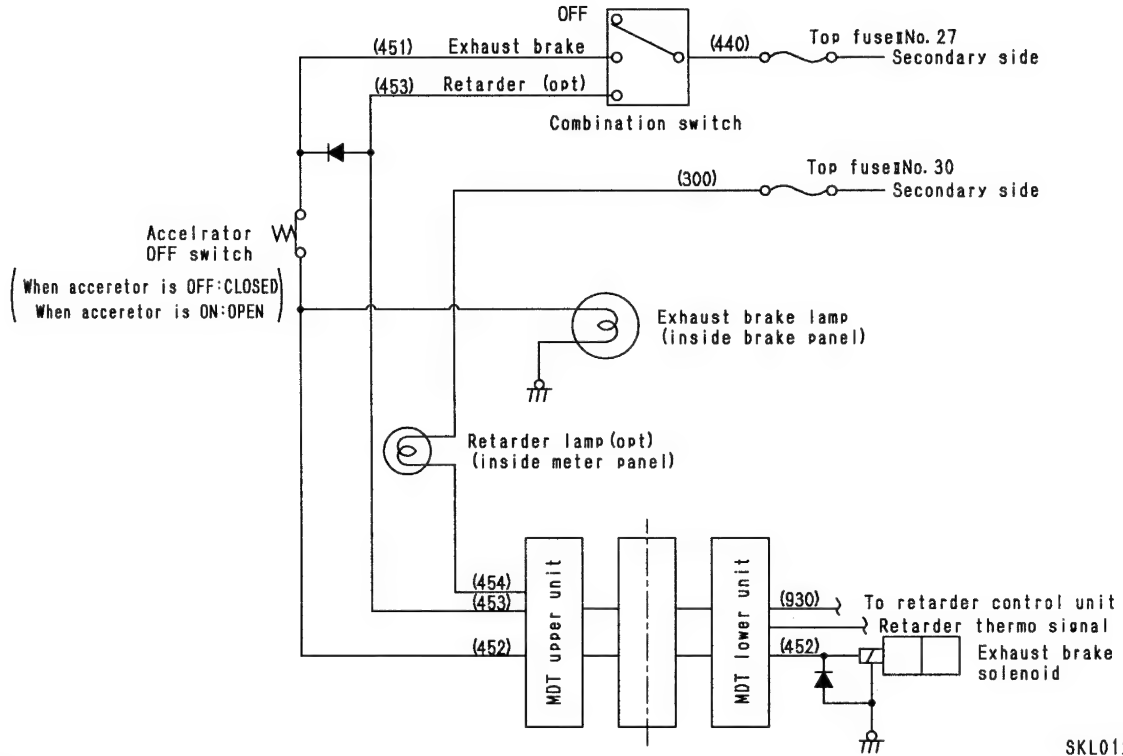
Some of the electricity leaving terminal 2 flows to the auxiliary brake lamp (S) and lights up the lamp. The rest flows to the MDT unit, then flows to the auxiliary brake solenoid and actuates the valve. This switches the air circuit and sends high-pressure air to the rear brake booster to apply the rear brake.

- When the bottom pressure switch is actuated (closed) and the parking brake lamp is lighted up, if the transmission lever is set to any position other than **N**, the monitor buzzer will sound to prevent the brakes from dragging.

SKL01233

023S05

21. EXHAUST BRAKE CIRCUIT



SKL01234

Outline

- With the exhaust brake circuit, if the exhaust brake switch is operated when going down a long hill, and the accelerator OFF switch (which detects the low idling position of the brake pedal) is actuated, the solenoid valve is actuated to switch the air circuit and apply the exhaust brake. At the same time, gear shifting is controlled according to the special shift pattern.

Operation

Standard machine

If the combination switch is at the EXHAUST BRAKE or RETARDER position, the electricity from top fuse II No. 27 flows to the inlet port of the accelerator OFF switch. If the accelerator pedal is released, the accelerator OFF switch is CLOSED, and the following three actions are carried out.

- (1) The exhaust brake lamp on the meter panel lights up.
- (2) The lower exhaust brake solenoid is actuated through the MDT and the exhaust brake is applied.
- (3) Control is carried out by the special shift and lockup pattern.

Machines with retarder (opt)

When the combination switch is set to the EXHAUST BRAKE position, the function is the same as on the standard machine.

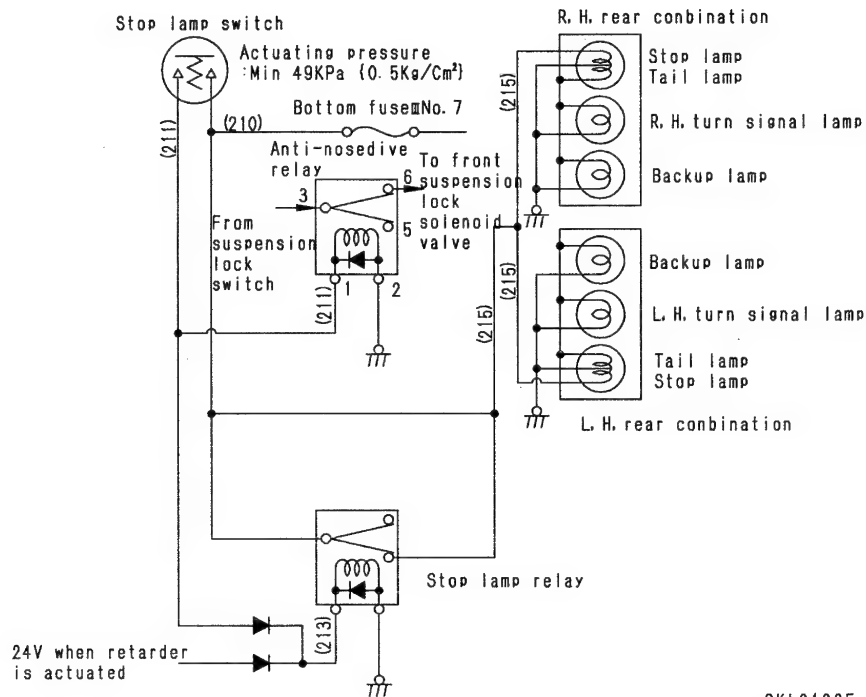
When the combination switch is set to the RETARDER position, if the accelerator is turned OFF, the MDT sends a signal to the lower retarder control unit.

The system is also equipped with a retarder cut-off relay to cut the operation of the retarder if the battery voltage should drop abnormally (below approx. 22V).

The retarder lamp inside the meter panel lights up or goes out according to the actuation of the retarder. If the retarder lamp is flashing at 2.5Hz, it shows that the temperature of the retarder coil has risen.

If it flashes at 1 Hz, it shows that the temperature of the retarder drum has risen. To prevent overheating of both of these, the retarder controller reduces the braking force and also sends a signal to the MDT to make the MDT light up or flash.

22. BRAKE LAMP CIRCUIT



SKL01235

Outline

- In the brake lamp circuit, the stop lamp switch in the air circuit between the brake valve and brake booster detects the pressure in the air circuit when the brake pedal is depressed, and lights up the stop lamp.

Operation

- When the brake pedal is depressed, the stop lamp switch is connected, and electricity from bottom fuse IV No. 7 flows to the stop lamp and lights the lamp up. The electricity from the switch also flows to the coil of the anti-nosedive relay, and connects relay terminals 3 and 5 to LOCK the front suspension lock cylinder. In other words, it acts to prevent the machine from nosediving.
- Machines equipped with retarder**
When the retarder is operated, the stop lamp relay is also actuated and lights up the stop lamp.

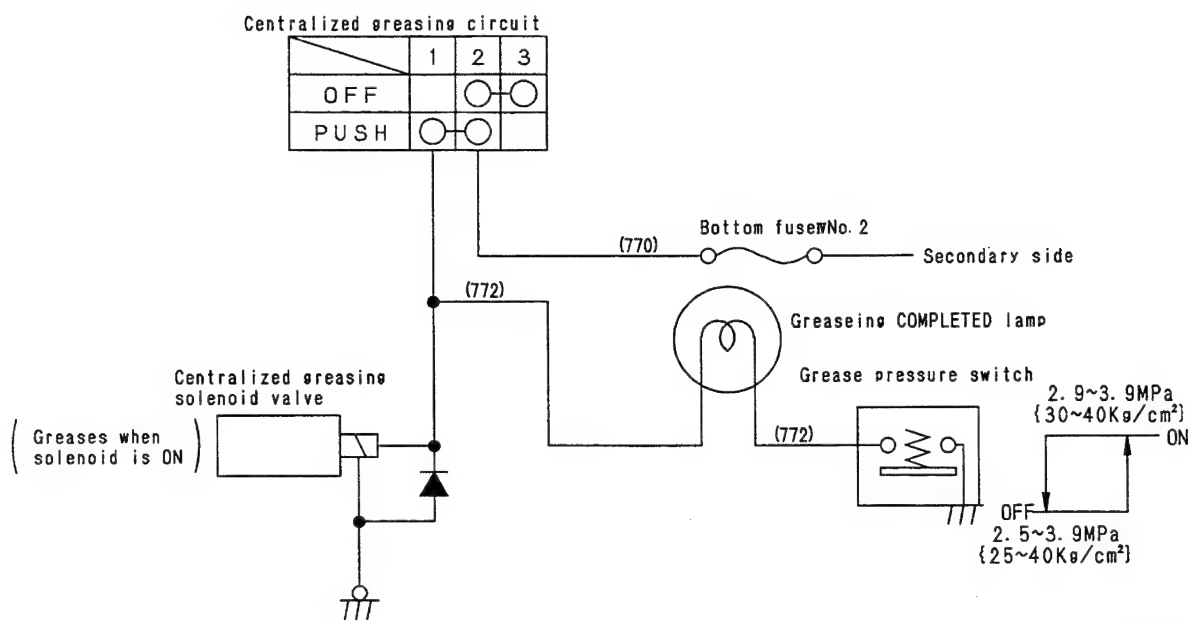
023S05

23. CENTRALIZED GREASING CIRCUIT

SERIAL No.

X-shaped outriger specification : 50001 – 50205

H-shaped outriger specification : 53001 – 53075



SKL01236

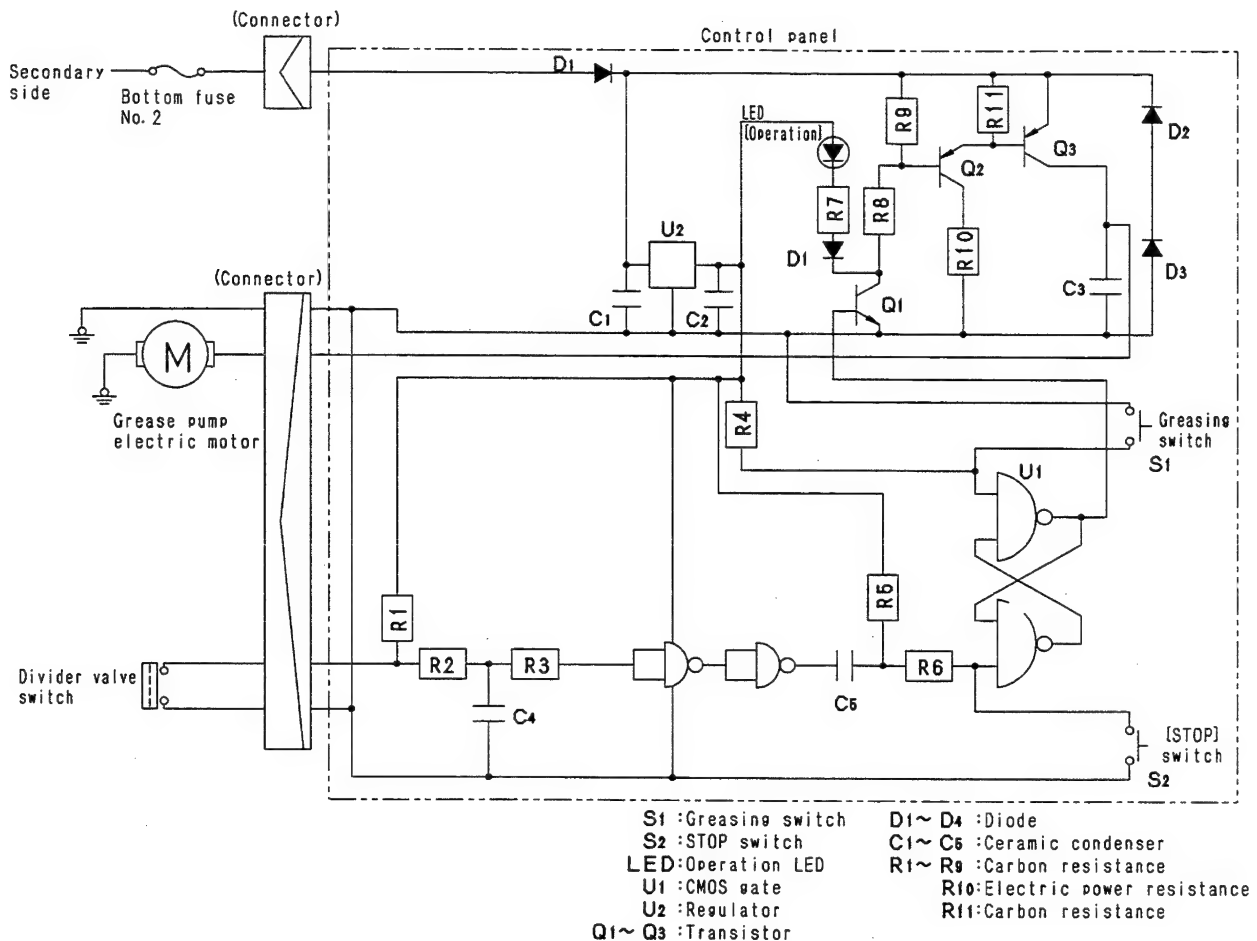
Outline

- On this machine, to make greasing easier, piping is brought from the distributor to one place to connect that place to all the greasing points. With the centralized greasing circuit, it is enough simply to press the greasing switch, and grease from the grease reservoir is sent from the air pump to each distributor to carry out the greasing operations efficiently.

Operation

- When the greasing switch is pressed, terminals 2 and 1 are connected, and the electricity from bottom fuse IV No. 2 flows from terminal 2 to terminal 1. Some of the electricity leaving terminal 1 flows to the greasing solenoid, actuates the valve, switches the air circuit, and actuates the air pump. The rest passes through the greasing COMPLETED lamp and becomes the power source for the pressure switch. When the greasing is completed, the contacts of the pressure switch are connected and joined to the ground. When this happens, the lamp lights up to indicate that the greasing is completed.

023S05

SERIAL No.**X-shaped outriger specification : 50206 and up****H-shaped outriger specification : 53076 and up**

023S05

SVL01715

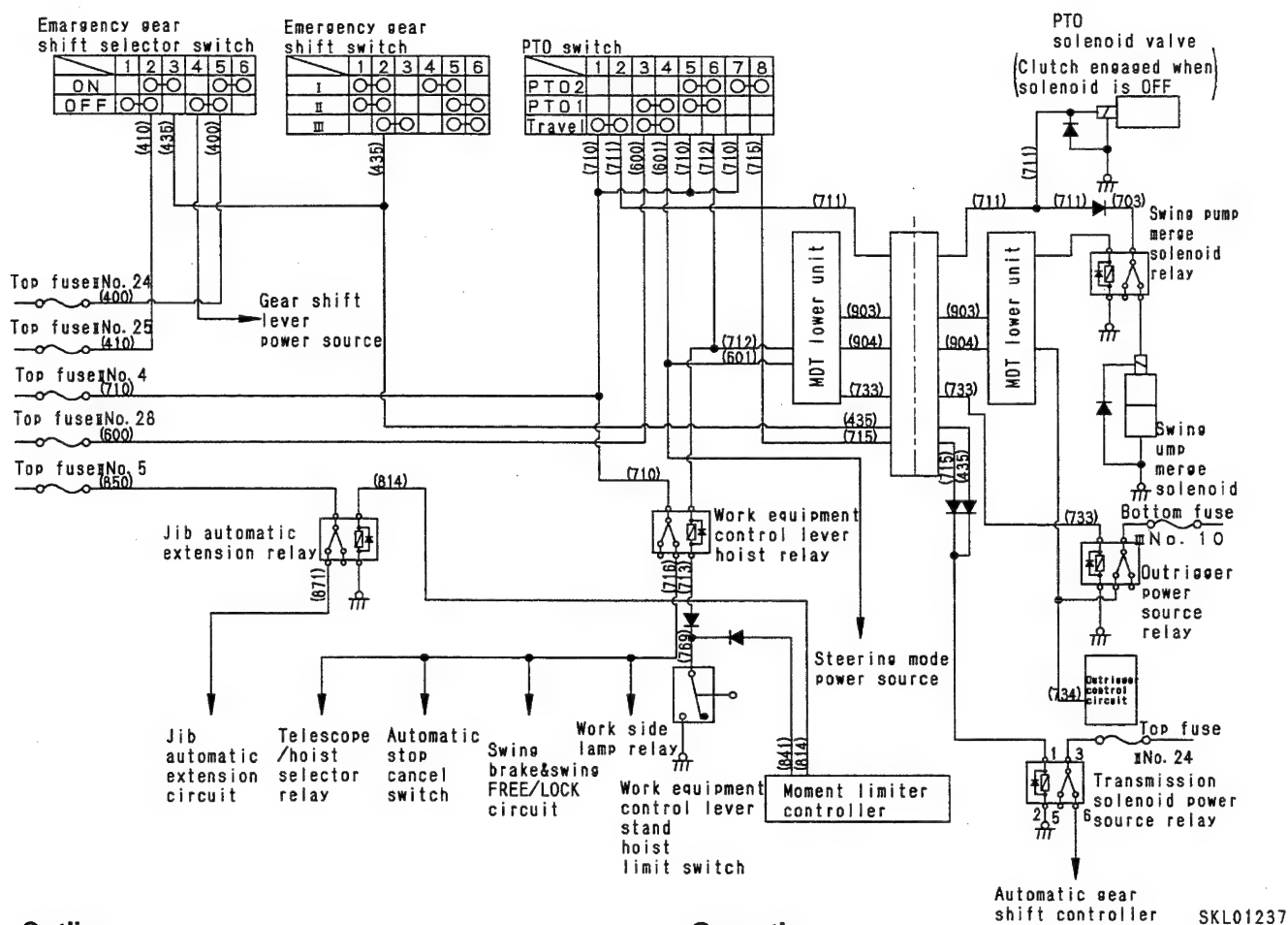
Outline

- To make greasing easier, distributors are located at important points on the machine and the distributors are connected to each greasing point by piping. The centralized greasing circuit is designed to make the greasing operation more effective. It sends grease in the grease reservoir from the plunger pump to each distributor simply by pressing the greasing switch.

Operation

- When the greasing switch is pressed, the power circuit becomes a closed circuit. Electricity flows to each circuit and the operating condition is displayed. The LEDs light up and the electric motor is actuated.
- When the greasing switch is pressed, the ON condition is saved in memory, the divider valve switch which is actuated when the grease spreads fully is actuated, and when the circuit opens, the greasing switch memory circuit is turned OFF, the electric motor stops, and the LED goes out.
- When the STOP switch (which is used to forcibly stop the operation) is pressed, the greasing switch memory circuit is actuated, and this circuit is turned OFF, the electric motor stops, and the LED goes out.

24. PTO CIRCUIT



Outline

- In the PTO circuit, the solenoid valve is actuated by operation of the PTO switch to switch the PTO clutch in the torque converter PTO system. This drives the boom and winch pump and actuates the boom, winch, and outriggers. The PTO switch also carries out the switching of the maximum engine speed setting and the switching of the power source for the travel system.
- When the PTO switch is at the "TRAVEL" position, only travel is possible, and when it is at "OPERATION 1", it is possible to travel and also operate the work equipment and outriggers. When it is at "OPERATION 2", only operations are possible.

Operation

1. PTO switch at "Travel"

If the PTO switch is set to the "TRAVEL" position, terminals 2 and 1, and 3 and 4 are connected. The electricity from top fuse I No. 4 passes through terminal 1 and goes out from terminal 2. The electricity from top fuse II No. 28 passes through terminal 3 and goes out from terminal 4. The electricity leaving terminal 2 passes through the slip ring and excites the PTO solenoid valve. This switches the hydraulic circuit and sets the PTO clutch to DISENGAGE and the engine speed setting to TRAVEL. The electricity leaving terminal 4 becomes the power source for the steering. In addition, if the emergency gear shift selector switch is OFF, the transmission solenoid power source relay is not excited. Terminals 3 and 6 of the relay are connected, and the power source from top fuse II No. 24 flows to the automatic gear shift controller. This makes it possible to operate the travel and steering.

2. PTO switch at PTO1

If the PTO switch is set to the PTO1 position, terminals 3 and 4 and terminals 5 and 6 are connected. The electricity from top fuse I No. 4 passes through terminal 5 and goes out from terminal 6. The electricity from top fuse II No. 28 passes through terminal 3 and goes out from terminal 4.

The electricity leaving terminal 4 becomes the steering power source, and if the emergency gear shift selector switch is OFF, the transmission solenoid power source relay is not actuated. The power source from top fuse II No. 24 becomes the power source for the automatic gear shift controller, so it becomes possible to operate the travel and steering.

In addition, the connection between terminals 1 and 2 of the switch is separated, so there is no output from terminal 2 and the PTO solenoid is de-energized. This switches the hydraulic circuit and sets the PTO clutch to ENGAGE and the engine speed setting to OPERATION.

If the hoist switch on the work equipment lever stand is at RAISE, the electricity leaving terminal 6 flows from terminal 1 of the work equipment lever hoist relay to terminal 2, and excites the relay. The power source from top fuse I No. 4 is supplied to the various operation relays and switches.

In addition, the electricity leaving terminal 4 of the switch passes through wire No. 601, and the electricity leaving terminal 6 passes through wire No. 712, and they then flow to the MDT upper unit. If the MDT upper unit receives power simultaneously from wire No. 712 and wire No. 601, power is output through the slip ring to the outrigger power source relay and excites the relay.

Therefore, the power source of bottom fuse III No. 10 is supplied to the outrigger control circuit to make it possible to operate the outrigger.

However,

- (1) when the transmission control lever is at neutral and the machine is stopped, and
- (2) when the outriggers have been extended and operations carried out, and the over-rear stability stop conditions are fulfilled, the MDT stops the output to the outrigger power source relay, de-energizes the relay, and prohibits outrigger operations.

In the case of (1), the hydraulic power source for the outrigger operation comes from the steering pump, so it prevents the outriggers

from being operated during travel, thereby preventing any problem with the operation of the steering when traveling.

In the case of (2), if the outrigger is stowed away, it prevents the machine from tipping over to the rear.

3. PTO switch at PTO2

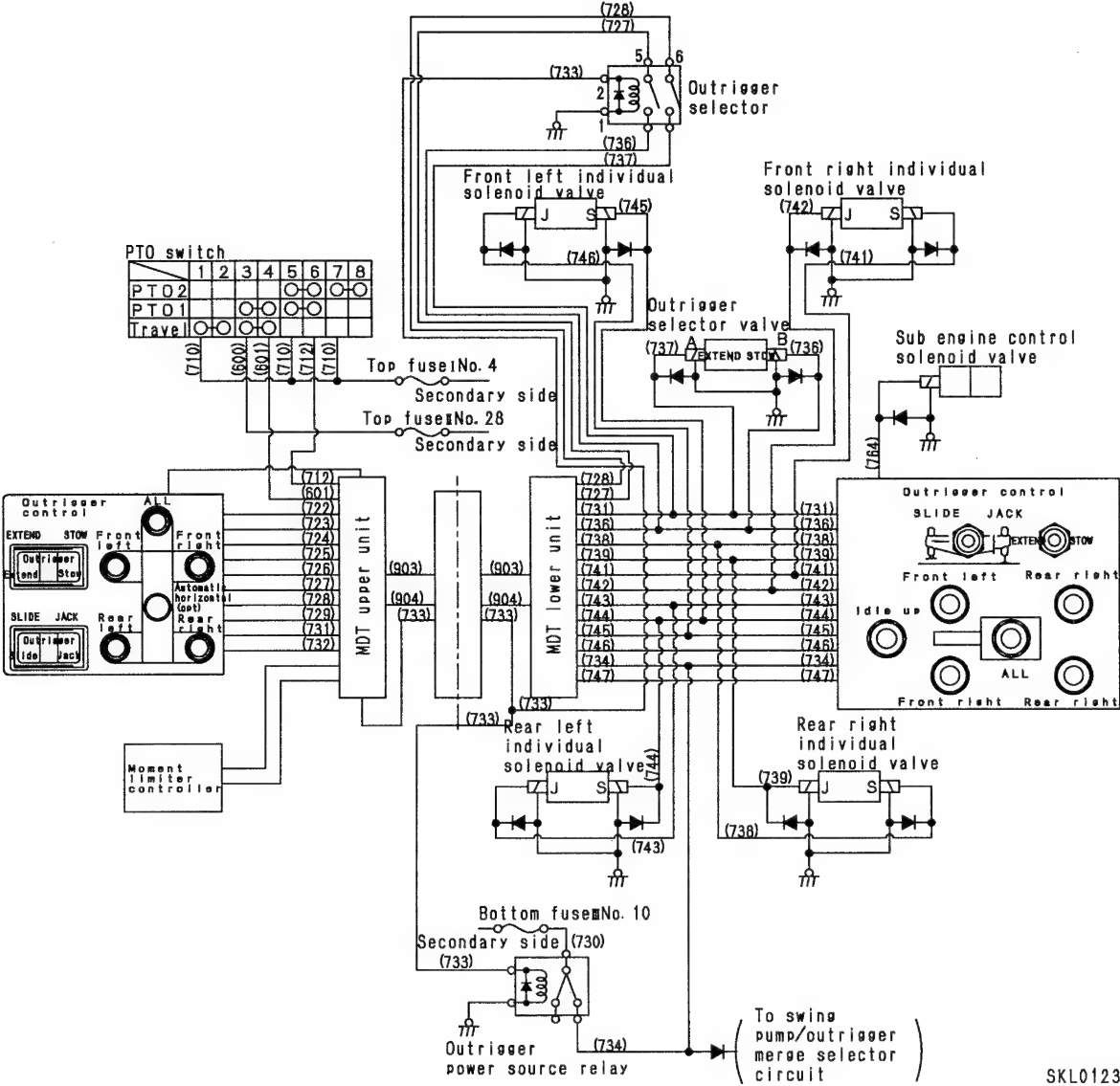
When the PTO switch is set to the PTO2 position, terminals 5 and 6 and terminals 7 and 8 are connected.

When terminals 7 and 8 are connected, electricity from top fuse I No. 4 excites the transmission solenoid power source relay and cuts the connection between relay terminals 3 and 6, so it becomes impossible for the machine to travel.

In addition, the connection between terminal 1 and terminal 2 is separated, and there is no output from terminal 2, so the PTO solenoid is DE-ENERGIZED and it becomes possible to carry out operations.

The MDT upper unit also stops output to the outrigger power source relay, so the outriggers cannot be operated.

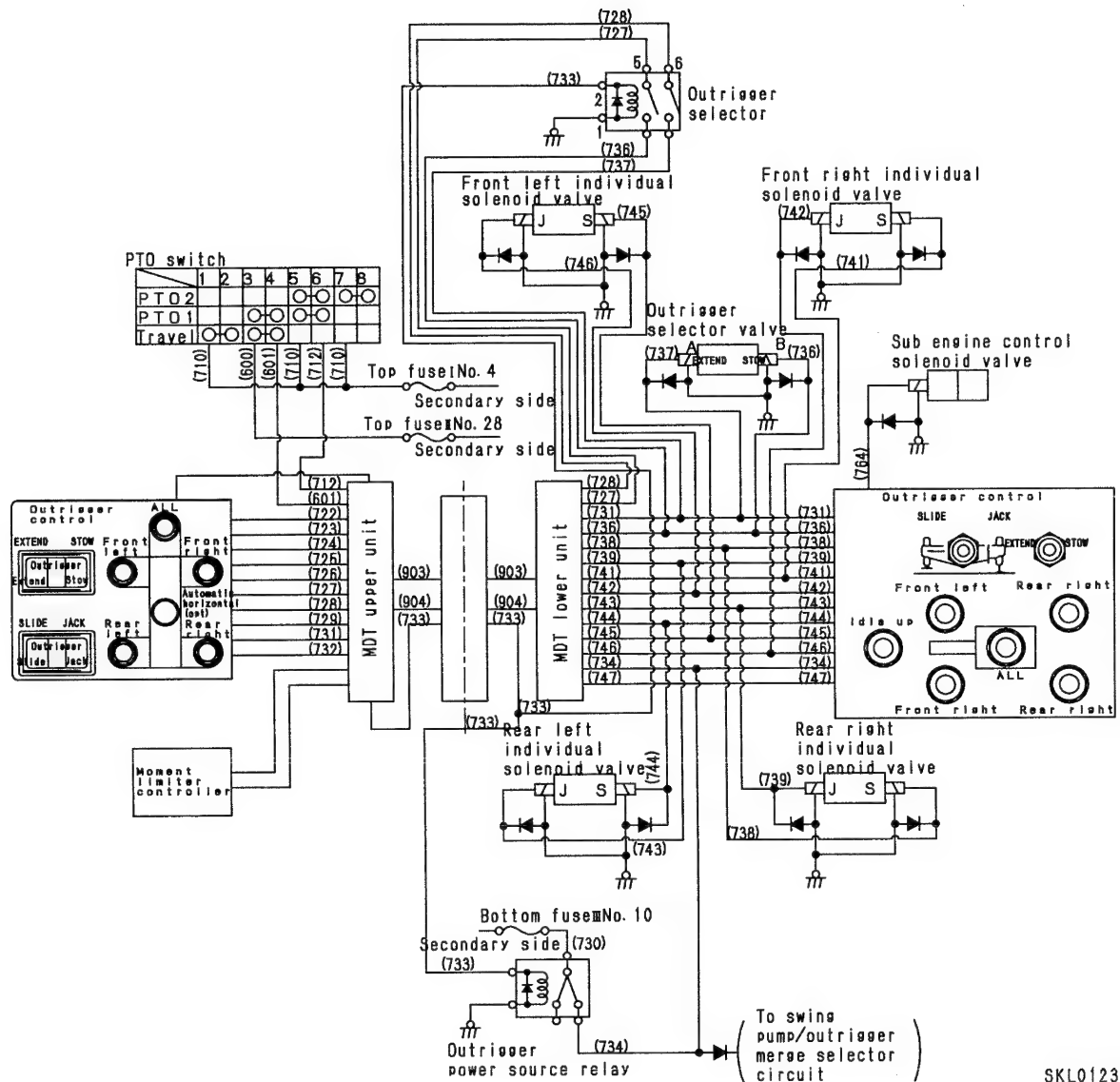
25. OUTRIGGER CONTROL CIRCUIT
H-SHAPED OUTRIGGER SPECIFICATION MACHINE



023S05

SKL01238

X-SHAPED OUTRIGGER SPECIFICATION MACHINE



SKL01239

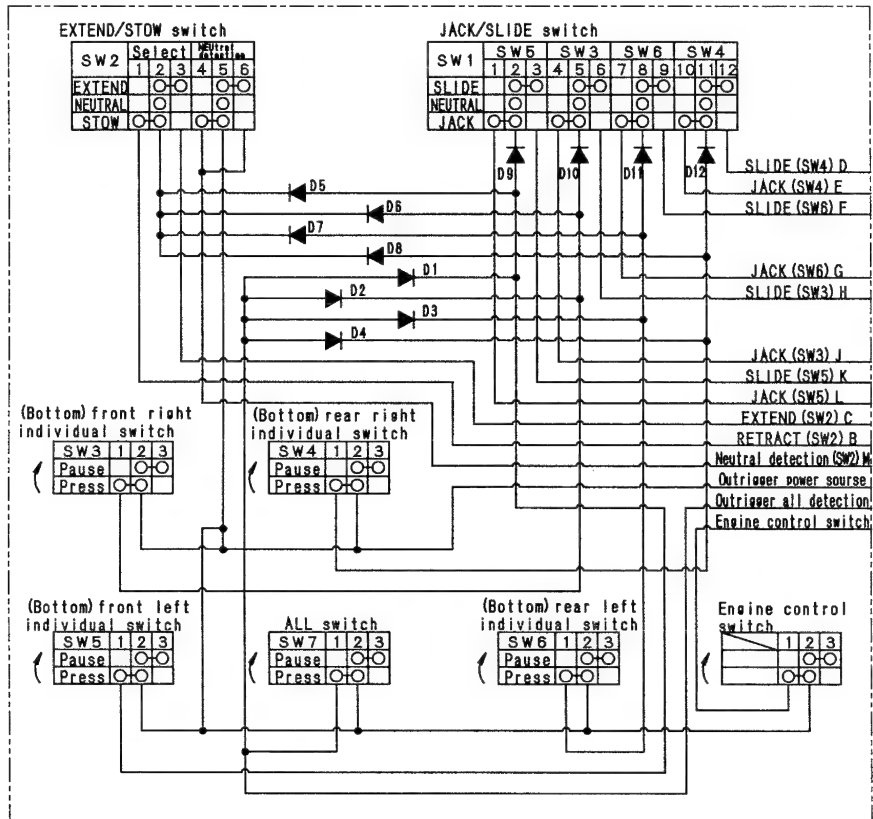
Outline

- When the PTO switch is set to the PTO1 position, the power source is provided to the two controller switches at the top and bottom. When these are operated, the outrigger control circuit actuates the selector valve and the four sets of individual solenoid valves to EXTEND or STOW the outrigger. However, the MDT controller acts to make it impossible to operate the outrigger if the travel speed is above 5 km/h at the PTO1 position, or the shift lever is not at the N position, and the over-rear stability stop condition

will occur if the outriggers are stowed away. There are two controllers for carrying out the outrigger operation: the top controller (inside the cab) and bottom controller (on the center left side of the undercarriage). If the top and bottom controllers are both operated at the same time, the system will not work properly and this will lead to failure.

To prevent this, never operate the bottom control panel when the top control panel is being used.

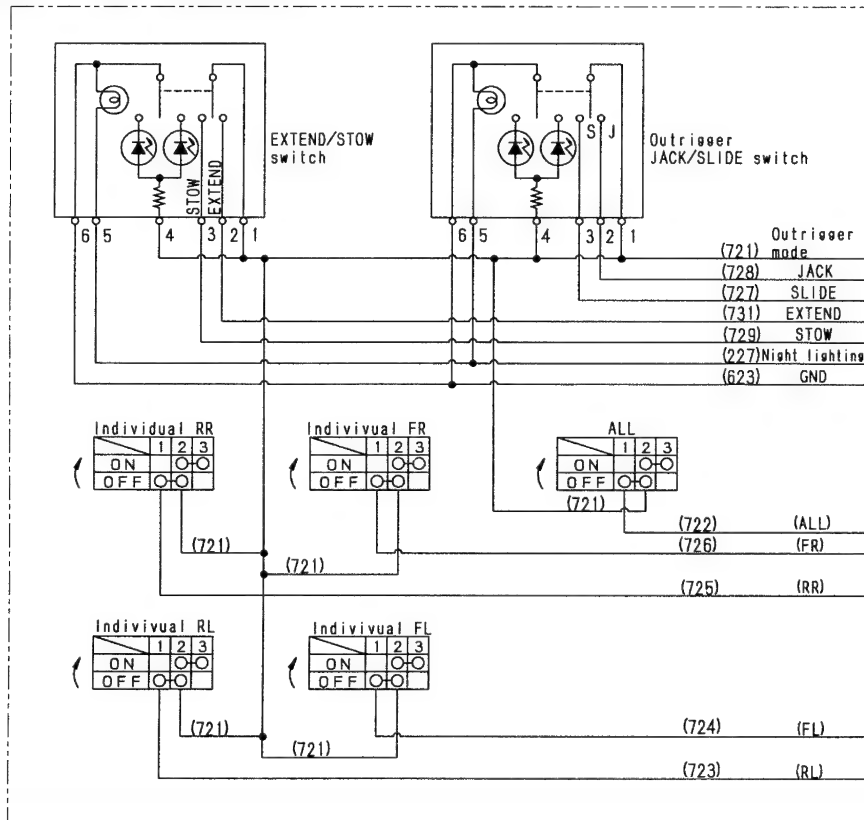
BOTTOM OUTRIGGER CONTROLLER



SKL01240

023S05

TOP OUTRIGGER CONTROLLER



SKL01241

Operation (bottom outrigger controller)

- ★ The power source (electricity from top fuse III No. 10) comes to the bottom outrigger controller switches when the PTO switch is set to the PTO1 position.
The power is connected to each terminal 2 of the ALL switch and the four sets of individual control switches.

1. Outrigger EXTEND (ALL switch operated)

- 1) [JACK/SLIDE switch at SLIDE]
When the switch is set to the SLIDE position, terminals 2 and 3, 5 and 6, 8 and 9, and 11 and 12 are connected, and the ALL switch can be operated.
Terminals 2, 5, 8, and 11 are connected to terminals 1 of the ALL switch and the four sets of individual control switches. Terminals 3, 6, 9, and 12 are connected to the four solenoids S.
- 2) [EXTEND/STOW switch at EXTEND]
From the condition in Step 1, if the switch is set to the EXTEND position, terminals 2 and 3, and terminals 5 and 6 are connected, and the ALL switch can be operated.
Terminal 2 is connected to terminals 2, 5, 8, and 11 of the JACK/SLIDE selector switch, and terminal 3 is connected to solenoid A of the selector valve.
- 3) [ALL switch PRESSED]
When the ALL switch is PRESSED, terminal 1 and terminal 2 are connected, and the electricity entering terminal 2 goes out from terminal 1, enters terminals 2, 5, 8, and 11 of the JACK/SLIDE switch, and also enters terminal 2 of the EXTEND/STOW switch.
Therefore, electricity flows to the four solenoid valves S. Electricity also flows to solenoid A of the selector valve, and extends the slide.
- 4) [JACK/SLIDE switch at JACK]
When the operation in Step 3 is completed, turn the switch to the JACK position.
When this is done, terminals 1 and 2, 4 and 5, 7 and 8, and 10 and 11 are connected, and the ALL switch can be operated.
Terminals 1, 4, 7, and 10 are connected to the four solenoids J.

5) [ALL switch PRESSED]

From the condition in Step 4), if the switch is PRESSED, electricity flows in the same way as in Step 3).
Therefore, the electricity flows to solenoid A of the selector valve, and actuates the valve. It also flows to the four solenoids J, actuates the valve, switches the hydraulic circuit, and extends the outrigger jacks. This completes the operation for the extension of the outriggers.

2. Outrigger STOW (ALL switch operated)

When stowing the outriggers away, follow the operation in Step 1-2) above to set the EXTEND/STOW switch to the STOW position, then carry out the procedure in the order 4) → 5) → 1) → 3).

3. Outrigger EXTEND (using front left individual control as example)

1) [Front left individual switch at SLIDE/EXTEND]

From the condition in Item 1-2), if the individual switch is **PRESSED**, terminals 1 and 2 are connected, and electricity flows from terminal 2 to terminal 1. The electricity leaving terminal 1 enters JACK/SLIDE switch and EXTEND/STOW switch, and flows to the individual solenoid.

2) [Front left individual switch at JACK EXTEND]

From the condition in Item 1-4), if the individual switch is **PRESSED**, terminals 1 and 2 are connected, and electricity flows from terminal 2 to terminal 1.

The electricity leaving terminal 1 goes to the solenoid in the same way as in Item 3-1).

4. Top outrigger switch neutral detection

- When the PTO switch is at the "OPERATION 1" position, if the EXTEND/STOW or JACK/SLIDE switch is **ON**, the indicator inside the switch lights up. This is to warn the operator to reset the switch to the neutral position in order to prevent the outrigger from being actuated if the button switch should be pressed by mistake.

However, this function is not available on the bottom panel.

Therefore, when carrying out work with the outriggers extended, we recommend you to set the PTO switch to the "OPERATION 2" position. (At the "OPERATION 2" position, the outrigger cannot be actuated.)

5. When engine control (idle up) switch is operated

Electricity from bottom fuse No. 20 passes through the outrigger power source relay and enters terminal 2 of the engine control switch. When the switch is pressed, terminals 2 and 1 of the switch are connected, and the electricity from bottom fuse III No.10 flows to the sub engine control solenoid and excites it.

In this way, even when the accelerator valve is not actuated, it is possible to raise the engine idling speed from outside the operator's compartment and to increase the operating speed of the outriggers.

Operation (top outrigger controller)

- ★ When the PTO switch is set to the "OPERATION 1" position, the power source (from the upper MDT) enters the switches of the top outrigger controller.

The power source is connected to each terminal 2 of the ALL switch and the four sets of individual control switches. It is also connected to terminals 2 and 5 of the EXTEND/STOW switch and SLIDE/JACK switch.

When the individual switches and the ALL switch are turned ON, the electric signal is input directly to the upper MDT if the setting is other than neutral for the JACK/SLIDE switch and EXTEND/STOW switch.

The MDT judges which solenoid to drive and carries out the output according to the content of Table 1 from the combination of the signals that are input.

<Example of operation>

Let's imagine that the operating condition of the top outrigger controller is as follows.

- (1) EXTEND/STOW switch at EXTEND
- (2) SLIDE/JACK switch at JACK
- (3) Individual switch **RL**

In this case, 24V is input to 731 and 723 on the upper MDT and 739 (and 728-737) is output from the lower MDT to extend the rear left jack (J.RL).

- When the electricity for the three types of switches (EXTEND/STOW, SLIDE/JACK, individual/ALL) is output to the upper MDT, the lower MDT outputs electricity to the solenoid.

Table 1

Name of signal			Wire No.	Operation (when selector is extended or retracted)									
				Individual jack				Individual slide				ALL jack	ALL slide
Upper MDT input	Outrigger JACK/SLIDE	Jack	731	○	○	○	○					○	
		Slide	729					○	○	○	○		○
	Individual operation	Outrigger RL	723	○				○				/	/
		Outrigger RR	725		○				○				
		Outrigger FL	724			○				○			
		Outrigger FR	726				○				○		
	ALL		722									○	○
	Outrigger mode		733	○	○	○	○	○	○	○	○	○	○
Lower MDT output	Jack	Outrigger J.RL	739	○								○	
		Outrigger J.RR	743		○							○	
		Outrigger J.FL	742			○						○	
		Outrigger J.FR	746				○					○	
	Slide	Outrigger S.RL	738					○					○
		Outrigger S.RR	744						○				○
		Outrigger S.FL	741							○			○
		Outrigger S.FR	745								○		○

023S05

Outrigger operation prohibition conditions

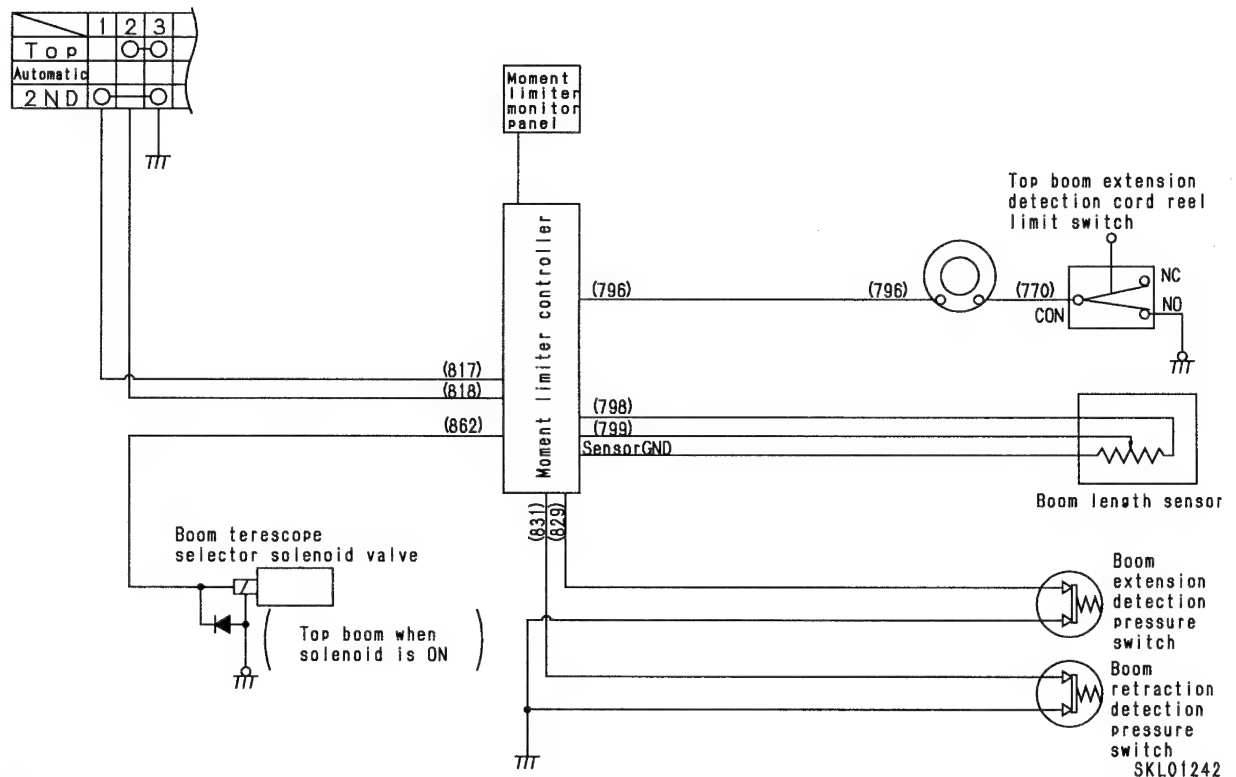
- When the PTO switch is at the PTO1 position, the MDT controller excites the outrigger selector relay and outrigger power source relay through wire No. 733. It supplies electric power to the bottom outrigger control panel, and also supplies electric power to the top outrigger control panel through wire No. 721 to make it possible to operate the outriggers. However, if any of the following conditions exist, the output to wire No. 721 and 723 is stopped.
 - 1) If the outriggers are stowed and the machine is on tire, and there is danger that the machine may tip over to the rear. In this case, if the outrigger is operated at the top controller, a voice message will be given from the OSS panel saying "DANGER! OUTRIGGER OPERATION".
 - 2) When the shift control switch is at any position other than **N**.
 - 3) When the travel speed is more than approx. 5 km/h

In cases 2) and 3), if the outrigger is operated, the supply of oil to the steering is stopped, so it becomes impossible to steer the machine. For this reason, it is prohibited to operate the outriggers in order to prevent any danger that may occur if the machine is moving or if it may move.

Therefore, it is prohibited to operate the outriggers from the top outrigger controller or bottom outrigger controller.

In addition, if the suspension lift is being operated, the outrigger circuit is used as the source of hydraulic oil, so if the outrigger and suspension lift are operated at the same time, priority is given to the suspension lift and the outriggers cannot be operated.

26. BOOM TELESCOPE CIRCUIT



Outline

- With the boom telescope circuit, when the PTO switch is set to the PTO1 or PTO2 position, the OSS controller selects one of the boom telescope cylinders according to the operation of the boom select switch, top boom extension detection limit switch, boom length sensor, and the two pressure switches which detect the boom extension or boom retraction, and carries out the procedure for telescoping the boom and adjusting the telescoping.

Operation

- The OSS controller does the following:
If the following condition ([boom control = EXTEND] + [boom telescope selector solenoid = OFF] + [boom length = 13.66 - 0.15m or more]) continues for 1.5 seconds, the OSS controller sets the second boom extension detection flag.
If the condition is [boom control = RETRACT] + [boom telescope selector solenoid = ON] + [top boom STOW limit switch = COM-NO connection], it resets the second boom extension detection flag.
The following explanation of operation in Items 1 – 4 uses the case of the **automatic telescoping** mode where the two boom selector switches are not pressed together.

1. When boom telescope lever is at EXTEND (2nd boom EXTEND)

The top boom and second boom are stowed away, so the second boom extension detection flag is not set. The moment limiter cuts the flow of electricity to the boom extension solenoid and actuates the valve. This switches the hydraulic circuit, opens the No. 1 telescope cylinder circuit, and extends the second boom.

2. When boom telescope lever is at EXTEND (top boom EXTEND)

When the extension of the second boom is completed under the condition in Item 1, the signal for [boom length 13.66 - 0.15 m or more] is input from the boom length sensor, and the conditions for setting the second boom extension detection flag are fulfilled. As a result, the moment limiter sets the second boom extension detection flag after 1.5 seconds, sends electricity to the boom extension solenoid and actuates the valve. This switches the circuit, opens the No. 2 telescope cylinder circuit and extends the top boom. When the top boom starts to extend, the top boom extension detection switch is set to the COM-NC connected condition and the connection with the ground is separated.

3. When boom telescope lever is at RETRACT (top boom RETRACT)

Under the condition in Item 2, if the boom telescope lever is moved to the RETRACT position, the second boom extension detection flag is set, so the moment limiter sends electricity to the boom telescope solenoid and actuates the valve. This switches the hydraulic circuit, opens the No. 2 telescope cylinder circuit, and retracts the top boom.

4. When boom telescope lever is at RETRACT (2nd boom RETRACT)

Under the condition in Item 3, when the top boom is completely retracted, the top boom extension detection switch is set to the COM-NO connected position and is connected to the ground.

As a result, the moment limiter sets the second boom extension detection flag, the moment limiter cuts the flow of electricity to the boom telescope solenoid and actuates the valve. This switches the hydraulic circuit, opens the No.1 telescope cylinder circuit, and retracts the second boom.

5. When boom select switch is at TOP (manual operation)

When the switch is turned to the TOP position, the moment limiter sends electricity to the boom telescope solenoid and actuates the valve. This switches the hydraulic circuit and opens the No. 2 telescope cylinder circuit.

6. When boom select switch is at 2ND (manual operation)

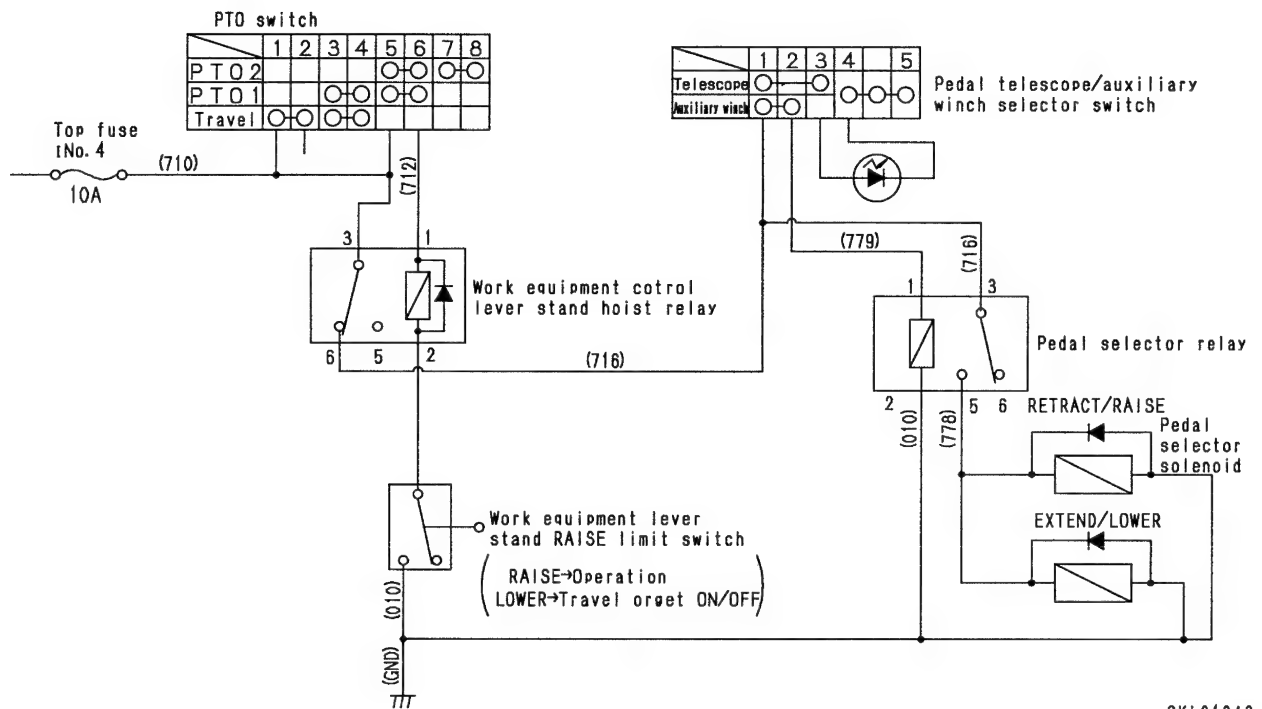
When the switch is turned to the 2ND position, the moment limiter cuts the flow of electricity to the boom telescope solenoid and actuates the valve. This switches the hydraulic circuit and opens the No. 1 telescope cylinder circuit.

If the second boom extension detection flag and top boom stow limit switch condition do not match, a boom telescope abnormal display is given on the moment limiter monitor panel.

Boom select switch	Boom telescope direction	2nd boom extension detection flag	Top boom stow detection limit switch	Boom telescope selector solenoid	Remarks
Automatic telescope selection	EXTEND	Open Open Close Close	Open Close Open Close	OFF OFF ON ON	Attention! Boom telescope abnormality] display/second boom EXTEND ① Second boom EXTEND ② Top boom EXTEND ③ 1.5 sec after completion of 2nd boom extension, OFF switches to ON
	RETRACT-N	Open Open Close Close	Open Close Open Close	ON OFF ON ON	[Attention! Boom telescope abnormality] display/top boom EXTEND ③ Top boom RETRACT ① Top boom RETRACT ② Top boom retraction completion/switches to telescope
Manual (2nd)	EXTEND	Open Open Close Close	Open Close Open Close	OFF	2nd boom EXTEND 2nd boom 2nd boom 2nd boom / [Boom EXTEND completed] displayed
	RETRACT-N	Open Open Close Close	Open Close Open Close	OFF	2nd boom RETRACT 2nd boom 2nd boom 2nd boom
Manual (top)	EXTEND	Open Open Close Close	Open Close Open Close	ON	Top boom EXTEND Top boom Top boom Top boom
	RETRACT-N	Open Open Close Close	Open Close Open Close	ON	Top boom RETRACT Top boom Top boom Top boom / [Boom RETRACTION completed] displayed

2nd boom extension detection flag: Set → close
Reset → open

27. BOOM TELESCOPE/AUXILIARY WINCH PEDAL SELECTOR CIRCUIT



SKL01243

Outline

- The boom telescope/auxiliary winch pedal selector circuit actuates the two pedal selector solenoids when the pedal telescope/auxiliary winch selector switch is operated during PTO operations. It switches the hydraulic circuit and switches the actuation of the pedal.

Operation

- When the PTO switch is at the PTO1 or PTO2 position, electricity from top fuses I No. 4 enters from terminal 5 of the switch, goes through terminal 6, and goes to terminal 1 of the work equipment control lever stand hoist relay. When this happens, if the work equipment control lever stand is at RAISE, terminal 2 of the work equipment control lever stand hoist relay is connected to the ground and is excited, so terminals 3 and 5 of the relay are connected. Therefore, the electricity from top fuse I No. 4 enters terminal 3 of the relay and goes out from terminal 5. Some of the electricity leaving terminal 5 of

the relay enters terminal 1 of the pedal telescope/auxiliary winch selector switch, and the rest enters terminal 3 of the pedal selector relay.

1. When pedal selector switch is at AUXILIARY WINCH

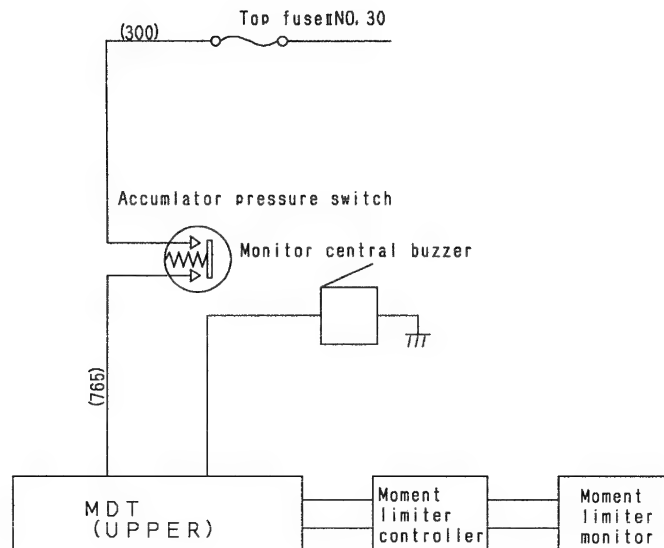
When the pedal selector switch is at the AUXILIARY WINCH position, terminals 1 and 2 of the switch are connected, and electricity from top fuse I No. 4 excites the pedal selector relay. Therefore, the electricity from top fuse I No. 4 entering terminal 3 of the pedal selector relay excites the 2 pedal selector solenoids, switches the hydraulic circuit, and changes the pedal to auxiliary winch operation.

2. When pedal selector switch is at TELESCOPE

When the pedal selector switch is at the TELESCOPE position, terminals 1 and 3 of the switch are not connected, so the pedal selector valve is not excited. Therefore, neither of the two pedal selector solenoids are actuated, so the hydraulic circuit is switched and the pedal is set to boom telescope operation.

023S05

28. ACCUMULATOR CHARGE WARNING



SKL01244

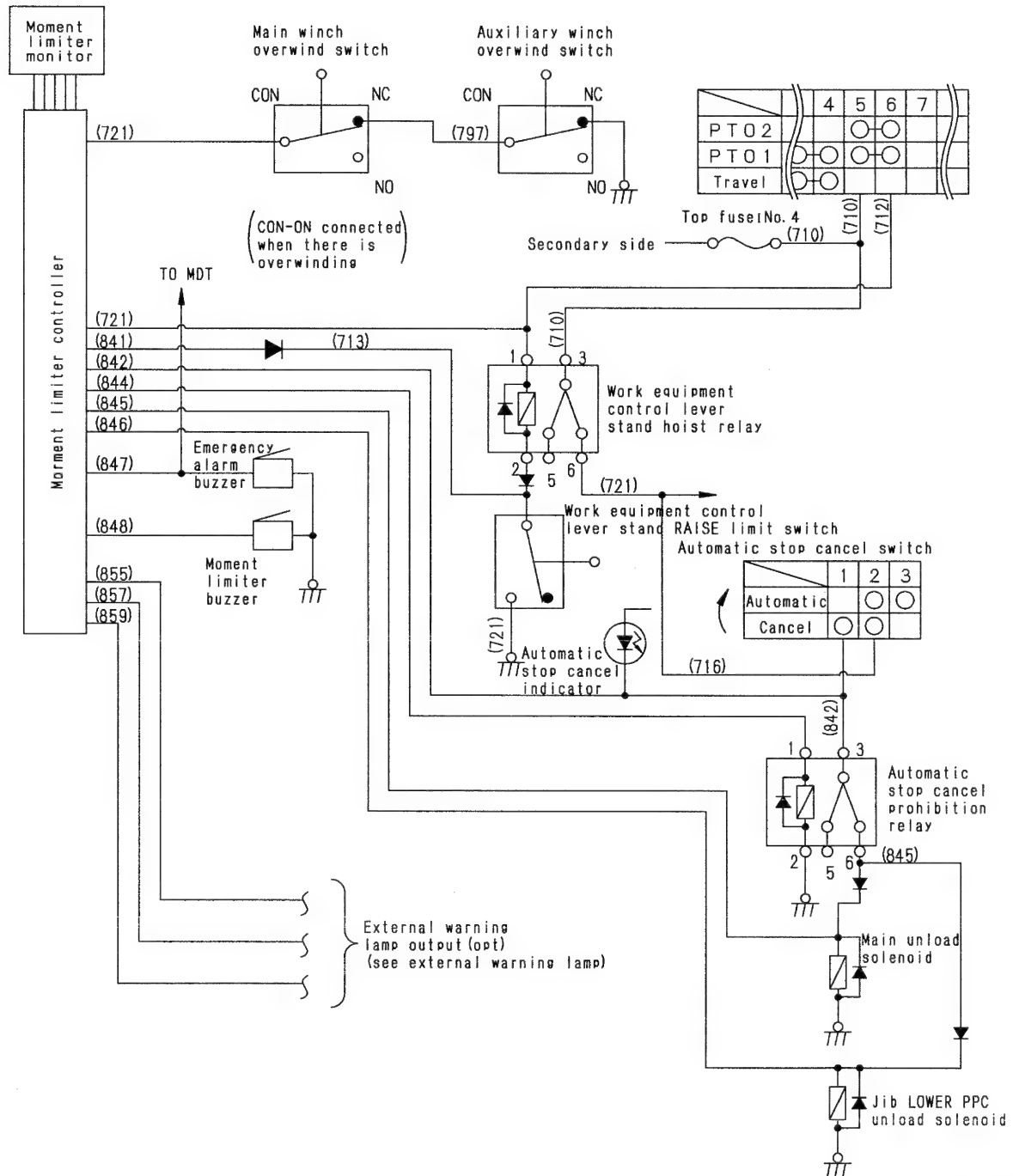
Outline

- With the accumulator charge warning circuit, when the pressure in the accumulator hydraulic circuit drops below 9.3 ± 0.5 MPa (95 ± 5 kg/cm²), the accumulator pressure relay is actuated. It displays the accumulator pressure drop warning and sounds the monitor alarm buzzer.

Operation

When the accumulator pressure drops (9.3 ± 0.5 MPa (95 ± 5 kg/cm²)), the accumulator pressure switch is closed, and the power source from the top fuse II No. 30 is input to the MDT as a signal.

When this happens, the MDT sounds the monitor central buzzer and displays [Danger! Accumulator pressure drop] on the moment limiter monitor.

29. MOMENT LIMITER CIRCUIT**29-1 OVERWIND PREVENTION CIRCUIT, AUTOMATIC STOP CANCEL CIRCUIT**

Outline

- In the overwind prevention circuit, if the winch wire is wound in too far, the wire (hook) actuates the overwind detection switch installed to the tip of the boom or jib. When the OSS controller receives this signal, it lights up the overwind warning lamp and sounds the overload alarm buzzer to inform the operator. At the same time, it cuts the electricity flowing to the work equipment unload solenoid valve and lowers the hydraulic pressure in the winch hydraulic circuit to make it impossible to operate the winch.
- The automatic stop cancel circuit cancels the automatic stop condition that occurs when there is overwinding of the winch. It also cancels the automatic stop caused by overloading.

Operation

When the PTO switch is set to the PTO1 or PTO2 position, terminals 5 and 6 are connected, and electricity at top fuse I No. 4 flows from terminal 5 to terminal 6.

Some of the electricity leaving terminal 6 excites work equipment control lever stand hoist relay if the work equipment control lever stand limit switch is at RAISE. The electricity from top fuse I No. 4 goes to the terminal of the automatic stop cancel switch, and the rest of the electricity passes through wire No. 712, enters the OSS controller and informs that the machine is in the working mode condition.

1. When there is overwinding during winch operations

If the winch is wound in too far and causes an overwind condition, all of the overwind detection switches become OPEN, and the connection of the electricity from the controller to the ground is disconnected.

When this happens, if the work equipment is being operated in the danger direction (boom EXTEND, boom LOWER, jib LOWER, winch WIND IN) or all the work equipment control levers are at the neutral position, the controller is actuated and shuts off the flow of electricity to the main unload solenoid. This actuates the valve, switches the winch hydraulic circuit, and connects the pilot pressure in the relief valve to the drain circuit. As a result, the pressure is reduced, and this makes it impossible for the winch motor to turn.

At the same time, the controller displays the OVERWIND message on the moment limiter

monitor and sends electricity to the buzzer to sound the buzzer. If an external display lamp is installed, it lights up the external display lamp (red).

2. Canceling automatic stop

When an overwind condition occurs, the overwind detection limit switch cuts the connection of wire No. 795 with the ground, so the moment limit controller detects that there is an overwind condition. It cuts off the flow of electricity through wire

No.844 to the main unload solenoid valve and automatically stops the winch operation. The same happens when there is an overload condition. The flow of electricity to the main unload solenoid valve is cut off and the operation automatically stops.

If the automatic stop cancel switch is set to **AUTOMATIC STOP CANCEL**, terminal 2 and terminal 1 of the switch are connected, and the electricity from top fuse I No.4 passes through the work equipment control lever stand hoist relay and automatic stop cancel switch, and enters terminal 3 of the automatic stop cancel prohibition relay.

When this happens, if the automatic stop cancel prohibition relay is not being excited, the electricity entering terminal 3 of the relay goes out from terminal 6, actuates the main unload solenoid valve, and cancels the automatic stop condition.

In addition, the electricity leaving terminal 1 of the automatic stop cancel switch lights up the indicator lamp, and if an external display lamp is installed, it lights up the external display lamp (red).

3. When there is automatic stop cancel prohibition

If the moment limiter controller is in either of the following conditions:

- Work equipment control lever stand at LOWER
- Over-rear stability stop condition fulfilled the automatic cancel prohibition relay is excited through wire No. 844. Therefore, the electricity from top fuse I No. 4 cannot flow to the main unload solenoid valve because the connection of terminals 3 and 6 of the relay is cut. For this reason, even if the automatic stop cancel switch is set to CANCEL, the automatic stop condition is maintained.
- If the lever stand is lowered, LEVER STAND LOWERED is displayed on the moment limiter monitor.

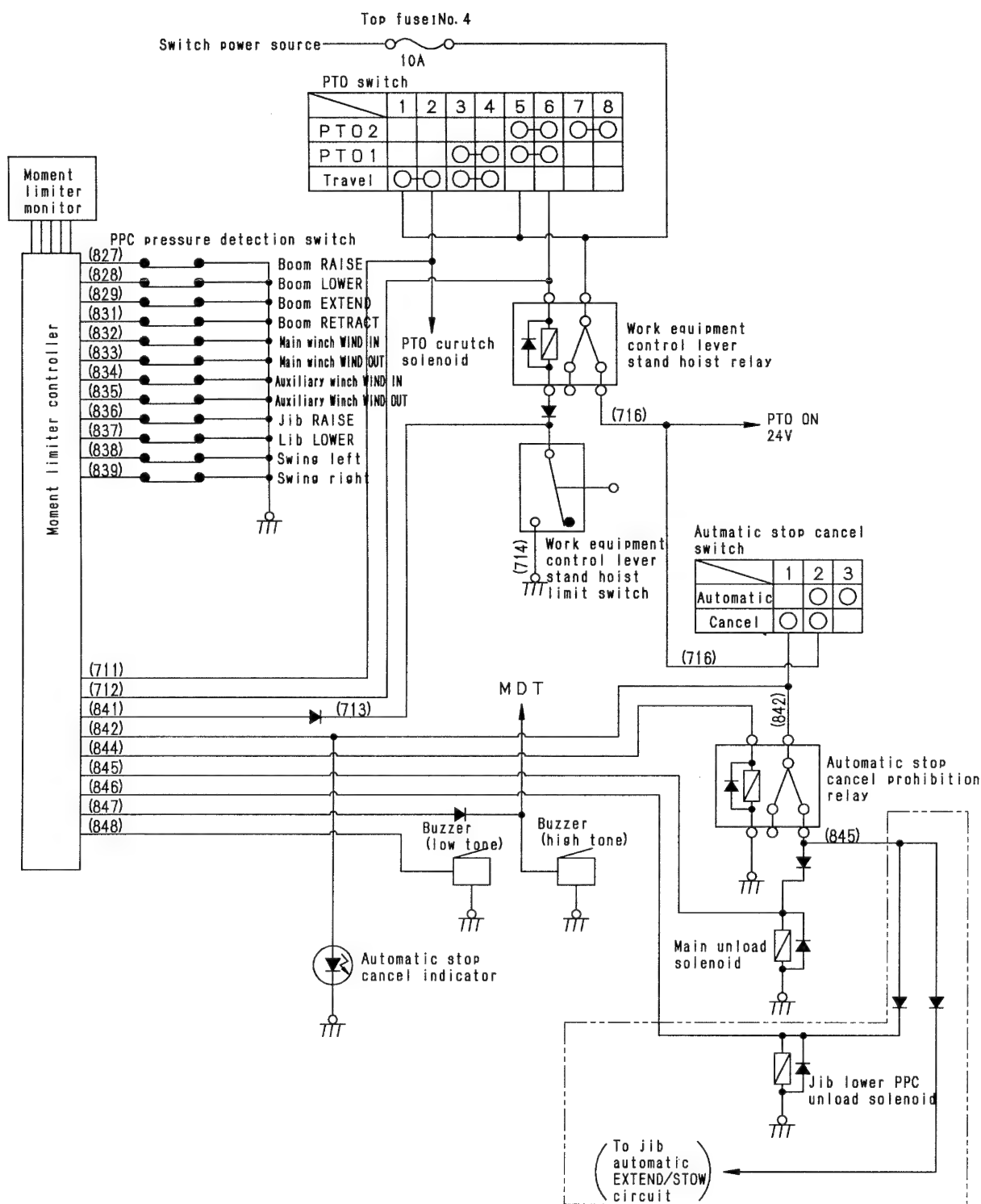
- If the automatic stop cancel switch is set to CANCEL when there is over-rear stability stop, "DANGER! CANCEL PROHIBITED" is displayed on the moment limiter.

4. When jib is automatically extended, stowed

For the power tilt jib specification machine, if the working mode switch on the OSS monitor is set to PREPARATORY mode, the moment limiter controller cancels the automatic stop which was generated by overwinding (it ignores the signal from the overwind limit switch).

At the same time, "ATTENTION!" and "NO OVERWIND AUTOMATIC STOP" messages are displayed in turn on the moment limiter monitor panel. If an external display lamp is installed, it lights up the external display lamp (red).

29-2 OVERLOAD AUTOMATIC STOP CIRCUIT, PPC PRESSURE DETECTION CIRCUIT



023S05

SKL01246

Outline [overload automatic stop circuit]

- With the overload automatic stop circuit, the moment limiter controller computes the condition of the machine from the setting of the switches on the moment limiter panel and the signals from the boom length sensor, boom angle sensor, and pressure sensors installed to the boom and cylinders. It then compares the actual load with the rated overall load for the machine condition. If the value reaches the overload condition, it sounds the overload alarm buzzer and stops the flow of electricity to the work equipment unload solenoid valve. It then lowers the hydraulic pressure in the winch and boom hydraulic circuits and makes it impossible to operate the winch, boom, or jib.

Operation**1. Overload during winch operations**

If the overload condition (100%) is reached during winch operations, the controller is actuated and shuts off the flow of electricity to the main unload solenoid. This actuates the valve, switches the hydraulic circuit, and connects the pilot pressure of the relief valve to the drain circuit to lower the hydraulic pressure and make it impossible to lower or extend the boom or to wind in the winch motor. In power tilt jib operations, the flow of electricity to the jib PPC unload solenoid valve is shut off to make it impossible to lower the power tilt jib.

At the same time, the controller sends electricity to the overload alarm buzzer to sound the buzzer and to display the OVERLOAD STOP message on the OSS monitor.

If an external display lamp is installed, it lights up the external display lamp (red).

2. Operation in direction of safety

If there is overwinding or overload, all operations are made impossible.

However, the PPC pressure switches detect the direction of operation of the work equipment, so it is possible to return the machine in the direction of safety (WIND OUT, RETRACT, RAISE).

In other words, if the main or auxiliary winch levers are operated in the WIND OUT direction, or the boom lever is operated in the RETRACT or RAISE direction, the moment limiter controller sends electricity to the main unload solenoid and actuates the valve. This switches the hydraulic circuit, and closes the drain circuit of the relief valve pilot pressure. This allows the hydraulic pressure to rise normally, and enables the winch motor to wind out and the boom to be retracted or raised.

When carrying out power tilt jib operations, if the chassis is in an overload condition, the moment limiter de-energizes the jib LOWER PPC unload solenoid to automatically stop only the jib LOWER operation. Therefore, it is always possible to carry out operation in the direction of safety (jib RAISE).

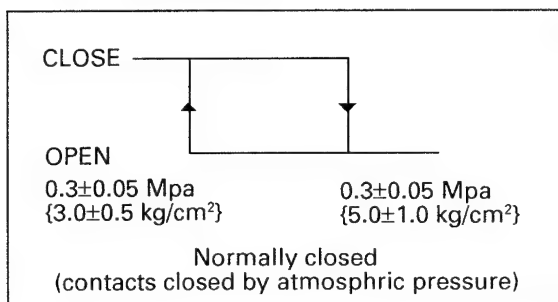
Outline [PPC pressure detection circuit]

- This machine has a low-pressure PPC circuit for operating the work equipment. The pressure of the oil is controlled by the PPC control valve, and the oil actuates the main control valve. However, this control pressure is detected by the moment limiter controller, and if there is overload or overwinding and the machine is operated in the direction of danger, it carries out automatic stop. In addition, it gives preliminary warning of the automatic stop in the same way.

Operation

- When the PPC control valve is operated, pressure is formed in the operated circuit, pushes in the main control valve and actuates the work equipment. However, there is a pressure switch installed in each PPC circuit, and when the pressure is formed in the circuit, the diaphragm inside the pressure switch is pushed and the contacts become OPEN. The terminal of the moment limiter controller is connected to the ground and detects that the appropriate operation is being carried out.

Diagram : Actuating properties of PPC pressure switch

**1. When there is overloading, overwinding**

When there is overload or overwinding, the following operations are in the direction of danger: Main/auxiliary winch WIND IN, boom/jib RAISE, and boom EXTEND.

If the load ratio exceeds 100% and the overwind limit switch is actuated, operation in the directions given above is prohibited. If the PPC pressure switch for the applicable direction of operation is being actuated, the flow of electricity to the main unload valve is stopped, and automatic stop is carried out. Therefore, even when the operation is in the direction of safety, if any operation in the direction of danger is being carried out at the

same time, the flow of electricity to the main unload valve is stopped and the work equipment cannot move.

In addition, even when no operation is being carried out, the flow of electricity to the main unload valve is stopped. This is because the time lag resulting from the time taken for calculation by the moment limiter controller causes a period when there is no movement, so action is taken to prevent any movement in the direction of danger when the work equipment is suddenly operated.

2. When there is automatic stop preliminary warning

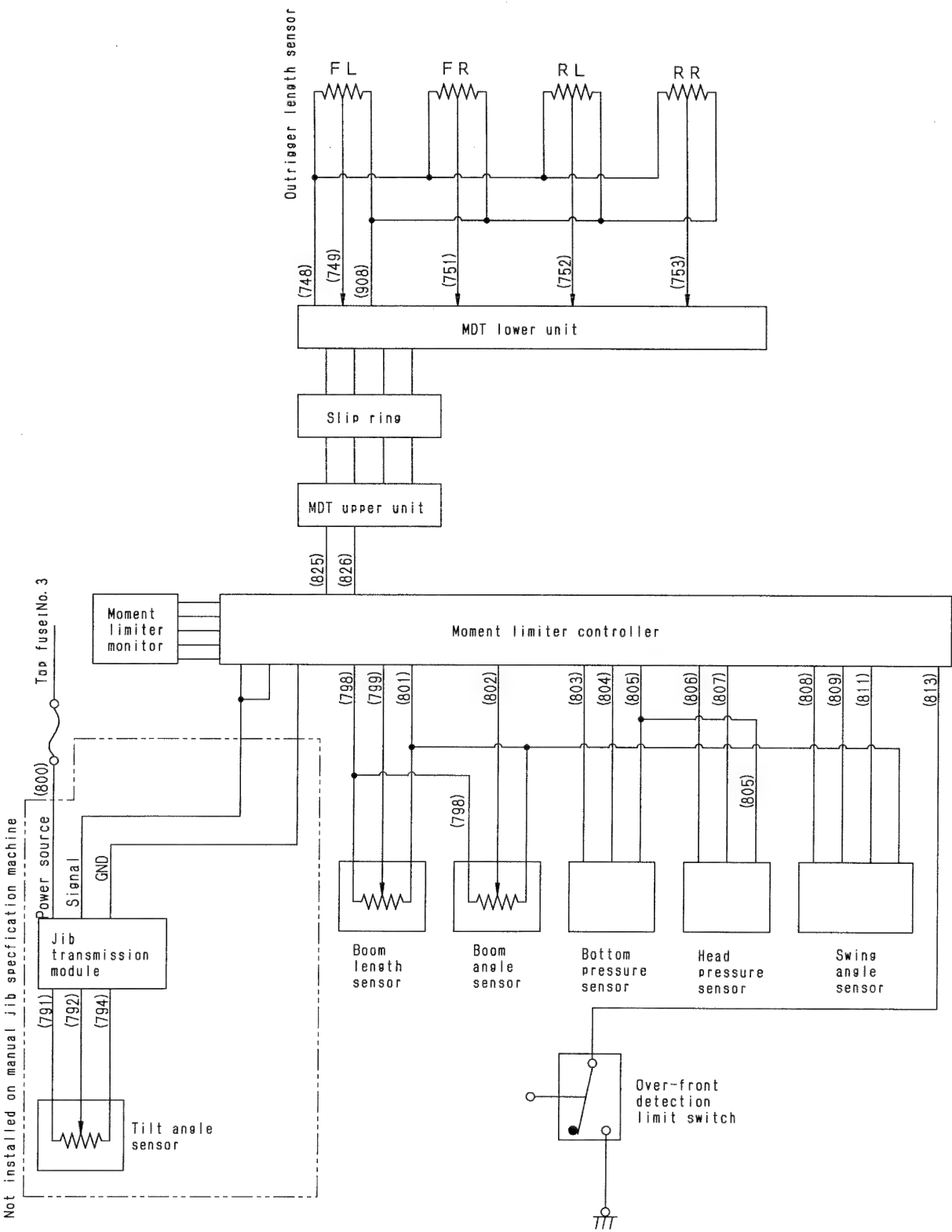
There is a preliminary warning function used when the jib tilt exceeds the upper or lower limit, or the boom angle exceeds the upper limit, or when there is limitation on the operating range setting in manual operations. In this case, if the operation is in the direction which brings the work equipment closer to the restricted area, the preliminary warning is output.

3. When operation is stopped at boom angle upper limit (outside set operating range) or when there is over-rear stability stop

When there is boom angle upper limit stop or over-rear stability stop, the boom raise operation is prohibited. When this happens, if there is an overload condition and the automatic stop is not canceled, the work equipment cannot move. However, in the case of over-rear stability stop, the automatic stop cancel is prohibited.

To escape from any dangerous condition in this case, it is possible to lower the boom as in the case of overload. Therefore, even if there is overload, and the boom angle upper limit stop or over-rear stability are generated at the same time, it is still possible to lower the boom.

29-3 SENSOR CIRCUIT



023S05

SKL01247

Outline

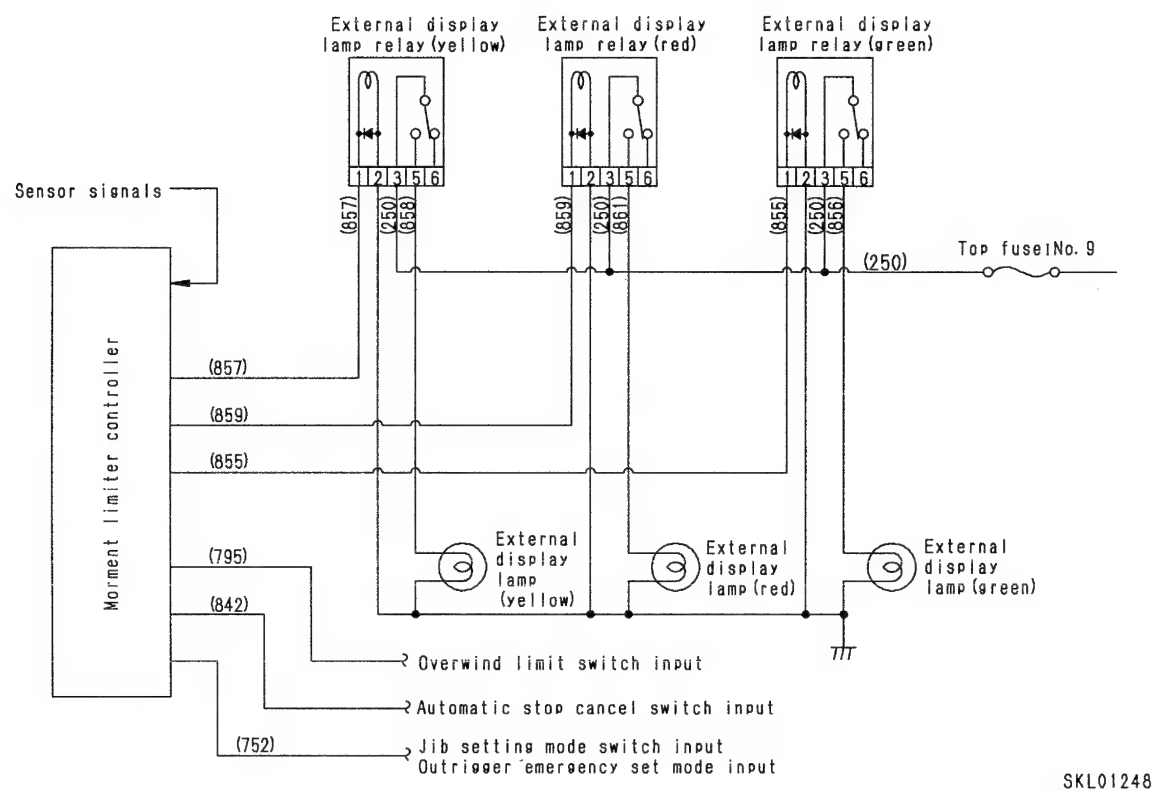
- The moment limiter controller uses the boom length sensor, boom angle sensor, head pressure sensor, bottom pressure sensor, swing angle sensor, and over-front detection limit switch signals to know the posture and working condition of the machine.
From this, it judges if there is any danger and controls the output to the unload solenoid valve.
For the power tilt jib specification machine, during jib operations, the moment limiter also adds the signals from the jib tilt angle sensor and the jib length input from the working mode switch on the moment limiter as data to judge if the condition is dangerous. It uses this information to control the output to the unload solenoid and the jib LOWER PPC unload solenoid valve.
In addition, it uses the signals from the four outrigger length sensors in the undercarriage to detect the extension width. It displays this information on the moment limiter panel and is set by confirmation from the operator.

Operation

- The five sensors in the upper structure are each supplied with a constant power source voltage, and as the values change, such as the length of the boom, the signal voltage changes and is input to the controller.
- The four outrigger length sensors receive a constant voltage from the MDT and change the signal voltage in accordance with the extension of the outriggers.
The four outrigger length signals are converted by the MDT into serial signals, then pass through the slip ring and are input to the moment limiter controller.
- For power tilt jib specification machines, a constant power source voltage is supplied to the jib tilt angle sensor. In the case of auxiliary jib operations, the signal voltage is changed as the auxiliary jib is raised or lowered, and this is input to the tilt angle transmission module.
The tilt angle transmission module takes the tilt angle signal (voltage) that has been input and converts it into a serial signal.
The serial signal for the tilt angle is input to the moment limiter controller. In addition, the condition of the working mode switch on the moment limiter monitor is input to the moment limiter controller from the moment limiter monitor.

023S05

29-4 EXTERNAL DISPLAY LAMP (OPT)



Outline

- The external display lamps consist of three different colored display lamps to inform the crane operator and people in the surrounding area of the load condition or cancellation of safety functions during operations.

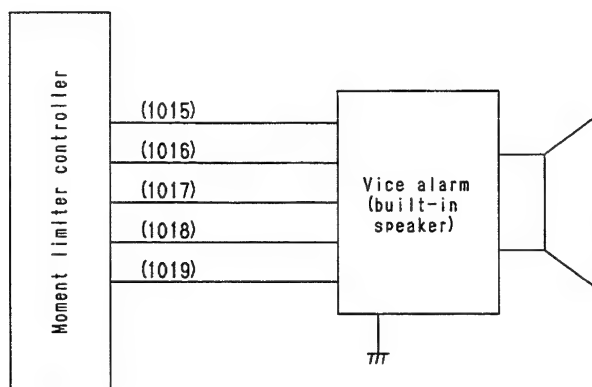
Operation

- The controller controls wire Nos. 855, 857, and 859 as shown in the actuation table on the right in accordance with the signals from the sensors and the settings of the overwind limit switch, automatic stop cancel switch, and jib setting mode switch.

Actuation table (PTO switch at PTO1, PTO2)

	Green	Yellow	Red
Load ratio less than 90%	○		
Load ratio 90% – 100%		○	
Load ratio over 100%			○
Overwind			○
Automatic stop cancel			○
Preparatory mode			○
Outrigger emergency set mode			○

29-5 VOICE ALARM CIRCUIT (OPT)



SKL01249

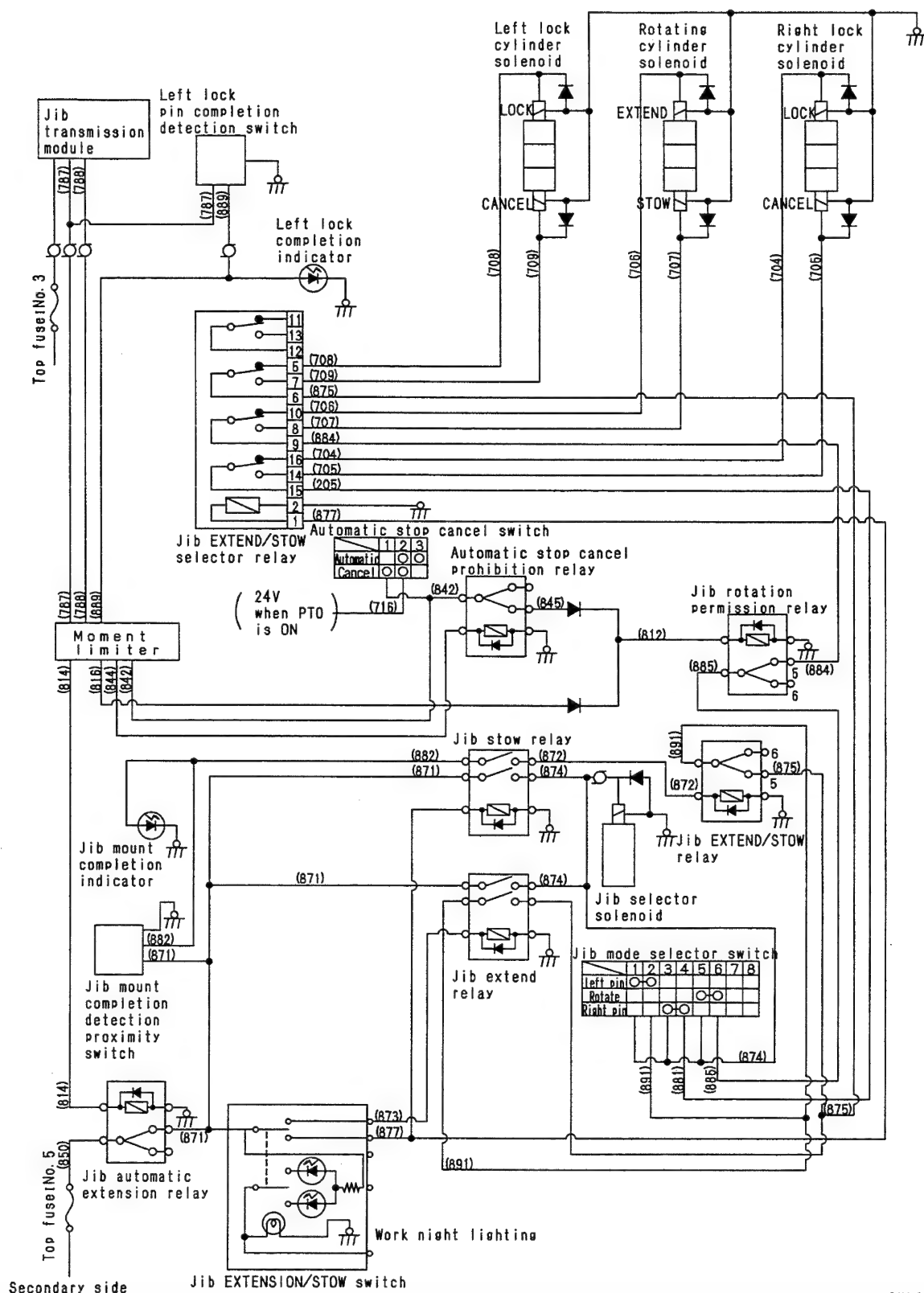
Operation

- When the machine has a raised load, the moment limiter controller uses the buzzer to give graded alarms and to issue various warnings on the message display of the monitor panel. The voice alarm circuit acts as an additional system to generate a synthesized voice on the eight channels below by using a combination of message stop signals (through wire No.1015 and No.1019) and three channels of message selection signal (through wire No. 1016,1017,and 1018) from the moment limiter controller.

Channel ch	Moment limiter output signal					Voice message	Conditions
	Wire No. 1018	Wire No. 1016	Wire No. 1017	Wire No. 1015	Wire No. 1019		
CH1				○	○	Danger	Overload ratio more than 110%,automatic stop in operation, OSS automatic stop cancel, etc.
CH2	○			○	○	Overload	Overload ratio 100%
CH3		○		○	○	Upper limit stop	Over-rear safety limit, hoist upper limit
CH4	○	○		○	○	Set stop	Working range limit
CH5			○	○	○	About to stop	When approaching range before automatic stop position
CH6	○		○	○	○	Stop swing	When approaching set range before swing limit position
CH7		○	○	○	○	Check working mode	PTO ON, outrigger operated
CH8	○	○	○	○	○	Set outriggers	PTO ON, working mode changed
Wait- ing	X	X	X				

○ : +24V output X : Regardless of whether there is output or not

30. POWER TILT JIB EXTENSION CIRCUIT (MACHINE WITH POWER TILT JIB)



023S05

Outline

- On the power tilt jib specification machine, when the working mode switch on the moment limiter monitor is set to PREPARATORY mode and the jib is extended, six solenoid valves are actuated by the operation of the jib switch and mode selector switch to switch the hydraulic circuit. This circuit makes it possible to operate the left and right jib mount and pin cylinder and the jib rotation cylinder with the single tilt lever.

Operation

- When the jib set switch on the moment limiter monitor is set to PREPARATORY mode, the moment limiter controller excites the jib automatic extension relay and supplies the power source from the top fuse I No. 5 to the jib EXTEND/STOW switch. The electricity also enters terminal 3 of the jib extension relay and terminal 1 of the jib stow relay.

- When jib EXTEND/STOW switch is at neutral**
When the jib EXTEND/STOW switch is set to neutral, the power source from top fuse I No. 5 is not supplied to terminal 5 of the jib extension relay and jib stow relay. Therefore, the connections between terminals 3 and 4 of the jib extension relay and terminals 1 and 2 of the jib stow relay are cut, the jib selector solenoid is de-energized, and the hydraulic circuit is switched. This makes it possible to extend or retract the jib tilt cylinder by operating the power tilt lever.

- When EXTEND/STOW switch is at EXTEND**
When the jib EXTEND/STOW switch is at the EXTEND position, electricity from top fuse I No.5 is supplied to terminal 5 of the jib extension relay. Therefore, the electricity entering terminal 3 of the relay goes out from terminal 4 and excites the jib selector solenoid. It also enters terminals 1, 3, and 5 of the jib mode selector switch.

The jib EXTEND/STOW selector relay is not excited, so relay terminals 15 and 16, 9 and 10, and 5 and 7 are connected.

When the jib mode selector switch is set to RIGHT PIN, the electricity entering terminal 3 goes out from terminal 4. It then enters terminal 15 of the jib EXTEND/STOW selector relay, goes out from terminal 16, excites the right lock cylinder lock solenoid, and switches the hydraulic circuit to make it possible to extend the jib mount right pin cylinder by pulling the tilt lever.

When the jib mode selector switch is set to

ROTATE, the electricity entering terminal 5 goes out from terminal 6. When this happens, if the jib rotation permission relay is being excited by the moment limiter controller, the electricity enters terminal 9 of the jib EXTEND/STOW selector relay, goes out from terminal 10, excites the jib rotation cylinder extension solenoid, and switches the hydraulic circuit to make it possible to swing the jib out by pulling the tilt lever.

When the jib mode selector switch is set to LEFT PIN, the electricity entering terminal 1 goes out from terminal 2, enters terminal 1 of the jib extension relay, and goes out from terminal 2. It then enters terminal 6 of the jib EXTEND/STOW selector relay, goes out from terminal 5, excites the left lock cylinder lock solenoid, and switches the hydraulic circuit to make it possible to extend the jib mount left pin cylinder by pulling the tilt lever.

In this condition, if the pin lock is completed, the left pin lock completion detection proximity sensor is set to the LOCK COMPLETED position, sends the LOCK COMPLETED signal to the moment limiter, and also lights up the left lock completion indicator.

- When EXTEND/STOW switch is at STOW**
When the jib EXTEND/STOW switch is at the STOW position, electricity from top fuse I No. 5 is supplied to terminal 5 of the jib stow relay. Therefore, the electricity entering terminal 1 of the relay goes out from terminal 2 and excites the jib selector solenoid. It also enters terminals 1, 3, and 5 of the jib mode selector switch.

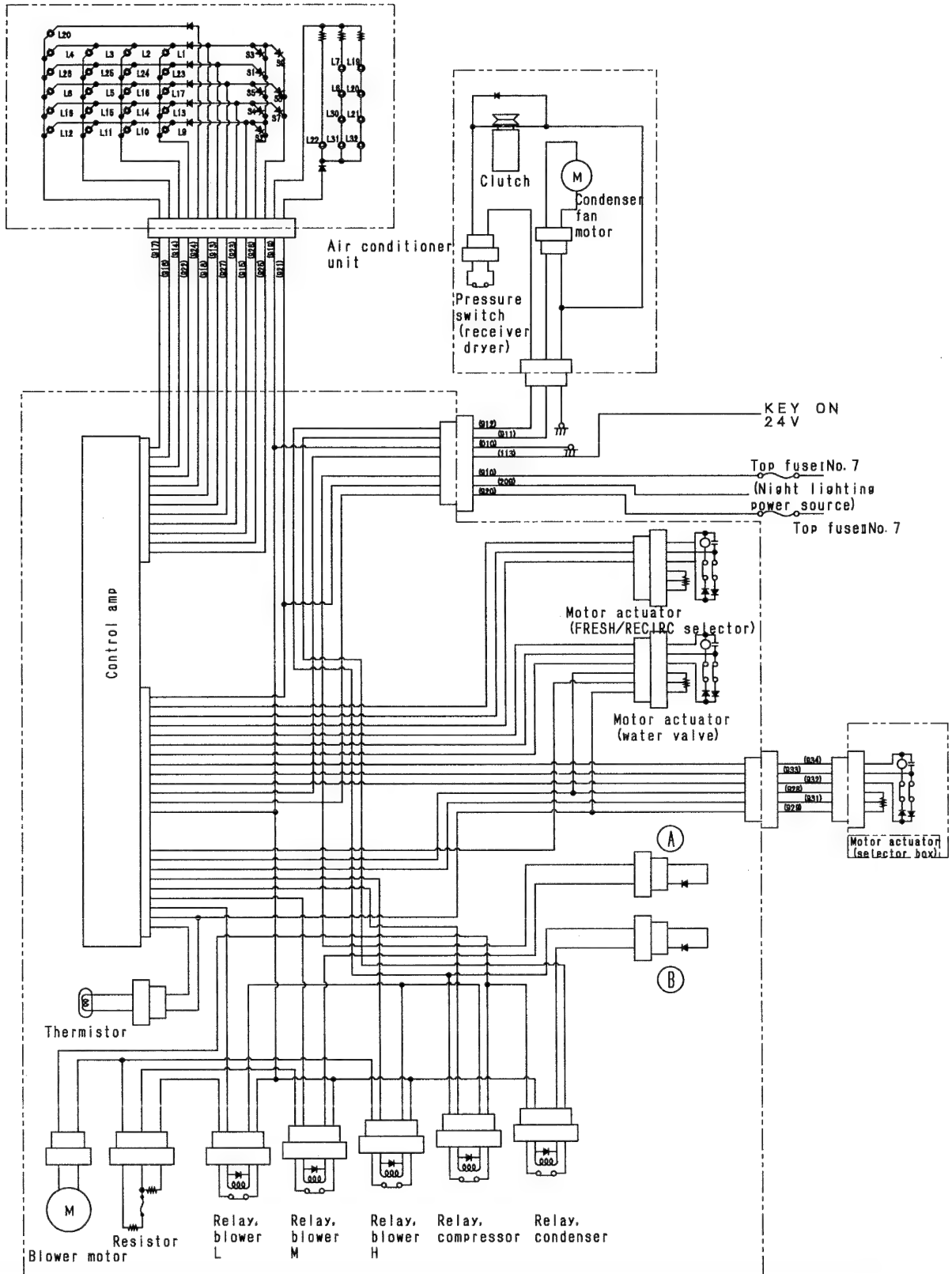
In addition, the electricity from the jib EXTEND/STOW jib switch excites the EXTEND/STOW selector relay, so relay terminals 14 and 15, 8 and 9, and 6 and 7 are connected.

When the jib mode selector switch is set to RIGHT PIN, the electricity entering terminal 3 goes out from terminal 4. It then enters terminal 15 of the jib EXTEND/STOW selector relay, goes out from terminal 14, excites the right lock cylinder cancel solenoid, and switches the hydraulic circuit to make it possible to retract the jib mount right pin cylinder by pulling the tilt lever.

When the jib mode selector switch is set to ROTATE, the electricity entering terminal 5 goes out from terminal 6. When this happens, if the jib rotation permission relay is being excited by the moment limiter controller, the electricity enters terminal 9 of the jib EXTEND/STOW selector relay, goes out from terminal 8, excites the jib rotation cylinder extension solenoid, and switches the hydraulic circuit to make it possible to swing the jib in and stow it by pulling the tilt lever.

When the jib mode selector switch is set to LEFT PIN, if the jib mount completion detection switch is at COMPLETED, the STOW COMPLETED lamp lights up, the jib EXTEND/STOW relay is excited, and relays 3 and 5 are connected. Therefore, the electricity entering terminal 1 of the jib mode selector switch goes out from terminal 2, enters terminal 3 of the jib extension relay, and goes out from terminal 5. It then enters terminal 6 of the jib EXTEND/STOW selector relay, goes out from terminal 7, excites the left lock cylinder cancel solenoid, and switches the hydraulic circuit to make it possible to retract the jib mount left pin cylinder by pulling the tilt lever. If the jib mount completion detection switch is not at the COMPLETED position, the left pin cancel operation is set to the automatic stop condition by the jib EXTEND/STOW relay, and the jib stow completion lamp does not light up.

31. AIR CONDITIONER CIRCUIT

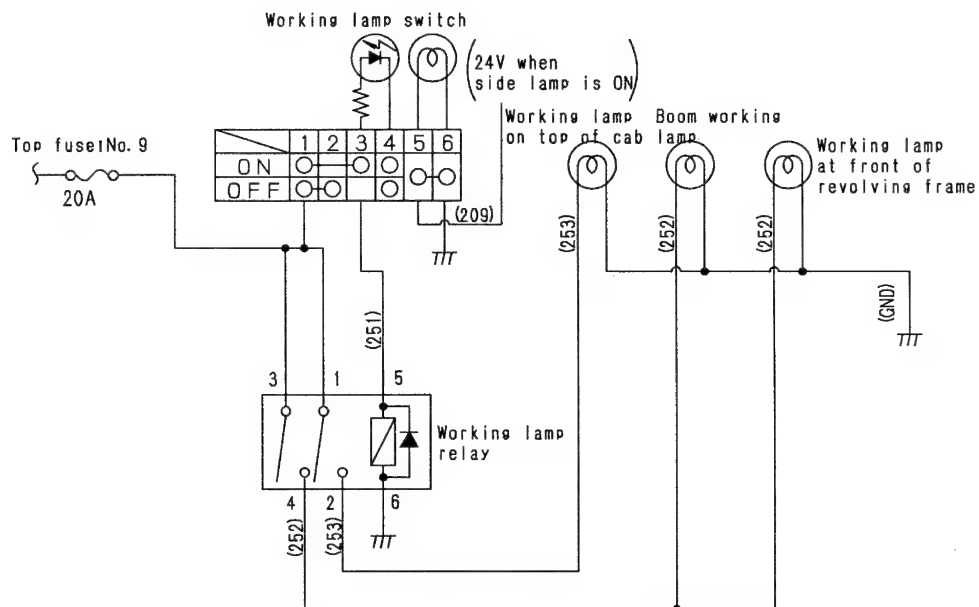


SKL01251

Outline

- The air conditioner circuit has the following functions:
 - ① When the mode selector switch on the air conditioner control panel is operated, it actuates the motor actuator of the vent selector box on the air conditioner unit and selects the vent.
 - ② When the fan switch is turned, it switches between air conditioner ON, OFF, and wind LOW, MI, HI.
 - ③ When the FRESH/RECIRC selector switch is operated, it actuates the FRESH/RECIRC selector motor and selects the intake air source.
 - ④ When the air conditioner switch is operated, it turns the cooling and dehumidifying functions ON or OFF.
 - ⑤ It turns the compressor ON or OFF according to the combination for temperature measurement set by the thermistor and the setting of the temperature set switch.

32. WORKING LAMP CIRCUIT



SKL01252

Outline

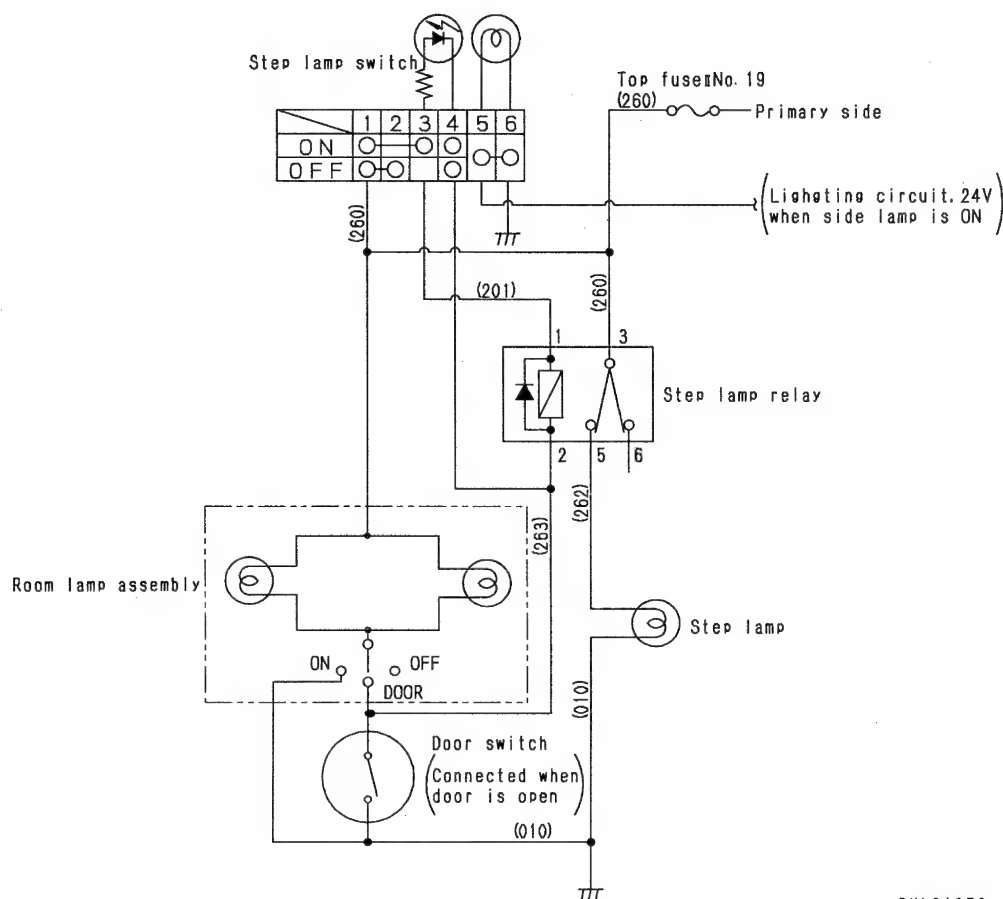
- The three working lamps (on top of cab, on the boom, and at the front of the revolving frame) are lighted up by turning the working lamp switch inside the top panel ON.

Operation

- When the working lamp switch is turned ON, terminals 1 and 3 are connected, and the electricity from top fuse I No. 9 leaving terminal 5 enters terminal 5 of the working lamp relay, excites the relay and lights up the indicator built into the switch. At the same time, relay terminals 1 and 2, and 3 and 4 are connected, and the electricity from top fuse I No. 9 is sent to each lamp.

023S05

33. ROOM LAMP, STEP LAMP CIRCUIT



SKL01253

Outline

- The room lamp and step lamp circuit is a circuit which acts to light up the room lamp or step lamp according to the operation of the step lamp switch or room lamp assembly switch or the condition of the door (open or closed).

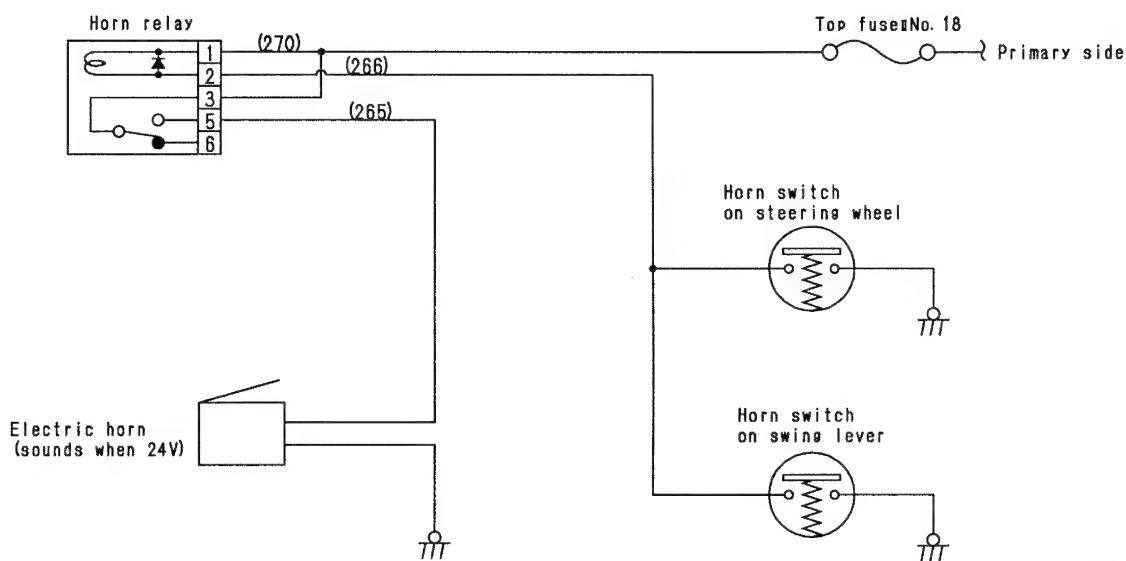
Operation

- The power source from top fuse II No.19 is supplied to the room lamp assembly. When the room lamp assembly switch is turned ON, the room lamp is connected to the ground and lights up. When the switch is turned to DOOR, and the door is opened, the room lamp is con-

nected to the ground and lights up. When the door is closed, the connection with the ground is cut and the lamp goes out.

The power source from top fuse II No.19 is also supplied to step lamp relay terminal 3 and step lamp switch terminal 1. If the step lamp switch is ON, terminals 1 and 3 of the switch are connected, and the electricity entering terminal 1 passes through terminal 3 and enters terminal 1 of the step lamp relay. When this happens, if the door is OPEN, relay terminal 2 is connected to the ground through the door switch, so the relay is excited and the step lamp lights up.

34. HORN CIRCUIT

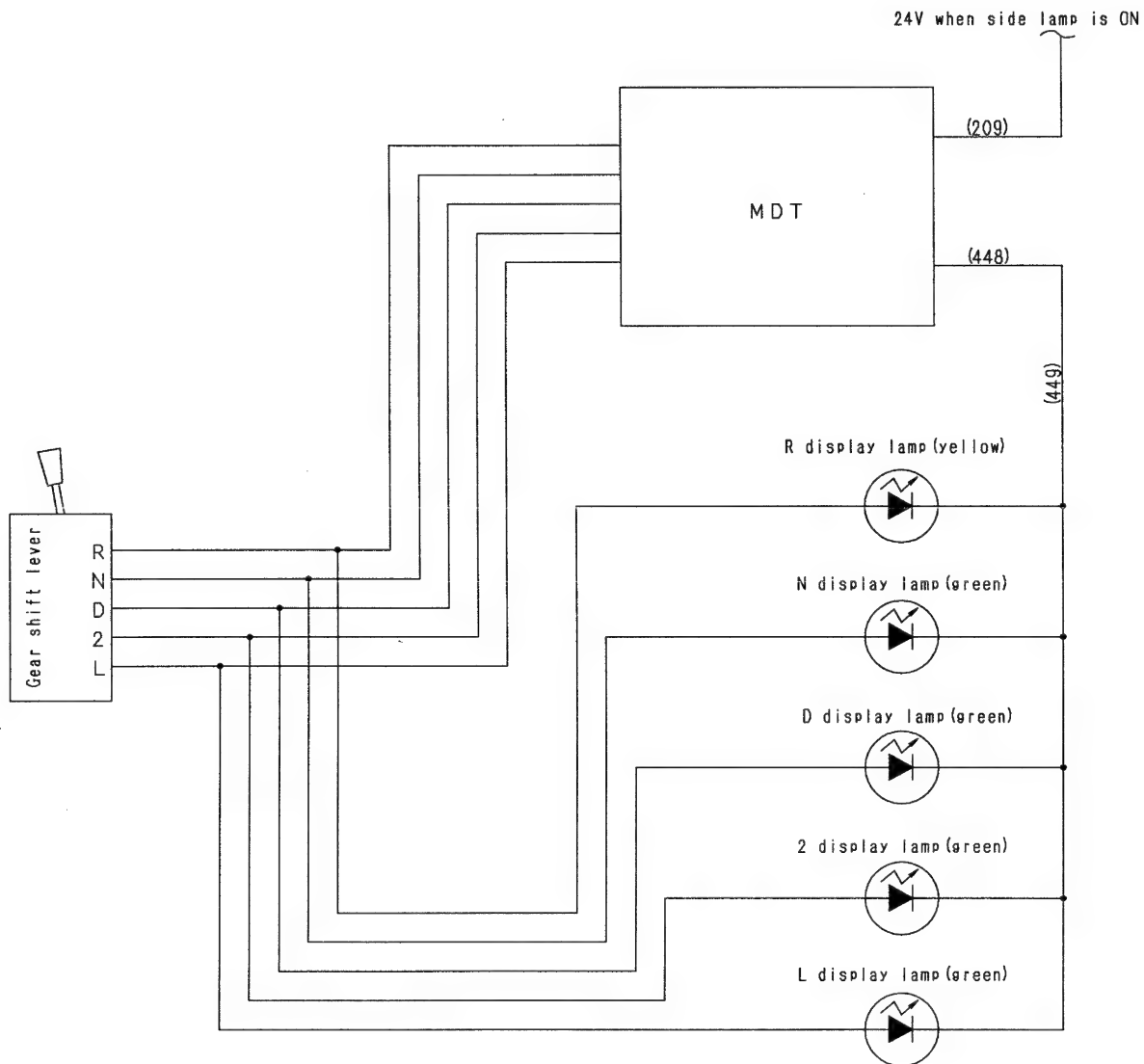


SKL01254

Operation

- The electricity from top fuse II No. 18 enters terminal 1 of the horn relay, and when the horn switch on the steering wheel or swing lever is pressed, it excites the relay. When this happens, relay terminals 3 and 5 are connected, and the electricity leaving terminal 5 is supplied to the air horn to sound it.

35. INDICATOR (LED) DIMMER CIRCUIT



SKL01255

023S05

Outline

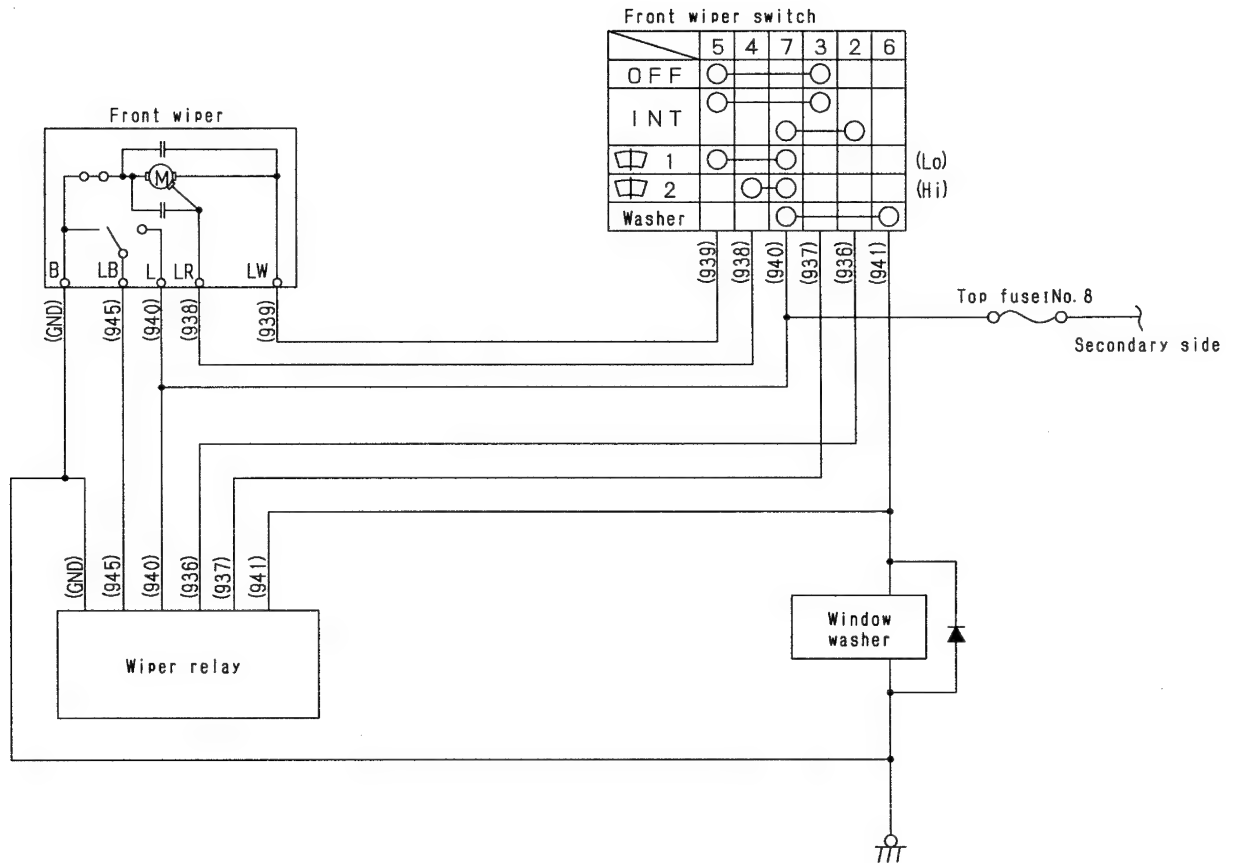
- This lights up the display lamp on the front panel to show the position of the gear shift lever. When the side lamps are turned on for night operations, the brightness is reduced by the MDT.

Operation

- The 24V position signal output to the MDT is used to light up the LEDs (Light Emitting Diodes) in accordance with the position of the gear shift lever. When the night lighting is on, the MDT reduces the electric current to the LED to dim the light.
- The same function is also provided for the rear steering LOCK/FREE/CENTER indicator.

36. WIPER CIRCUIT

36-1 FRONT WIPER CIRCUIT



SKL01256

Operation

- (1) Wiper switch at Lo
The electricity from top fuse I No. 8 flows from terminal 7 to terminal 5, and by sending electricity to wire No. 939, it actuates the wiper at low speed.
- (2) Wiper switch at Hi
The electricity from top fuse I No. 8 flows from terminal 7 to terminal 4, and by sending electricity to wire No. 938, it actuates the wiper at high speed.
- (3) Wiper switch at INT (intermittent)
The electricity from top fuse I No. 8 flows from terminal 7 to terminal 2, and is input to the wiper relay through wire No. 936. When the wiper switch is turned to INT, the wiper relay sends electricity to wire No. 937 at the same time, and the electricity flowing from terminal 3 to terminal 5 actuates the

wiper at low speed. After the wiper finishes one reciprocal movement backwards and forwards, it pauses for 4 - 7 seconds, then repeats the cycle.

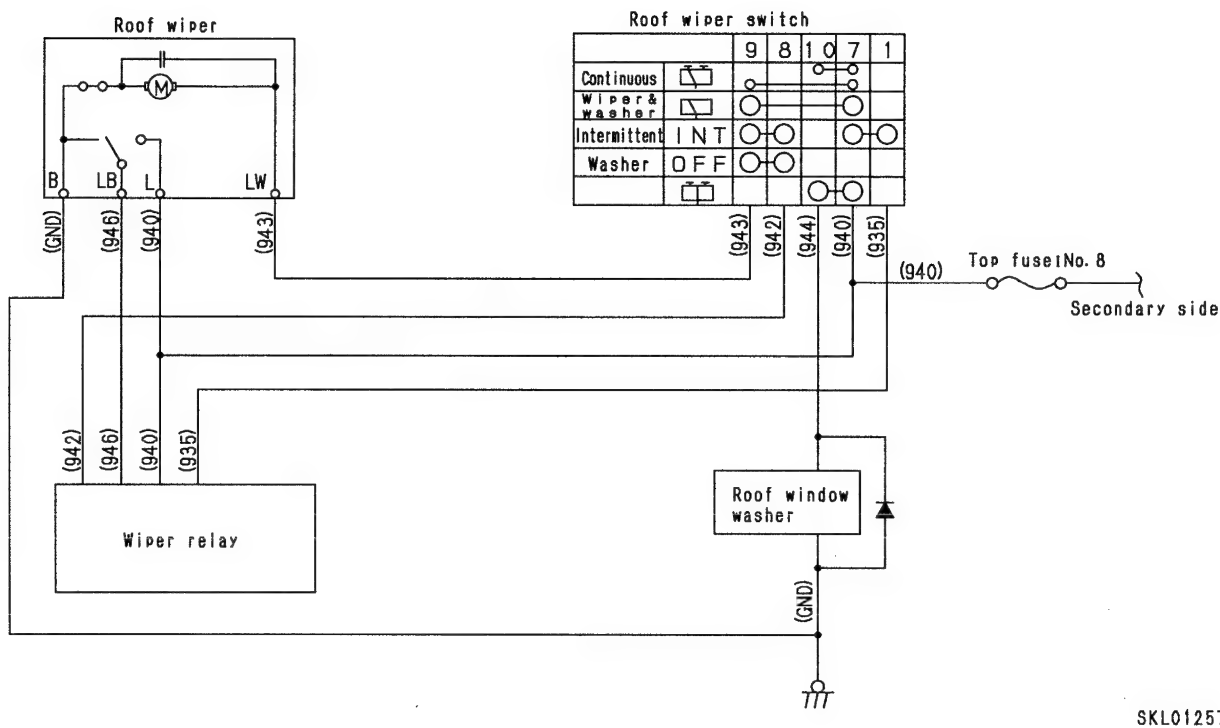
(4) Washer switch ON

The electricity from top fuse I No. 8 flows from terminal 7 to terminal 6, actuates the window washer, and also is input to the wiper relay. The wiper is actuated 0.2 - 0.8 seconds after the washer switch is turned ON.

After the washer switch is turned OFF, the operation of the wiper relay actuates the wiper 2 - 4 more times, then stops it.

The interconnected function of the wiper and washer switch works only if the washer switch is kept ON for longer than one cycle of the wiper.

36-2 ROOF WIPER CIRCUIT



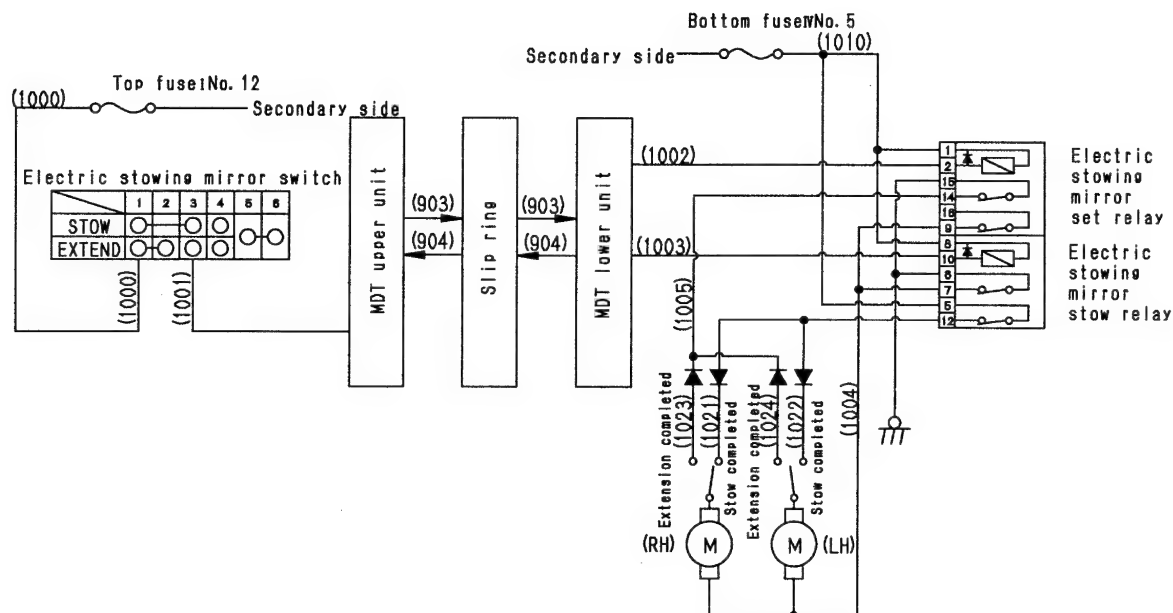
SKL01257

023S05

Operation

- (1) When wiper switch is at INT (intermittent)
Electricity from top fuse I No.8 flows from terminal 7 to terminal 1, passes through wire 935, and is input to the wiper relay.
When the wiper switch is turned to INT, the wiper relay sends electricity to wire No.942 at the same time, and electricity flows from terminal 3 to terminal 5 to actuate the wiper. After the wiper carries out one return movement, it waits for 4 – 7 seconds before repeating the operation.
- (2) When wiper switch is at CONTINUOUS
Electricity from top fuse I No.8 flows from terminal 7 to terminal 9, flows to wire No. 943, and actuates the wiper continuously.
- (3) When wiper and washer switch is ON
Electricity from top fuse I No. 8 flows from terminal 7 to terminal 10, actuates the roof window washer, and also flows from terminal 7 to terminal 9 to actuate the wiper.
- (4) When washer switch is ON
Electricity from top fuse I No. 8 flows from terminal 7 to terminal 10, and actuates the roof window washer.

37. ELECTRIC MIRROR CIRCUIT



Outline

- With the electric mirror circuit, when the electric stow mirror switch is operated, the output signal from the MDT is switched and actuates the two relays to actuate the electric mirror stow stay motor and to carry out stowing and extension.

Operation

1. When electric stowing mirror switch is at STOW

When the electric stowing mirror switch is at the STOW position, the power source from top fuse I No. 12 is input to the MDT upper unit as the signal. As a result, the MDT lower unit turns the output to wire No. 1002 ON (connects with GND), and the electricity from bottom fuse IV No. 5 excites the electric stowing mirror set relay.

Therefore, the electricity from bottom fuse IV No. 5 enters from relay terminal 1, passes through terminal 2, and goes to the left and right electric mirror stowing stays.

When this happens, the sliding contacts inside the electric mirror stowing stays are at the EXTENSION COMPLETED (set position), and are connected to the ground through electric stowing mirror set relay terminal 4 and terminal 3, so the electric mirror stays are stowed. When the stowing is completed, the sliding points inside the mirror stay are at STOWING COMPLETED (stow position), so

the mirror stay motor is no longer connected to the ground, and the movement of the stay stops.

2. When electric stowing mirror switch is at EXTEND

When the electric stowing mirror switch is at the EXTEND position, the electricity from wire No. 1001 is not input to the MDT upper unit. As a result, the MDT lower unit turns the output to wire No. 1002 OFF (cuts connection with GND), turns the output to wire No. 9003 ON, and the electricity from bottom fuse IV No. 5 excites the electric stowing mirror stow relay.

Therefore, the electricity from bottom fuse IV No. 5 enters from relay terminal 1, passes through terminal 2 and goes to the electric mirror stowing stays.

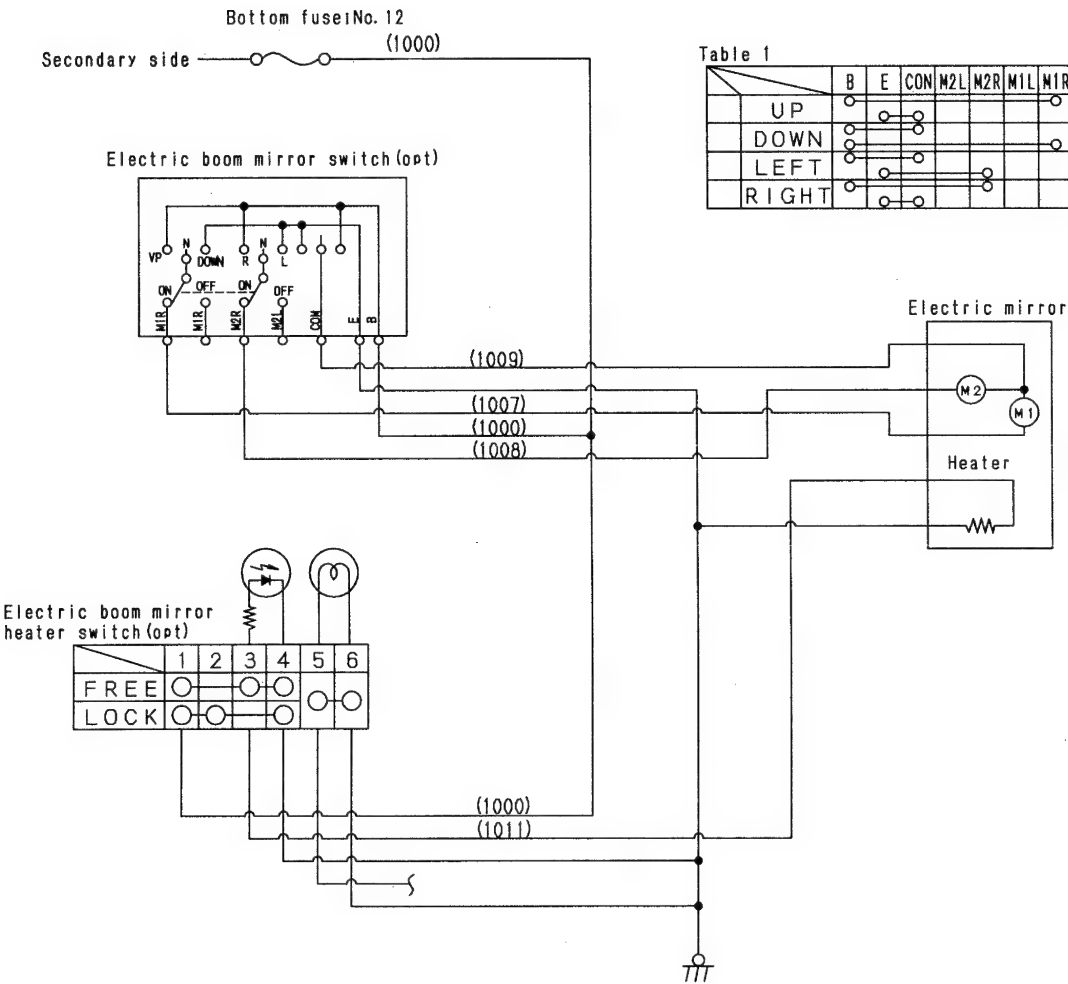
When this happens, the sliding contacts inside the stays are at the STOW COMPLETED, the electricity from relay terminal 2 flows to the stay motor in the opposite way to Item 1, it is connected to the ground through relay terminal 4 and terminal 3, so the electric mirror stays are extended.

When the extension is completed, the sliding points inside the mirror stay are at EXTENSION COMPLETED, so the mirror stay motor is no longer connected to the ground, and the movement of the stay stops.

SKL01258

023S05

38. ELECTRIC BOOM MIRROR CIRCUIT, ELECTRIC BOOM MIRROR HEATER CIRCUIT



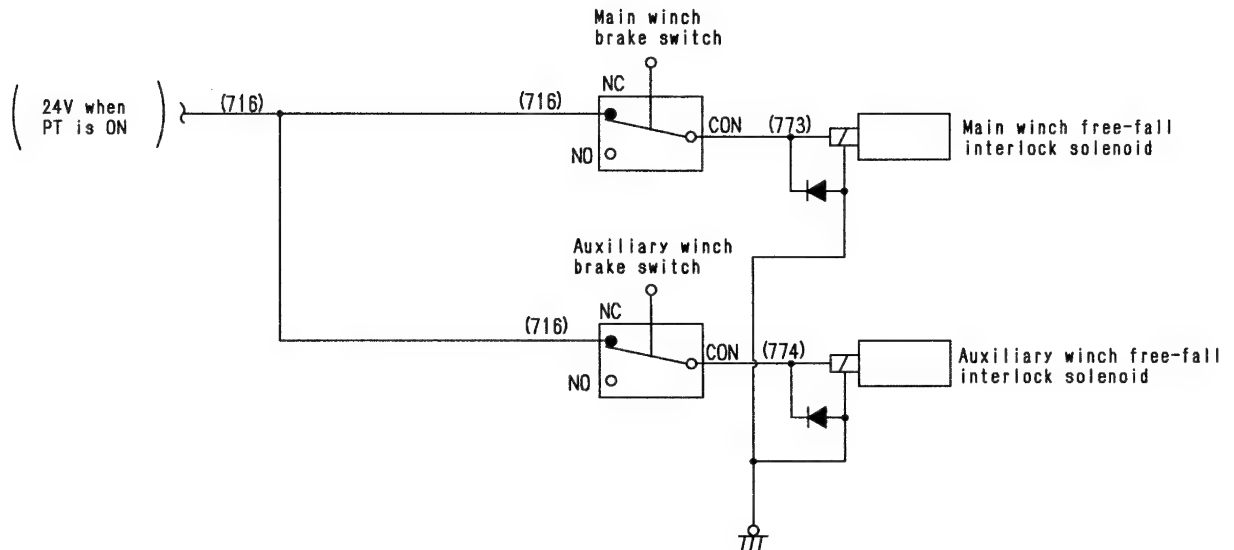
023S05

SKL01259

Operation

- The terminals of the electric boom mirror switch are connected as shown in Table 1. According to the operation of the switch, the power source from top fuse I No. 12 flows to electric boom mirror motors M1 and M2 and changes the angle of the electric boom mirror. In addition, when the electric boom mirror heater switch is turned ON, electricity from top fuse I No. 12 flows from terminal 1 of the switch to terminal 3, and flows to the electric boom mirror heater.

39. FREE-FALL INTERLOCK CIRCUIT



SKL01260

Outline

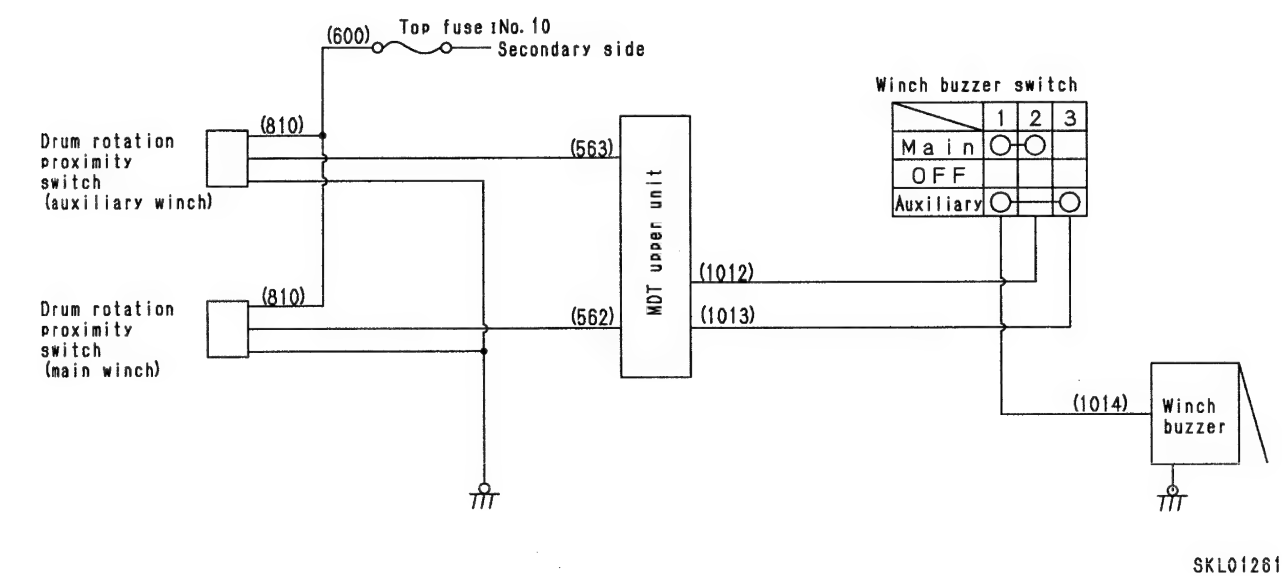
- On machines with the winch clutch specification, the winch brake switch is operated to actuate the winch free-fall interlock solenoid. This circuit makes it impossible to operate the winch clutch lever for free-fall operations (clutch OFF) if the winch brake is not being depressed.

The operation of the winch clutch lever to the CLUTCH ON position is always made possible by the link structure of the interlock.

Operation

- When the PTO is ON, the power source is supplied to both the main and auxiliary winch brake switches through each wire No. 716. When the main or auxiliary winch brake is depressed, the main or auxiliary winch brake switch installed near the winch brake master cylinder becomes NC-COM connected, so the power source is supplied from wire No. 716 to the main winch free-fall interlock solenoid or auxiliary winch free-fall interlock solenoid. In this way, the main and auxiliary winch free-fall interlock solenoids installed near the winch clutch control lever are excited, release the mechanical lock of the main and auxiliary winch clutch levers, and make it possible to operate to the FREE-FALL (clutch OFF) position.

40. WINCH BUZZER CIRCUIT



Outline

- When the winch buzzer switch is operated, the winch buzzer circuit sounds the buzzer intermittently when the winch WIND IN and WIND OUT operation is started in order to inform the operator.

Operation

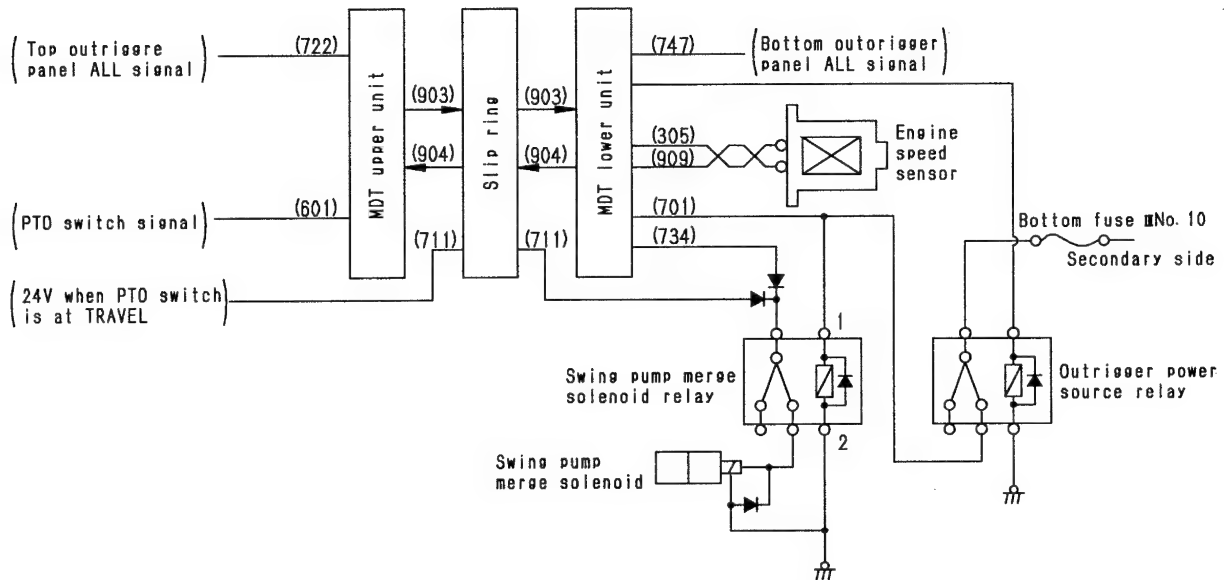
- A rotation detection groove is provided on both the main and auxiliary winch drums. The drum rotation proximity switch on the main and auxiliary drums outputs the pulse signal that accompanies the drum rotation through wires No. 562 and 563 and sends it to the MDT upper unit. The MDT upper unit outputs the signal as shown in Table 1 according to the pulse input from the drum rotation sensor. When this happens, a signal is sent to terminal 2 of the winch buzzer switch through wire No. 1012 in accordance with the input of the (main) winch drum rotation proximity switch; a signal is sent to terminal 3 of the winch buzzer switch through wire No.1013 in accordance with the input of the (auxiliary) winch drum rotation proximity switch. When the winch buzzer switch is at the MAIN position, terminals 1 and 2 are connected, so the winch buzzer generates a pulse sound

which matches the rotating speed of the main winch drum; when the winch buzzer switch is at the AUXILIARY position, terminals 1 and 3 are connected, so the winch buzzer generates a pulse sound which matches the rotating speed of the auxiliary winch drum. However, if the frequency of the pulse from the drum rotation proximity switch exceeds 5 Hz, the MDT stops the output to the winch buzzer, so the winch buzzer does not emit any pulse sound.

Table 1

Drum rotation proximity switch	H L
MDT output (wire No. 1012, 1013)	ON OFF

41. SWING PUMP/OUTRIGGER MERGE SELECTOR CIRCUIT



SKL01262

Outline

- On this machine, one hydraulic pump is used for both the steering cylinder operation and outrigger operation. However, the swing pump/outrigger merge selector circuit is a circuit to merge the oil from the steering/outrigger pump and swing pump. If the steering is operated when the machine is traveling with the engine running at low speed, it switches the hydraulic circuit and actuates the solenoid in order to ensure the flow of oil to the steering cylinder. When the outrigger ALL switch is operated, it switches the circuit to ensure the flow of pressure oil to the jack cylinder and slide cylinder.

Operation

- The MDT outputs a signal to wire No. 701 in the following cases.
 - When the engine speed is below 1300 rpm and the PTO switch is at TRAVEL
 - When the PTO switch is at PTO1, and the outrigger ALL switch is operated, and the outrigger control switch is set to EXTEND or STOW
 In these cases, the swing pump merge solenoid relay is actuated and connects relay terminals 3 and 5.

In the condition in Item 1), the power source is supplied through wire No. 711 to terminal 3 of the relay, goes out from terminal 5, excites the swing pump merge solenoid, and switches the hydraulic circuit.

In the condition in Item 2), the electricity leaving terminal 5 of the outrigger power source relay is supplied to the swing pump merge solenoid relay, excites the swing pump merge solenoid, and switches the circuit.

20 TESTING AND ADJUSTING

Standard value table for engine	20- 2	Testing and adjusting toe-in	20- 93
Standard value table for chassis	20- 3	Testing and adjusting parking brake effect.....	20- 94
Standard value table for electrical related parts	20- 8	Adjusting engine control	20- 95
Tool for testing, adjusting, and troubleshooting for engine	20- 53	Method for adjusting engine stop motor cable	20- 97
Adjusting valve clearance	20- 54	Adjusting brake pedal	20- 99
Measuring compression pressure	20- 55	Adjusting winch brake	20-100
Testing and adjusting fuel injection timing	20- 56	Adjusting winch drum lock	20-103
Measuring engine oil pressure	20- 58	Adjusting main, auxiliary winch clutch	20-104
Testing and adjusting fan belt tension	20- 59	Adjusting telescope/auxiliary winch pedal.....	20-107
Testing and adjusting air conditioner compressor belt tension	20- 59	Adjusting lever stand, lock lever	20-108
Measuring engine speed	20- 60	Adjusting telescope wire rope	20-109
Measuring blow-by pressure	20- 61	Adjusting limit switch	20-111
Measuring exhaust temperature	20- 62	Testing and adjusting proximity switch ...	20-114
Measuring exhaust color	20- 63	Checks before starting for over load prevention system.....	20-116
Measuring oil pressure	20- 64	Setting model selector switch for over load safety system	20-118
Measuring leakage of oil	20- 78	Method of displaying service mode for over load prevention system	20-119
Procedure for flushing hydraulic oil	20- 81	Troubleshooting	20-201
Measuring and adjusting air pressure	20- 83		
Bleeding air	20- 85		
Measuring steering wheel play	20- 91		
Adjusting minimum turning radius of steering	20- 92		

023S02

STANDARD VALUE TABLE FOR ENGINE

- ⚠ Check carefully that there is no one in the surrounding area before starting inspection.
- ★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling. (1/1)

Engine				S6D125E-2	
Model				LW250-5	
Cat- egory	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Engine related	Engine speed	Rated speed	rpm	2,100	–
	Exhaust gas temperature (temperature at turbocharger inlet port)	Whole speed range (ambient temperature: 20°C)	°C	Max. 600	700
	Exhaust gas color	At sudden acceleration At rated output	Bosch index	Max. 4.0 Max. 1.5	5.5 3.0
	Valve clearance (normal temperature)	Intake valve Exhaust valve	mm	0.33 0.71	– –
	Compression pressure (SAE30 oil)	Oil temperature: 40 – 60°C Engine speed: 200 – 250 rpm	MPa{kg/cm ² }	Min. 2.9{30}	2.0{20}
	Blow-by pressure (SAE30 oil)	(Water temperature: Operating range) At high idling	mmH ₂ O	Max. 100	200
	Oil pressure (SAE30 oil)	(Water temperature: Operating range) At high idling	MPa{kg/cm ² }	0.4±0.1{4.0±1.0}	0.21{2.1}
		At low idling (SAE30)		Min. 0.12{1.2}	0.069{0.7}
		At low idling (SAE10W)		Min. 0.08{0.8}	0.069{0.7}
	Oil temperature	Whole speed range (inside oil pan)	°C	90 – 110	120
	Fuel injection timing	Before compression top dead center	°	16±0.5	16±0.5
	Fan belt tension	Deflection when pressed with finger force of approx. 58.8 N {6 kg.}	mm	8 – 12	8 – 12
	Air conditioner compressor belt tension	Deflection when pressed with finger force of approx. 98.1 N {10 kg.}	mm	8 – 10	8 – 10

023S02

STANDARD VALUE TABLE FOR CHASSIS

⚠ Check carefully that there is no one in the surrounding area before starting inspection.

★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling. (1/5)

Cat-egory	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Engine speed	High idling (PTO switch: Travel)		<ul style="list-style-type: none">• Engine water temperature: Operating range• Hydraulic oil temperature: 45 – 55°C	rpm	2,350±50	–
	High idling (PTO switch: Operation 1, Operation 2)				1,790 ⁰ ₋₅₀	–
	Low idling				550 ⁰ ₊₅₀	–
	Torque converter stall speed		<ul style="list-style-type: none">• Engine water temperature: Operating range• Power train oil temperature: 70 – 90°C• Hydraulic oil temperature: 45 – 55°C• Travel mode: 2WD Hi• Gear shift lever: D	1,770±100	1,770±100	
Travel of control levers, pedals	Accelerator pedal		<ul style="list-style-type: none">• Engine stopped• Center of pedal• Full stroke	mm	60 – 70	60 – 70
	Brake pedal		<ul style="list-style-type: none">• Engine stopped• Center of pedal• Full stroke		61 – 71	61 – 71
	Swing lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob (lever at min. length)• Neutral to left swing or right swing		53 – 73	53 – 73
	Boom telescope lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• Neutral to EXTEND or RETRACT		53 – 73	53 – 73
	Boom hoist lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob (lever at min. length)• Neutral to RAISE or LOWER		53 – 73	53 – 73
	Winch (auxiliary winch) pedal	WIND IN	<ul style="list-style-type: none">• Engine stopped• Center of pedal• Full stroke		38 – 48	38 – 48
		WIND OUT pedal			38 – 48	38 – 48
	Boom telescope	EXTEND			38 – 48	38 – 48
		RETRACT			38 – 48	38 – 48
	Main, auxiliary winch lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob (lever at min. length)• Neutral to WIND IN or WIND OUT		53 – 73	53 – 73
	Power tilt lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob (lever at min. length)• Neutral to WIND IN or WIND OUT		53 – 73	53 – 73
	Main, auxiliary winch clutch lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• ON to OFF		34 – 54	34 – 54
	Main, auxiliary winch brake pedal		<ul style="list-style-type: none">• Engine stopped• Center of pedal• Full stroke• Operating effort: 98.0 N {10.0 kg}		60 – 80	60 – 80
	Play of steering wheel				<ul style="list-style-type: none">• Engine: Low idling• Machine posture: Straight travel	Max. 40
Operating effort of control levers, pedals	Accelerator pedal		<ul style="list-style-type: none">• Engine stopped• Center of pedal• Just before end of stroke	N {kg}	Max. 51{5.2}	Max. 61{6.2}

023S02

⚠ Check carefully that there is no one in the surrounding area before starting inspection.

★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.

(2/5)

Cat- egory	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Operating effort of control levers, pedals	Gear shift lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• N to each speed range and between other speed ranges	N {kg}	6.9±2.0{0.7±0.2}	11{1.1}
	Steering wheel		<ul style="list-style-type: none">• Engine: High idling• 180°/sec turning speed		Max. 15{1.5}	Max. 17{1.7}
	Brake pedal		<ul style="list-style-type: none">• Engine stopped• Center of pedal• Just before end of stroke		Max. 290{30}	Max. 350{36}
	Swing lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• Neutral to just before end of stroke		Max. 20{2.0}	Max. 24{2.4}
	Boom telescope lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• Neutral to just before end of stroke		Max. 20{2.0}	Max. 24{2.4}
	Boom hoist lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• Neutral to just before end of stroke		Max. 20{2.0}	Max. 24{2.4}
	Winch (auxiliary winch) pedal	WIND IN	<ul style="list-style-type: none">• Engine stopped• Tip of pedal• Just before end of stroke		Max. 42{4.3}	Max. 51{5.2}
		WIND OUT			Max. 42{4.3}	Max. 51{5.2}
	Boom telescope pedal	EXTEND			Max. 42{4.3}	Max. 51{5.2}
		RETRACT			Max. 42{4.3}	Max. 51{5.2}
	Main, auxiliary winch lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• Neutral to just before end of stroke		Max. 20{2.0}	Max. 24{2.4}
	Power tilt lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob (lever at min. length)• Neutral to WIND IN or WIND OUT		Max. 20{2.0}	Max. 24{2.4}
	Main, auxiliary winch clutch lever		<ul style="list-style-type: none">• Engine stopped• Center of lever knob• Winch brake pedal: LOCK• Winch drum: LOCK• ON to OFF		Max. 25{2.5}	Max. 29{3}
	Main, auxiliary winch brake pedal		<ul style="list-style-type: none">• Engine stopped• Center of pedal• Winch drum lock• Just before end of stroke• When supporting standard load		Max. 290{30}	Max. 440{45}
Hydraulic pressure	Torque converter outlet port pressure		<ul style="list-style-type: none">• PTO switch: Travel• Engine speed: High idling• Oil temperature: 60 – 80°C• Gear shift lever: D• Travel mode: 2WD Hi	MPa {kg/cm²}	0.49 ± 0.05 {5 ± 0.5}	0.49 ± 0.05 {5 ± 0.5}
	Torque converter lockup clutch pressure		<ul style="list-style-type: none">• PTO switch: Travel• Engine speed: High idling• Oil temperature: 60 – 80°C		2.01 ± 0.15 {20.5 ± 1.5}	2.01 ± 0.15 {20.5 ± 1.5}

023S02



Check carefully that there is no one in the surrounding area before starting inspection.

★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.

(3/5)

Cat-egory	Item	Measurement conditions			Unit	Standard value for new machine	Service limit value
Oil pressure	Transmission main relief pressure	<ul style="list-style-type: none">• PTO switch: Travel• Engine speed: High idling• Oil temperature: 60 – 80°C			MPa {kg/cm²}	2.7 ± 0.2 {28 ± 2.0}	2.7 ± 0.2 {28 ± 2.0}
	Transmission 1st clutch pressure					2.30 ± 0.15 {23.5 ± 1.5}	2.30 ± 0.15 {23.5 ± 1.5}
	Transmission 2nd clutch pressure					2.30 ± 0.15 {23.5 ± 1.5}	2.30 ± 0.15 {23.5 ± 1.5}
	Transmission 3rd clutch pressure					2.30 ± 0.15 {23.5 ± 1.5}	2.30 ± 0.15 {23.5 ± 1.5}
	Transmission RE-VERSE clutch pressure					2.30 ± 0.15 {23.5 ± 1.5}	2.30 ± 0.15 {23.5 ± 1.5}
	PTO clutch circuit pressure	<ul style="list-style-type: none">• PTO switch: Operation 1• Engine speed: High idling• Oil temperature: 60 – 80°C				2.7 ± 0.2 {28 ± 2.0}	2.7 ± 0.2 {28 ± 2.0}
	Steering, outrigger circuit pressure	<ul style="list-style-type: none">• Engine speed: High idling• Oil temperature: 45 – 55°C				19.1 ± 0.5 {195 ± 5}	19.1 ± 0.5 {195 ± 5}
	Swing circuit pressure					21.1 ± 0.5 {215 ± 5}	2.8 Min. 2.8 {28}
	Brake (foot) circuit pressure (air master cylinder outlet port)	<ul style="list-style-type: none">• Start engine• Air pressure normal• Depress pedal				See Remarks on page 20-7	
	PPC relief pressure	<ul style="list-style-type: none">• Engine speed: High idling• All levers at neutral• PTO switch: Operation 2				2.94 ^{+0.10} ₀ {30 ⁺ ₀ }	2.94 ^{+0.10} ₀ {30 ⁺ ₀ }
	Boom circuit pressure	<ul style="list-style-type: none">• PTO switch: Operation 1• Engine speed: High idling• Oil temperature: 45 – 55°C				21.1 ± 0.5 {215 ± 5}	21.1 ± 0.5 {215 ± 5}
	Winch motor circuit pressure					21.1 ± 0.5 {215 ± 5}	21.1 ± 0.5 {215 ± 5}
	Accumulator charge circuit pressure					13.7 ± 0.5 {140 ± 5}	13.7 ± 0.5 {140 ± 5}
	Winch brake oil pressure	<ul style="list-style-type: none">• EPTO switch: Operation 2• CEngine started• NBrake pedal depressed (operating effort: Approx. 2.94 N {approx. 30 kg})				Max. 6.9{70}	Max. 6.9{70}
	Suspension lift circuit pressure	<ul style="list-style-type: none">• Engine speed: High idling• Oil temperature: 45 – 55°C				20.6 ^{+2.5} ₀ {210 ⁺ ₀ }	20.6 ^{+2.5} ₀ {210 ⁺ ₀ }
Air pressure	Air charge pressure	Pressure when engine is started and buzzer stops sounding			0.49 ± 0.04 {5.0 ± 0.4}	0.49 ± 0.04 {5.0 ± 0.4}	
		Max. charge pressure			0.84 ± 0.03 {8.6 ± 0.3}	0.84 ± 0.03 {8.6 ± 0.3}	
		Recharge pressure after operating brake pedal			0.73 ± 0.039 {7.4 ± 0.4}	0.73 ± 0.039 {7.4 ± 0.4}	
T30. Power train	Travel speed	FORWARD	4WD Lo	D	km/h	24.7 – 27.3	24.7 – 27.3
				2		16.2 – 17.9	16.2 – 17.9
				L		8.6 – 9.5	8.6 – 9.5
			2WD Hi 4WD Hi	D		46.6 – 51.5	46.6 – 51.5
				2		39.0 – 43.1	39.0 – 43.1
				L		21.9 – 24.2	21.9 – 24.2
		REVERSE	4WD Lo	R		11.4 – 12.6	11.4 – 12.6
			2WD Hi 4WD Hi	R		28.5 – 31.5	28.5 – 31.5

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 ★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.

(4/5)

Cat-egory	Item	Measurement conditions			Unit	Standard value for new machine	Service limit value	
Brake	Service brake stopping distance	• Initial speed: 35 km/h			m	Max. 12	Max. 12	
	Parking brake starting test	• Engine speed when starting machine off in 2WD Hi, 4WD Hi with gear shift lever at D			rpm	Min. 1,500	Min. 1,500	
Swing system	Swing speed	• Outriggers fully extended • Boom fully retracted • Boom angle: 60° • Time taken to swing one turn	Engine speed: High idling		sec	19.0 – 29.0	19.0 – 29.0	
			Engine speed: Low idling			78.0 – 118.0	78.0 – 118.0	
Work equipment	Boom telescope speed	• Outriggers fully extended • Boom length: 7.6 – 32.0 m • Boom angle: 45° • Hook (1 m above ground) • Main winch lever: OPERATION • Main winch brake pedal: FREE • PTO switch: OPERATION 2 • Engine speed: High idling		RETRACT to EXTEND		sec	69.0 – 81.0	69.0 – 81.0
				EXTEND to RETRACT			62.0 – 78.0	62.0 – 78.0
	Boom hoist speed	• Outriggers fully extended • Boom: Extended 1 m • Auxiliary winch: Hold • Hook: Lower 1 m • PTO switch: OPERATION 2	Engine: High idling	Horizontal to upper limit (83°)		sec.	40.5 – 48.5	40.5 – 48.5
				Upper limit (83°) to horizontal			48.0 – 58.0	48.0 – 58.0
			Engine: Low idling	Upper limit (83°) to horizontal			195.0 – 215.0	195.0 – 215.0
	Winch speed	• Outriggers fully extended • Engine: 1000 rpm • Boom angle: 70° • Boom length: 13.7 m (to 2nd boom) • Overwind sensor – 2 m above ground	Main winch (4 lengths of rope)	RAISE		sec.	53.9 – 59.9	53.9 – 59.9
				LOWER			50.9 – 62.9	50.9 – 62.9
			Auxiliary winch (1 length of rope)	RAISE			14.8 – 16.8	14.8 – 16.8
				LOWER			13.8 – 17.8	13.8 – 17.8
		Hydraulic drift	• Oil temperature: 60 – 70°C • Outriggers fully extended • Boom length: 26.4 – 26.2 m • Boom angle: 70° • Single top extended • Raise 1 m from ground with 1 ton weight • EAmount weight moves down			mm	Max. 200/ 15 min.	Max. 200/ 15 min.

023S02



Check carefully that there is no one in the surrounding area before starting inspection.



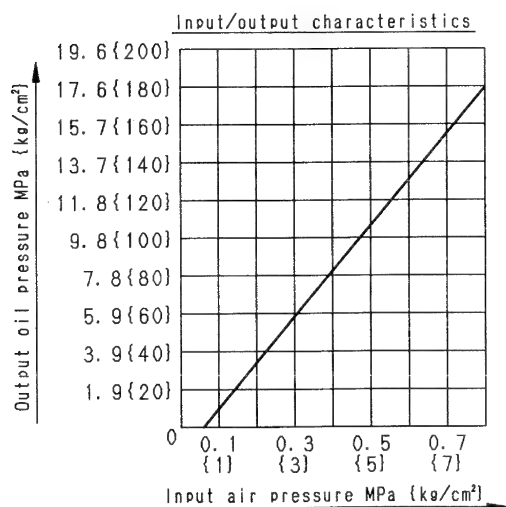
When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.

(5/5)

Cat-egory	Item		Measurement conditions			Unit	Standard value for new machine	Service limit value
Work equipment	Power tilt jib speed		• Outriggers fully extended • Engine: High idling, low idling • Boom angle: 65° • Jib length: 7.4 m	PTO full	5° to 60°	sec	17.0 – 23.0	17.0 – 23.0
					60° to 5°		17.0 – 23.0	17.0 – 23.0
			Low idling	5° to 60°	18.0 – 26.0		18.0 – 26.0	
				60° to 5°	18.0 – 26.0		18.0 – 26.0	
Oil leakage	Swing motor oil leakage		• At swing relief • Engine speed: High idling			ℓ/min		Max. 8
	Main winch motor oil leakage		• At main winch motor relief • Engine speed: High idling					Max. 3
	Auxiliary winch motor oil leakage		• At auxiliary winch motor relief • Engine speed: High idling					Max. 3
	Cylinder	Boom hoist	• When each circuit is relieved (For details, see TESTING AND ADJUSTING.)			cc/min		Max. 10
		Boom telescope						Max. 2
		Jib hoist (power tilt specification machines)						Max. 2

Remarks

Graph of relationship between brake fluid (oil) pressure and input air pressure



TKL00342

STANDARD VALUE TABLE FOR ELECTRICAL RELATED PARTS

- ⚠** Check carefully that there is no one in the surrounding area before starting inspection.
- ★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.
- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adaptor or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions
Controller Upper MDT	NSW power source	C02	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.
				Between (19) – chassis	20 – 30 V	
	Between (19) – (11), (21)					
	SW power source	C01 C02	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.
				Between C01 (6) – chassis	20 – 30 V	
				Between C02 (10), (20) – chassis		
				Between C01 (6) – C02 (11), (21)		
	Between F C02 (10) (20) – (11), (21)					
	S-NET (communication between upper MDT - moment limiter)	C05	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter 2) Turn starting switch ON.
Between (4), (12) – (10)	4 - 8 V					
C-NET (communication between upper MDT - lower MDT)	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.		
Between (5) – (6)	7 – 11 V					
Between (13) – (14)						
Swing flasher relay signal	C01	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2 ★ Operate the swing with the swing lock applied.	
When operating swing		Between (3) – chassis	17 – 30 V			
Swing lever at neutral			Max. 1 V			
Steering crab mode LED	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering lock cancel switch: CANCEL (Rear steering FREE) 5) Travel speed: Less than 10 km/h		
Steering mode switch: Crab mode	Between (5) – chassis	17 – 30 V				
Steering mode switch: Other mode		Max. 1 V				
Steering rear wheel mode LED	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering lock cancel switch: CANCEL (Rear steering FREE) 5) Travel speed: Less than 10 km/h		
Steering mode switch: Rear wheel mode	Between (7) – chassis	17 – 30 V				
Steering mode switch: Other mode		Max. 1 V				

023S02



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★ Operate the winch under no load.

★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions						
Controller Upper MDT	C01	Steering front wheel mode LED	Measure voltage	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Steering mode switch: Front wheel mode</td><td rowspan="2">Between (16) – chassis</td><td>17 – 30 V</td></tr><tr><td>Steering mode switch: Other mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Front wheel mode	Between (16) – chassis	17 – 30 V	Steering mode switch: Other mode	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering lock cancel switch: CANCEL (Rear steering FREE)	
		Steering mode switch: Front wheel mode			Between (16) – chassis	17 – 30 V						
		Steering mode switch: Other mode				Max. 1 V						
		Steering 4-wheel mode LED			Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Steering mode switch: Front wheel mode</td><td rowspan="2">Between (17) – chassis</td><td>17 – 30 V</td></tr><tr><td>Steering mode switch: Other mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Front wheel mode	Between (17) – chassis	17 – 30 V	Steering mode switch: Other mode	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering lock cancel switch: CANCEL (Rear steering FREE) 5) Travel speed: Less than 10 km/h
		Steering mode switch: Front wheel mode					Between (17) – chassis		17 – 30 V			
		Steering mode switch: Other mode			Max. 1 V							
Rear steering lock LED	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Rear steering LOCK</td><td rowspan="2">Between (8) – chassis</td><td>17 – 30 V</td></tr><tr><td>Rear steering FREE</td><td>Max. 1 V</td></tr></table>	Rear steering LOCK	Between (8) – chassis	17 – 30 V	Rear steering FREE	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1				
Rear steering LOCK			Between (8) – chassis		17 – 30 V							
Rear steering FREE	Max. 1 V											
Rear steering center LED	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Rear steering CENTER detected</td><td rowspan="2">Between (9) – chassis</td><td>17 – 30 V</td></tr><tr><td>Rear steering not at CENTER</td><td>Max. 1 V</td></tr></table>	Rear steering CENTER detected	Between (9) – chassis	17 – 30 V	Rear steering not at CENTER	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1				
Rear steering CENTER detected			Between (9) – chassis		17 – 30 V							
Rear steering not at CENTER	Max. 1 V											
Rear steering cancel (free) LED	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Rear steering FREE</td><td rowspan="2">Between (18) – chassis</td><td>17 – 30 V</td></tr><tr><td>Rear steering LOCK</td><td>Max. 1 V</td></tr></table>	Rear steering FREE	Between (18) – chassis	17 – 30 V	Rear steering LOCK	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1				
Rear steering FREE			Between (18) – chassis		17 – 30 V							
Rear steering LOCK	Max. 1 V											
Reverse steering display lamp	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Reverse steering switch ON</td><td rowspan="2">Between (19) – chassis</td><td>17 – 30 V</td></tr><tr><td>Reverse steering switch OFF</td><td>Max. 1 V</td></tr></table>	Reverse steering switch ON	Between (19) – chassis	17 – 30 V	Reverse steering switch OFF	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Swing angle: 180° (boom facing rear)				
Reverse steering switch ON	Between (19) – chassis	17 – 30 V										
Reverse steering switch OFF		Max. 1 V										

023S02

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★ Operate the winch under no load.

★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Upper MDT	Power source for outrigger panel	C01	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>PTO switch: Operation</td><td rowspan="2">Between (14) – chassis</td><td>17 – 30 V</td></tr><tr><td>PTO switch: Travel or Operation 2</td><td>Max. 1 V</td></tr></table>	PTO switch: Operation	Between (14) – chassis	17 – 30 V	PTO switch: Travel or Operation 2	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Shift lever: N</div>
		PTO switch: Operation		Between (14) – chassis	17 – 30 V						
		PTO switch: Travel or Operation 2			Max. 1 V						
		Outrigger mode		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>PTO switch: Operation 1</td><td rowspan="2">Between (15) – chassis</td><td>17 – 30 V</td></tr><tr><td>PTO switch: Travel or Operation 2</td><td>Max. 1 V</td></tr></table>	PTO switch: Operation 1	Between (15) – chassis	17 – 30 V	PTO switch: Travel or Operation 2	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Shift lever: N</div>
	PTO switch: Operation 1	Between (15) – chassis	17 – 30 V								
	PTO switch: Travel or Operation 2		Max. 1 V								
	Emergency alarm buzzer (moment limiter)	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Buzzer sounding</td><td rowspan="2">Between (20) – chassis</td><td>17 – 30 V</td></tr><tr><td>Buzzer stopped</td><td>Max. 1 V</td></tr></table> <div>* Buzzer sounds alarm 3 sec. after check mode IN.</div>	Buzzer sounding	Between (20) – chassis	17 – 30 V	Buzzer stopped	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Set moment limiter to check mode.</div>		
	Buzzer sounding	Between (20) – chassis	17 – 30 V								
	Buzzer stopped		Max. 1 V								
Monitor central buzzer	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Buzzer sounding (air pressure drop)</td><td rowspan="2">Between (21) – chassis</td><td>17 – 30 V</td></tr><tr><td>Buzzer stopped (air pressure normal)</td><td>Max. 1 V</td></tr></table> <div>* Air pressure drop: Less than 0.49 MPa {5.0 kg/cm²}</div>	Buzzer sounding (air pressure drop)	Between (21) – chassis	17 – 30 V	Buzzer stopped (air pressure normal)	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>			
Buzzer sounding (air pressure drop)	Between (21) – chassis	17 – 30 V									
Buzzer stopped (air pressure normal)		Max. 1 V									
	Front wheel mode switch signal	C02	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Steering mode switch: Front wheel mode</td><td rowspan="2">Between (1) – chassis</td><td>20 – 30 V</td></tr><tr><td>Steering mode switch: Other mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Front wheel mode	Between (1) – chassis	20 – 30 V	Steering mode switch: Other mode	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Travel or Operation 1</div>	
	Steering mode switch: Front wheel mode		Between (1) – chassis	20 – 30 V							
	Steering mode switch: Other mode			Max. 1 V							
4-wheel mode switch signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Steering mode switch: 4-wheel mode</td><td rowspan="2">Between (2) – chassis</td><td>20 – 30 V</td></tr><tr><td>Steering mode switch: Other mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: 4-wheel mode	Between (2) – chassis	20 – 30 V	Steering mode switch: Other mode	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Travel or Operation 1</div>			
Steering mode switch: 4-wheel mode	Between (2) – chassis	20 – 30 V									
Steering mode switch: Other mode		Max. 1 V									
Crab mode switch signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Steering mode switch: Crab mode</td><td rowspan="2">Between (12) – chassis</td><td>20 – 30 V</td></tr><tr><td>Steering mode switch: Other mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Crab mode	Between (12) – chassis	20 – 30 V	Steering mode switch: Other mode	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Travel or Operation 1</div>			
Steering mode switch: Crab mode	Between (12) – chassis	20 – 30 V									
Steering mode switch: Other mode		Max. 1 V									

023S02

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- ★ Turn the starting switch OFF before inserting the T-adaptor or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller Upper MDT		Rear wheel mode switch signal	C02	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Steering mode switch: Rear wheel mode</td><td rowspan="2">Between (13) – chassis</td><td>20 – 30 V</td></tr><tr><td>Steering mode switch: Other mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Rear wheel mode	Between (13) – chassis	20 – 30 V	Steering mode switch: Other mode	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Travel or Operation 1</div>
	Steering mode switch: Rear wheel mode	Between (13) – chassis		20 – 30 V							
	Steering mode switch: Other mode			Max. 1 V							
		Reverse steering compensation switch signal		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Reverse steering compensation switch signal: ON</td><td rowspan="2">Between (8) – chassis</td><td>20 – 30 V</td></tr><tr><td>Reverse steering compensation switch signal: OFF</td><td>Max. 1 V</td></tr></table>	Reverse steering compensation switch signal: ON	Between (8) – chassis	20 – 30 V	Reverse steering compensation switch signal: OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Travel or Operation 1</div>
	Reverse steering compensation switch signal: ON	Between (8) – chassis		20 – 30 V							
	Reverse steering compensation switch signal: OFF			Max. 1 V							
		4WD Hi switch signal		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Travel mode switch: 4WD Hi</td><td rowspan="2">Between (4) – chassis</td><td>20 – 30 V</td></tr><tr><td>Travel mode switch: 2WD Hi or 4WD Lo</td><td>Max. 1 V</td></tr></table>	Travel mode switch: 4WD Hi	Between (4) – chassis	20 – 30 V	Travel mode switch: 2WD Hi or 4WD Lo	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Emergency gear shift switch OFF</div>
	Travel mode switch: 4WD Hi	Between (4) – chassis		20 – 30 V							
Travel mode switch: 2WD Hi or 4WD Lo	Max. 1 V										
	4WD Lo switch signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Travel mode switch: 4WD Lo</td><td rowspan="2">Between (15) – chassis</td><td>20 – 30 V</td></tr><tr><td>Travel mode switch: 2WD Hi or 4WD Hi</td><td>Max. 1 V</td></tr></table>	Travel mode switch: 4WD Lo	Between (15) – chassis	20 – 30 V	Travel mode switch: 2WD Hi or 4WD Hi	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Emergency gear shift switch OFF</div>		
Travel mode switch: 4WD Lo	Between (15) – chassis	20 – 30 V									
Travel mode switch: 2WD Hi or 4WD Hi		Max. 1 V									
	Suspension lift switch signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Suspension lift switch ON</td><td rowspan="2">Between (7) – chassis</td><td>20 – 30 V</td></tr><tr><td>Suspension lift switch OFF</td><td>Max. 1 V</td></tr></table>	Suspension lift switch ON	Between (7) – chassis	20 – 30 V	Suspension lift switch OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Suspension lock switch: LOCK</div>		
Suspension lift switch ON	Between (7) – chassis	20 – 30 V									
Suspension lift switch OFF		Max. 1 V									
	Retarder switch signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Exhaust brake switch: Retarder</td><td rowspan="2">Between (5) – chassis</td><td>17 – 30 V</td></tr><tr><td>Exhaust brake switch: OFF</td><td>Max. 1 V</td></tr></table>	Exhaust brake switch: Retarder	Between (5) – chassis	17 – 30 V	Exhaust brake switch: OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Accelerator pedal: OFF (not depressed)</div>		
Exhaust brake switch: Retarder	Between (5) – chassis	17 – 30 V									
Exhaust brake switch: OFF		Max. 1 V									
	Exhaust brake signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Exhaust brake switch: Exhaust brake</td><td rowspan="2">Between (16) – chassis</td><td>17 – 30 V</td></tr><tr><td>Exhaust brake switch: OFF</td><td>Max. 1 V</td></tr></table>	Exhaust brake switch: Exhaust brake	Between (16) – chassis	17 – 30 V	Exhaust brake switch: OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Accelerator pedal: OFF (not depressed)</div>		
Exhaust brake switch: Exhaust brake	Between (16) – chassis	17 – 30 V									
Exhaust brake switch: OFF		Max. 1 V									

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- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adaptor or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Upper MDT	Service brake signal	C02	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Parking brake switch: Auxiliary</td><td rowspan="2">Between (17) – chassis</td><td>20 – 30 V</td></tr><tr><td>Parking brake switch: OFF</td><td>Max. 1 V</td></tr></table>	Parking brake switch: Auxiliary	Between (17) – chassis	20 – 30 V	Parking brake switch: OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>
		Parking brake switch: Auxiliary		Between (17) – chassis	20 – 30 V						
		Parking brake switch: OFF			Max. 1 V						
		Preheating signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Starting switch: HEAT</td><td rowspan="2">Between (3) – chassis</td><td>20 – 30 V</td></tr><tr><td>Starting switch: ON</td><td>Max. 1 V</td></tr></table>	Starting switch: HEAT	Between (3) – chassis	20 – 30 V	Starting switch: ON	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>	
		Starting switch: HEAT	Between (3) – chassis	20 – 30 V							
		Starting switch: ON		Max. 1 V							
	Starting switch START (C) signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Starting switch: START</td><td rowspan="2">Between (6) – chassis</td><td>20 – 30 V</td></tr><tr><td>Starting switch: ON</td><td>Max. 1 V</td></tr></table>	Starting switch: START	Between (6) – chassis	20 – 30 V	Starting switch: ON	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Shift lever: N</div>		
	Starting switch: START	Between (6) – chassis	20 – 30 V								
	Starting switch: ON		Max. 1 V								
	Fuel level	C03	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>FULL</td><td rowspan="2">Between (2) – chassis</td><td>0.5 – 1.6 V</td></tr><tr><td>EMPTY</td><td>3.5 – 7.5 V</td></tr></table>	FULL	Between (2) – chassis	0.5 – 1.6 V	EMPTY	3.5 – 7.5 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>	
FULL	Between (2) – chassis		0.5 – 1.6 V								
EMPTY			3.5 – 7.5 V								
Engine water temperature	Measure voltage		<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>100°C</td><td rowspan="2">Between (10) – chassis</td><td>0.9 – 1.7 V</td></tr><tr><td>50°C</td><td>2.5 – 5.5 V</td></tr></table>	100°C	Between (10) – chassis	0.9 – 1.7 V	50°C	2.5 – 5.5 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>		
100°C	Between (10) – chassis	0.9 – 1.7 V									
50°C		2.5 – 5.5 V									
Engine oil pressure	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Engine oil pressure: Above 0.05 MPa (0.5 kg/cm²) (start engine)</td><td rowspan="2">Between (4) – chassis</td><td>20 – 30 V</td></tr><tr><td>Engine oil pressure: Below 0.05 MPa (0.5 kg/cm²) (starting switch ON)</td><td>Max. 1 V</td></tr></table>	Engine oil pressure: Above 0.05 MPa (0.5 kg/cm ²) (start engine)	Between (4) – chassis	20 – 30 V	Engine oil pressure: Below 0.05 MPa (0.5 kg/cm ²) (starting switch ON)	Max. 1 V	<div>1) Insert T-adapter.</div>			
Engine oil pressure: Above 0.05 MPa (0.5 kg/cm ²) (start engine)	Between (4) – chassis	20 – 30 V									
Engine oil pressure: Below 0.05 MPa (0.5 kg/cm ²) (starting switch ON)		Max. 1 V									
Torque converter oil temperature	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Within 2 sec after starting switch ON</td><td rowspan="2">Between (11) – chassis</td><td>Max. 1 V</td></tr><tr><td>More than 2 sec after starting switch ON</td><td>17 – 30 V</td></tr></table>	Within 2 sec after starting switch ON	Between (11) – chassis	Max. 1 V	More than 2 sec after starting switch ON	17 – 30 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>			
Within 2 sec after starting switch ON	Between (11) – chassis	Max. 1 V									
More than 2 sec after starting switch ON		17 – 30 V									

023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions				
Controller Upper MDT	C03	Brake fluid level	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.				
		<table><tr><td>Within 2 sec after starting switch ON</td><td rowspan="2">Between (15) – chassis</td><td>20 – 30 V</td></tr><tr><td>More than 2 sec after starting switch ON</td><td>Max. 1 V</td></tr></table>		Within 2 sec after starting switch ON	Between (15) – chassis	20 – 30 V	More than 2 sec after starting switch ON	Max. 1 V		
		Within 2 sec after starting switch ON		Between (15) – chassis		20 – 30 V				
		More than 2 sec after starting switch ON			Max. 1 V					
		Parking brake actuation		Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON. 3) Air pressure: Min. 0.49 MPa {5 kg/cm ² }			
		<table><tr><td>Parking brake switch: PARKING</td><td rowspan="2">Between (5) – chassis</td><td>Max. 1 V</td></tr><tr><td>Parking brake switch: OFF</td><td>20 – 30 V</td></tr></table>			Parking brake switch: PARKING	Between (5) – chassis	Max. 1 V	Parking brake switch: OFF	20 – 30 V	
		Parking brake switch: PARKING		Between (5) – chassis	Max. 1 V					
Parking brake switch: OFF	20 – 30 V									
Preheating pilot	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.						
<table><tr><td>Starting switch: HEAT</td><td rowspan="2">Between (12) – chassis</td><td>Max. 1 V</td></tr><tr><td>Starting switch: ON</td><td>20 – 30 V</td></tr></table>		Starting switch: HEAT	Between (12) – chassis	Max. 1 V	Starting switch: ON	20 – 30 V				
Starting switch: HEAT	Between (12) – chassis	Max. 1 V								
Starting switch: ON		20 – 30 V								
Charge lamp	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.						
<table><tr><td>Engine started</td><td rowspan="2">Between (7) – chassis</td><td>17 – 30 V</td></tr><tr><td>Starting switch ON</td><td>Max. 1 V</td></tr></table>		Engine started	Between (7) – chassis	17 – 30 V	Starting switch ON	Max. 1 V				
Engine started	Between (7) – chassis	17 – 30 V								
Starting switch ON		Max. 1 V								
Tachometer signal	Measure voltage	If If the condition is as shown in the table below, it is normal (measure with AC range)		1) Insert T-adapter. 2) Start engine. 3) Accelerator: Low idling						
<table><tr><td>Between (1) – chassis</td><td>7.5 – 15.5 V</td></tr></table>		Between (1) – chassis	7.5 – 15.5 V							
Between (1) – chassis	7.5 – 15.5 V									
Speedometer signal	Measure voltage	If the condition is as shown in the table below, it is normal (measure with AC range)		1) Insert T-adapter. 2) Start engine. 3) Wheels rotating under no load with machine jacked up, or with machine traveling						
<table><tr><td>Between (9) – chassis</td><td>7.5 – 15.5 V</td></tr></table>		Between (9) – chassis	7.5 – 15.5 V							
Between (9) – chassis	7.5 – 15.5 V									
Service meter (hourmeter) power source	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.						
<table><tr><td>Starting switch: ON</td><td rowspan="2">Between (14) – chassis</td><td>Max. 1 V</td></tr><tr><td>Engine started</td><td>17 – 30 V</td></tr></table>		Starting switch: ON	Between (14) – chassis	Max. 1 V	Engine started	17 – 30 V				
Starting switch: ON	Between (14) – chassis	Max. 1 V								
Engine started		17 – 30 V								



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions
Controller Upper MDT	C03	Hi beam pilot	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.
		Lamp switch stage 2 ON, dimmer switch (pressed odd number of times, head lamp Hi)		Between (6) – chassis	17 – 30 V	
					Max. 1 V	
		Lamp switch OFF				
	Left turn pilot	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.	
	Turn signal lever: Left		Between (16) – chassis	17 – 30 V		
	Turn signal lever: OFF	Max. 1 V				
	Right turn pilot	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.	
Turn signal lever: Right	Between (8) – chassis		17 – 30 V			
Turn signal lever: OFF		Max. 1 V				
Retarder lamp (opt)	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON. 3) Accelerator pedal: OFF (not depressed)		
Exhaust brake switch: Retarder		Between (13) – chassis	Max. 1 V			
Exhaust brake switch: OFF	20 – 30 V					
C04	Travel or PTO 1 (Travel or Operation 1)	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.	
	PTO switch: Travel or Operation 1		Between (1) – chassis	20 – 30 V		
	PTO switch: Operation 2	Max. 1 V				
PTO 1 or PTO 2 (Operation 1 or Operation 2)	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.		
PTO switch: Operation 1 or Operation 2		Between (2) – chassis	20 – 30 V			
PTO switch: Travel	Max. 1 V					
Rear steering lock switch	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1		
Rear steering lock/cancel switch: LOCK		Between (3) – chassis	20 – 30 V			
Rear steering lock/cancel switch: CANCEL or Neutral	Max. 1 V					

023S02

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- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller Upper MDT		Rear steering FREE switch	C04	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Rear steering lock/cancel switch: CANCEL</td><td rowspan="2">Between (13) – chassis</td><td>20 – 30 V</td></tr><tr><td>Rear steering lock/cancel switch: LOCK or Neutral</td><td>Max. 1 V</td></tr></table>	Rear steering lock/cancel switch: CANCEL	Between (13) – chassis	20 – 30 V	Rear steering lock/cancel switch: LOCK or Neutral	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Travel or Operation 1</div>
	Rear steering lock/cancel switch: CANCEL	Between (13) – chassis		20 – 30 V							
	Rear steering lock/cancel switch: LOCK or Neutral			Max. 1 V							
		Head lamp Hi signal		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Lamp switch stage 2 ON, dimmer switch ON (pressed odd number of times, head lamp Hi)</td><td rowspan="2">Between (4) – chassis</td><td>20 – 30 V</td></tr><tr><td>Lamp switch: OFF</td><td>Max. 1 V</td></tr></table>	Lamp switch stage 2 ON, dimmer switch ON (pressed odd number of times, head lamp Hi)	Between (4) – chassis	20 – 30 V	Lamp switch: OFF	Max. 1 V	<div>1) Insert T-adapter</div>
	Lamp switch stage 2 ON, dimmer switch ON (pressed odd number of times, head lamp Hi)	Between (4) – chassis		20 – 30 V							
	Lamp switch: OFF			Max. 1 V							
		Head lamp Lo signal		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Lamp switch stage 2 ON, dimmer switch ON (pressed even number of times, head lamp Lo)</td><td rowspan="2">Between (14) – chassis</td><td>20 – 30 V</td></tr><tr><td>Lamp switch: OFF</td><td>Max. 1 V</td></tr></table>	Lamp switch stage 2 ON, dimmer switch ON (pressed even number of times, head lamp Lo)	Between (14) – chassis	20 – 30 V	Lamp switch: OFF	Max. 1 V	<div>1) Insert T-adapter.</div>
	Lamp switch stage 2 ON, dimmer switch ON (pressed even number of times, head lamp Lo)	Between (14) – chassis		20 – 30 V							
Lamp switch: OFF	Max. 1 V										
	Side lamp	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Lamp switch: Stage 1 ON</td><td rowspan="2">Between (5) – chassis</td><td>20 – 30 V</td></tr><tr><td>Lamp switch: OFF</td><td>Max. 1 V</td></tr></table>	Lamp switch: Stage 1 ON	Between (5) – chassis	20 – 30 V	Lamp switch: OFF	Max. 1 V	<div>1) Insert T-adapter.</div>		
Lamp switch: Stage 1 ON	Between (5) – chassis	20 – 30 V									
Lamp switch: OFF		Max. 1 V									
	Left turn	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Turn signal lever: Left</td><td rowspan="2">Between (16) – chassis</td><td>20 – 30 V</td></tr><tr><td>Turn signal lever: OFF</td><td>Max. 1 V</td></tr></table>	Turn signal lever: Left	Between (16) – chassis	20 – 30 V	Turn signal lever: OFF	Max. 1 V	<div>1) Insert T-adapter.</div>		
Turn signal lever: Left	Between (16) – chassis	20 – 30 V									
Turn signal lever: OFF		Max. 1 V									
	Right turn	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Turn signal lever: Right</td><td rowspan="2">Between (6) – chassis</td><td>20 – 30 V</td></tr><tr><td>Turn signal lever: OFF</td><td>Max. 1 V</td></tr></table>	Turn signal lever: Right	Between (6) – chassis	20 – 30 V	Turn signal lever: OFF	Max. 1 V	<div>1) Insert T-adapter.</div>		
Turn signal lever: Right	Between (6) – chassis	20 – 30 V									
Turn signal lever: OFF		Max. 1 V									
	Starting switch BR signal	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Starting switch: ON</td><td rowspan="2">Between (12) – chassis</td><td>20 – 30 V</td></tr><tr><td>Starting switch: OFF</td><td>Max. 1 V</td></tr></table>	Starting switch: ON	Between (12) – chassis	20 – 30 V	Starting switch: OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>		
Starting switch: ON	Between (12) – chassis	20 – 30 V									
Starting switch: OFF		Max. 1 V									



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions						
Controller	Upper MDT	Model selection	C04	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>W,Y</td><td>Between (9), (10) – chassis</td><td>Max. 1 V</td></tr><tr><td>X,Z</td><td>Between (19), (20) – chassis</td><td>15 – 30 V</td></tr></table>	W,Y	Between (9), (10) – chassis	Max. 1 V	X,Z	Between (19), (20) – chassis	15 – 30 V	1) Insert T-adapter. 2) Turn starting switch ON.
		W,Y		Between (9), (10) – chassis	Max. 1 V							
		X,Z		Between (19), (20) – chassis	15 – 30 V							
		Top selection	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (8) – chassis</td><td>Max. 1 V</td></tr></table>	Between (8) – chassis	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON.					
		Between (8) – chassis	Max. 1 V									
		Bottom selection (memory cancel)	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (18) – chassis</td><td>15 – 30 V</td></tr></table>	Between (18) – chassis	15 – 30 V	1) Insert T-adapter. 2) Turn starting switch ON.					
	Between (18) – chassis	15 – 30 V										
	Main drum speed sensor	C05	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Speed sensor ON (sensor actuation LED ON)</td><td rowspan="2">Between (7) – chassis</td><td>Max. 1 V</td></tr><tr><td>Speed sensor OFF (sensor actuation LED OFF)</td><td>3 – 4 V</td></tr></table>	Speed sensor ON (sensor actuation LED ON)	Between (7) – chassis	Max. 1 V	Speed sensor OFF (sensor actuation LED OFF)	3 – 4 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Actuate main drum		
	Speed sensor ON (sensor actuation LED ON)		Between (7) – chassis	Max. 1 V								
	Speed sensor OFF (sensor actuation LED OFF)	3 – 4 V										
Auxiliary drum speed sensor	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Speed sensor ON (sensor actuation LED ON)</td><td rowspan="2">Between (15) – chassis</td><td>Max. 1 V</td></tr><tr><td>Speed sensor OFF (sensor actuation LED OFF)</td><td>3 – 4 V</td></tr></table>	Speed sensor ON (sensor actuation LED ON)	Between (15) – chassis	Max. 1 V	Speed sensor OFF (sensor actuation LED OFF)	3 – 4 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Actuate auxiliary drum				
Speed sensor ON (sensor actuation LED ON)	Between (15) – chassis	Max. 1 V										
Speed sensor OFF (sensor actuation LED OFF)		3 – 4 V										
	Transmission lever R	C06	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Transmission lever: R</td><td rowspan="2">Between (18) – chassis</td><td>17 – 30 V</td></tr><tr><td>Transmission lever: Other than R</td><td>Max. 1 V</td></tr></table>	Transmission lever: R	Between (18) – chassis	17 – 30 V	Transmission lever: Other than R	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Turn emergency gear shift switch OFF		
	Transmission lever: R		Between (18) – chassis	17 – 30 V								
	Transmission lever: Other than R			Max. 1 V								
Transmission lever N	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Transmission lever: N</td><td rowspan="2">Between (17) – chassis</td><td>17 – 30 V</td></tr><tr><td>Transmission lever: Other than N</td><td>Max. 1 V</td></tr></table>	Transmission lever: N	Between (17) – chassis	17 – 30 V	Transmission lever: Other than N	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Turn emergency gear shift switch OFF				
Transmission lever: N	Between (17) – chassis	17 – 30 V										
Transmission lever: Other than N		Max. 1 V										
Transmission lever D	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Transmission lever: D</td><td rowspan="2">Between (7) – chassis</td><td>17 – 30 V</td></tr><tr><td>Transmission lever: Other than D</td><td>Max. 1 V</td></tr></table>	Transmission lever: D	Between (7) – chassis	17 – 30 V	Transmission lever: Other than D	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Turn emergency gear shift switch OFF				
Transmission lever: D	Between (7) – chassis	17 – 30 V										
Transmission lever: Other than D		Max. 1 V										

023S02

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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller Upper MDT	Transmission lever 2		C06	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Transmission lever: 2</td><td rowspan="2">Between (16) – chassis</td><td>17 – 30 V</td></tr><tr><td>Transmission lever: Other than 2</td><td>Max. 1 V</td></tr></table>	Transmission lever: 2	Between (16) – chassis	17 – 30 V	Transmission lever: Other than 2	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Turn emergency gear shift switch OFF</div>
	Transmission lever: 2	Between (16) – chassis		17 – 30 V							
	Transmission lever: Other than 2			Max. 1 V							
	Transmission lever L			Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Transmission lever: L</td><td rowspan="2">Between (8) – chassis</td><td>17 – 30 V</td></tr><tr><td>Transmission lever: Other than L</td><td>Max. 1 V</td></tr></table>	Transmission lever: L	Between (8) – chassis	17 – 30 V	Transmission lever: Other than L	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) Turn emergency gear shift switch OFF</div>
	Transmission lever: L	Between (8) – chassis		17 – 30 V							
	Transmission lever: Other than L			Max. 1 V							
Outrigger EXTEND		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger EXTEND/STOW switch: EXTEND</td><td rowspan="2">Between (2) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger EXTEND/STOW switch: Neutral or STOW</td><td>Max. 1 V</td></tr></table>	Top outrigger EXTEND/STOW switch: EXTEND	Between (2) – chassis	17 – 30 V	Top outrigger EXTEND/STOW switch: Neutral or STOW	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>		
Top outrigger EXTEND/STOW switch: EXTEND	Between (2) – chassis	17 – 30 V									
Top outrigger EXTEND/STOW switch: Neutral or STOW		Max. 1 V									
Outrigger RETRACT (stow)		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger EXTEND/STOW switch: STOW</td><td rowspan="2">Between (12) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger EXTEND/STOW switch: Neutral or EXTEND</td><td>Max. 1 V</td></tr></table>	Top outrigger EXTEND/STOW switch: STOW	Between (12) – chassis	17 – 30 V	Top outrigger EXTEND/STOW switch: Neutral or EXTEND	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>		
Top outrigger EXTEND/STOW switch: STOW	Between (12) – chassis	17 – 30 V									
Top outrigger EXTEND/STOW switch: Neutral or EXTEND		Max. 1 V									
Outrigger slide		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger SLIDE/JACK switch: SLIDE</td><td rowspan="2">Between (11) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger SLIDE/JACK switch: JACK or Neutral</td><td>Max. 1 V</td></tr></table>	Top outrigger SLIDE/JACK switch: SLIDE	Between (11) – chassis	17 – 30 V	Top outrigger SLIDE/JACK switch: JACK or Neutral	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>		
Top outrigger SLIDE/JACK switch: SLIDE	Between (11) – chassis	17 – 30 V									
Top outrigger SLIDE/JACK switch: JACK or Neutral		Max. 1 V									
Outrigger jack		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger SLIDE/JACK switch: JACK</td><td rowspan="2">Between (1) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger SLIDE/JACK switch: SLIDE or Neutral</td><td>Max. 1 V</td></tr></table>	Top outrigger SLIDE/JACK switch: JACK	Between (1) – chassis	17 – 30 V	Top outrigger SLIDE/JACK switch: SLIDE or Neutral	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>		
Top outrigger SLIDE/JACK switch: JACK	Between (1) – chassis	17 – 30 V									
Top outrigger SLIDE/JACK switch: SLIDE or Neutral		Max. 1 V									

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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Upper MDT	Outrigger ALL control	C06	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: ALL</td><td rowspan="2">Between (15) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: ALL	Between (15) – chassis	17 – 30 V	Top outrigger control switch: OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>
		Top outrigger control switch: ALL		Between (15) – chassis	17 – 30 V						
		Top outrigger control switch: OFF			Max. 1 V						
		Outrigger FL		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Front left ON</td><td rowspan="2">Between (3) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Front left OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Front left ON	Between (3) – chassis	17 – 30 V	Top outrigger control switch: Front left OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>
		Top outrigger control switch: Front left ON		Between (3) – chassis	17 – 30 V						
	Top outrigger control switch: Front left OFF	Max. 1 V									
Outrigger FR	Measure voltage	<div>If the condition is as shown in the table below, it is normal (measure with the AC range)</div> <table><tr><td>Top outrigger control switch: Front right ON</td><td rowspan="2">Between (4) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Front right OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Front right ON	Between (4) – chassis	17 – 30 V	Top outrigger control switch: Front right OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>			
Top outrigger control switch: Front right ON	Between (4) – chassis	17 – 30 V									
Top outrigger control switch: Front right OFF		Max. 1 V									
Outrigger RL	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Rear left ON</td><td rowspan="2">Between (13) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Rear left OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Rear left ON	Between (13) – chassis	17 – 30 V	Top outrigger control switch: Rear left OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>			
Top outrigger control switch: Rear left ON	Between (13) – chassis	17 – 30 V									
Top outrigger control switch: Rear left OFF		Max. 1 V									
Outrigger RR	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Rear right ON</td><td rowspan="2">Between (14) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Rear right OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Rear right ON	Between (14) – chassis	17 – 30 V	Top outrigger control switch: Rear right OFF	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>3) PTO switch: Operation 1</div> <div>4) Shift lever: N</div>			
Top outrigger control switch: Rear right ON	Between (14) – chassis	17 – 30 V									
Top outrigger control switch: Rear right OFF		Max. 1 V									

023S02

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- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions				
Controller Lower MDT		NSW power source	M02	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (19) – (11), (21)</td><td rowspan="2">20 – 30 V</td></tr><tr><td>Between (19) – chassis</td></tr></table>	Between (19) – (11), (21)	20 – 30 V	Between (19) – chassis	1) Insert T-adapter.	
	Between (19) – (11), (21)	20 – 30 V								
	Between (19) – chassis									
		SW power source	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (10), (20) – (11), (21)</td><td rowspan="2">20 – 30 V</td></tr><tr><td>Between (10), (20) – chassis</td></tr></table>	Between (10), (20) – (11), (21)	20 – 30 V	Between (10), (20) – chassis	1) Insert T-adapter. 2) Turn starting switch ON.		
	Between (10), (20) – (11), (21)	20 – 30 V								
	Between (10), (20) – chassis									
	Outrigger power source	M01	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>PTO switch: Operation 1</td><td rowspan="2">Between (6) – chassis</td><td>20 – 30 V</td></tr><tr><td>PTO switch: Travel or Operation 2</td><td>Max. 1 V</td></tr></table>	PTO switch: Operation 1	Between (6) – chassis	20 – 30 V	PTO switch: Travel or Operation 2	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Shift lever: N
PTO switch: Operation 1	Between (6) – chassis		20 – 30 V							
PTO switch: Travel or Operation 2			Max. 1 V							
	Selector EXTEND	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger EXTEND/STOW switch: EXTEND</td><td rowspan="2">Between (8) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger EXTEND/STOW switch: STOW or Neutral</td><td>Max. 1 V</td></tr></table> <div>* See Comments at bottom of page.</div>	Top outrigger EXTEND/STOW switch: EXTEND	Between (8) – chassis	17 – 30 V	Top outrigger EXTEND/STOW switch: STOW or Neutral	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: SLIDE or JACK 6) Outrigger control switch: INDIVIDUAL switch ON (any switch)	
Top outrigger EXTEND/STOW switch: EXTEND	Between (8) – chassis	17 – 30 V								
Top outrigger EXTEND/STOW switch: STOW or Neutral		Max. 1 V								
	Selector RETRACT (stow)	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger EXTEND/STOW switch: STOW</td><td rowspan="2">Between (18) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger EXTEND/STOW switch: EXTEND or Neutral</td><td>Max. 1 V</td></tr></table> <div>* See Comments at bottom of page.</div>	Top outrigger EXTEND/STOW switch: STOW	Between (18) – chassis	17 – 30 V	Top outrigger EXTEND/STOW switch: EXTEND or Neutral	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: SLIDE or JACK 6) Outrigger control switch: INDIVIDUAL switch ON (any switch)	
Top outrigger EXTEND/STOW switch: STOW	Between (18) – chassis	17 – 30 V								
Top outrigger EXTEND/STOW switch: EXTEND or Neutral		Max. 1 V								

Comments:

- (1) This checks the output of the controller, so operate with the top control switch.
(If the bottom control panel is used, it turns the solenoid ON directly.)
- (2) When operating the outrigger, if both the EXTEND/STOW switch and JACK/SLIDE switch are at any position except neutral, the solenoid is only switched ON if the INDIVIDUAL (or ALL) switch is set to ON to operate the outrigger slide with the PTO switch at "Operation 1" (PTO1) and the gear shift lever is at N.



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller Lower MDT		Outrigger slide solenoid FL	M01	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Front left ON</td><td rowspan="2">Between (16) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Front left OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Front left ON	Between (16) – chassis	17 – 30 V	Top outrigger control switch: Front left OFF	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: SLIDE 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</div>
	Top outrigger control switch: Front left ON	Between (16) – chassis		17 – 30 V							
	Top outrigger control switch: Front left OFF			Max. 1 V							
		Outrigger slide solenoid FR		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Front right ON</td><td rowspan="2">Between (17) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Front right OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Front right ON	Between (17) – chassis	17 – 30 V	Top outrigger control switch: Front right OFF	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: SLIDE 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</div>
	Top outrigger control switch: Front right ON	Between (17) – chassis		17 – 30 V							
Top outrigger control switch: Front right OFF	Max. 1 V										
	Outrigger slide solenoid RL	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Rear left ON</td><td rowspan="2">Between (5) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Rear left OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Rear left ON	Between (5) – chassis	17 – 30 V	Top outrigger control switch: Rear left OFF	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: SLIDE 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</div>		
Top outrigger control switch: Rear left ON	Between (5) – chassis	17 – 30 V									
Top outrigger control switch: Rear left OFF		Max. 1 V									
	Outrigger slide solenoid RR	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Rear right ON</td><td rowspan="2">Between (7) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Rear right OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Rear right ON	Between (7) – chassis	17 – 30 V	Top outrigger control switch: Rear right OFF	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: SLIDE 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</div>		
Top outrigger control switch: Rear right ON	Between (7) – chassis	17 – 30 V									
Top outrigger control switch: Rear right OFF		Max. 1 V									
	Outrigger jack solenoid FL	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Top outrigger control switch: Front left ON</td><td rowspan="2">Between (14) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Front left OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Front left ON	Between (14) – chassis	17 – 30 V	Top outrigger control switch: Front left OFF	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: JACK 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</div>		
Top outrigger control switch: Front left ON	Between (14) – chassis	17 – 30 V									
Top outrigger control switch: Front left OFF		Max. 1 V									

023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Lower MDT	Outrigger jack solenoid FR	M01	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Top outrigger control switch: Front right ON</td><td rowspan="2">Between (15) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Front right OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Front right ON	Between (15) – chassis	17 – 30 V	Top outrigger control switch: Front right OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: JACK 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</p>
		Top outrigger control switch: Front right ON		Between (15) – chassis	17 – 30 V						
		Top outrigger control switch: Front right OFF			Max. 1 V						
		Outrigger jack solenoid RL		Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Top outrigger control switch: Rear left ON</td><td rowspan="2">Between (3) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Rear left OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Rear left ON	Between (3) – chassis	17 – 30 V	Top outrigger control switch: Rear left OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger SLIDE/JACK switch: JACK 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</p>
		Top outrigger control switch: Rear left ON		Between (3) – chassis	17 – 30 V						
Top outrigger control switch: Rear left OFF	Max. 1 V										
Outrigger jack solenoid RR	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Top outrigger control switch: Rear right ON</td><td rowspan="2">Between (4) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top outrigger control switch: Rear right OFF</td><td>Max. 1 V</td></tr></table>	Top outrigger control switch: Rear right ON	Between (4) – chassis	17 – 30 V	Top outrigger control switch: Rear right OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Outrigger slide, jack switch: JACK 6) Outrigger EXTEND/STOW switch: EXTEND or STOW (any position except neutral)</p>			
Top outrigger control switch: Rear right ON	Between (4) – chassis	17 – 30 V									
Top outrigger control switch: Rear right OFF		Max. 1 V									
Rear steering lock solenoid	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Rear steering control (until LOCK is detected)</td><td rowspan="2">Between (9) – chassis</td><td>17 – 30 V</td></tr><tr><td>Rear steering lock cancel switch: OFF</td><td>Max. 1 V</td></tr></table>	Rear steering control (until LOCK is detected)	Between (9) – chassis	17 – 30 V	Rear steering lock cancel switch: OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or PTO 1 4) When detecting rear steering CENTER 5) Rear steering FREE 6) Steering mode switch: Front wheel</p>			
Rear steering control (until LOCK is detected)	Between (9) – chassis	17 – 30 V									
Rear steering lock cancel switch: OFF		Max. 1 V									
Rear steering FREE solenoid	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Rear steering lock cancel switch: CANCEL</td><td rowspan="2">Between (19) – chassis</td><td>17 – 30 V</td></tr><tr><td>Rear steering lock cancel switch: OFF</td><td>Max. 1 V</td></tr></table>	Rear steering lock cancel switch: CANCEL	Between (19) – chassis	17 – 30 V	Rear steering lock cancel switch: OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Steering mode switch: Front wheel</p>			
Rear steering lock cancel switch: CANCEL	Between (19) – chassis	17 – 30 V									
Rear steering lock cancel switch: OFF		Max. 1 V									

023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions			
Controller Lower MDT	Service brake solenoid	Retarder (opt)	Exhaust brake solenoid	Preheating	M01	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON.	
							Parking brake switch: Auxiliary	Between (10) – chassis	17 – 30 V
							Parking brake switch: OFF		Max. 1 V
							Exhaust brake switch: Retarder	Between (11) – chassis	17 – 30 V
							Exhaust brake switch: OFF		Max. 1 V
	Exhaust brake switch: Exhaust brake	Between (20) – chassis	17 – 30 V						
	Exhaust brake switch: OFF		Max. 1 V						
	Starting switch: HEAT	Between (21) – chassis	17 – 30 V						
	Starting switch: ON		Max. 1 V						
Steering mode solenoid a	Steering mode solenoid b	Steering mode solenoid c	M02	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering FREE 5) Travel speed: Max. 10 km/h			
					Steering mode switch: Rear wheel mode	Between (1) – chassis	17 – 30 V		
					Steering mode switch: Front wheel mode		Max. 1 V		
Steering mode switch: Rear wheel mode	Between (2) – chassis	17 – 30 V							
Steering mode switch: Front wheel mode		Max. 1 V							
Steering mode switch: Crab mode	Between (12) – chassis	17 – 30 V							
Steering mode switch: Front wheel mode		Max. 1 V							

023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller Lower MDT		Steering mode solenoid d	M02	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Reverse steering compensation switch: ON</td><td rowspan="2">Between (13) – chassis</td><td>17 – 30 V</td></tr><tr><td>Reverse steering compensation switch: OFF</td><td>Max. 1 V</td></tr></table>	Reverse steering compensation switch: ON	Between (13) – chassis	17 – 30 V	Reverse steering compensation switch: OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Swing angle: 180° (boom facing rear)</p>
	Reverse steering compensation switch: ON	Between (13) – chassis		17 – 30 V							
	Reverse steering compensation switch: OFF			Max. 1 V							
		Swing pump merge selector solenoid		Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Outrigger control switch: ALL</td><td rowspan="2">Between (3) – chassis</td><td>17 – 30 V</td></tr><tr><td>Outrigger control switch: OFF</td><td>Max. 1 V</td></tr></table>	Outrigger control switch: ALL	Between (3) – chassis	17 – 30 V	Outrigger control switch: OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO mode: Operation 1 4) Outrigger EXTEND/STOW switch: Other than Neutral 5) Outrigger JACK/SLIDE switch: Other than Neutral 6) Shift lever: N</p>
	Outrigger control switch: ALL	Between (3) – chassis		17 – 30 V							
	Outrigger control switch: OFF			Max. 1 V							
		Rear steering lock (detection) switch		Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Rear steering LOCK</td><td rowspan="2">Between (5) – chassis</td><td>Max. 1 V</td></tr><tr><td>Rear steering FREE</td><td>15 – 30 V</td></tr></table>	Rear steering LOCK	Between (5) – chassis	Max. 1 V	Rear steering FREE	15 – 30 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1</p>
	Rear steering LOCK	Between (5) – chassis		Max. 1 V							
Rear steering FREE	15 – 30 V										
	Rear steering free (detection) switch	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Rear steering FREE</td><td rowspan="2">Between (16) – chassis</td><td>Max. 1 V</td></tr><tr><td>Rear steering LOCK</td><td>15 – 30 V</td></tr></table>	Rear steering FREE	Between (16) – chassis	Max. 1 V	Rear steering LOCK	15 – 30 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1</p>		
Rear steering FREE	Between (16) – chassis	Max. 1 V									
Rear steering LOCK		15 – 30 V									
	Rear steering center proximity switch	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Rear steering CENTER</td><td rowspan="2">Between (6) – chassis</td><td>Max. 1 V</td></tr><tr><td>Other</td><td>15 – 30 V</td></tr></table>	Rear steering CENTER	Between (6) – chassis	Max. 1 V	Other	15 – 30 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1</p>		
Rear steering CENTER	Between (6) – chassis	Max. 1 V									
Other		15 – 30 V									
	Suspension lift solenoid	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Suspension lift switch: ON</td><td rowspan="2">Between (15) – chassis</td><td>17 – 30 V</td></tr><tr><td>Suspension lift switch: OFF</td><td>Max. 1 V</td></tr></table>	Suspension lift switch: ON	Between (15) – chassis	17 – 30 V	Suspension lift switch: OFF	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Suspension lock switch: Lock 5) Shift lever: N</p>		
Suspension lift switch: ON	Between (15) – chassis	17 – 30 V									
Suspension lift switch: OFF		Max. 1 V									
	Outrigger EXTEND signal	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Bottom outrigger EXTEND/STOW switch: EXTEND</td><td rowspan="2">Between (7) – chassis</td><td>17 – 30 V</td></tr><tr><td>Bottom outrigger EXTEND/STOW switch: STOW or Neutral</td><td>Max. 1 V</td></tr></table>	Bottom outrigger EXTEND/STOW switch: EXTEND	Between (7) – chassis	17 – 30 V	Bottom outrigger EXTEND/STOW switch: STOW or Neutral	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Bottom outrigger JACK/SLIDE switch: Other than Neutral 6) Bottom outrigger control switch: INDIVIDUAL switch (any switch) ON</p>		
Bottom outrigger EXTEND/STOW switch: EXTEND	Between (7) – chassis	17 – 30 V									
Bottom outrigger EXTEND/STOW switch: STOW or Neutral		Max. 1 V									

023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller Lower MDT		Outrigger RE-TRACT (stow) signal	M02	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Bottom outrigger EXTEND/STOW switch: STOW</td><td rowspan="2">Between (8) – chassis</td><td>17 – 30 V</td></tr><tr><td>Bottom outrigger EXTEND/STOW switch: EXTEND or Neutral</td><td>Max. 1 V</td></tr></table>	Bottom outrigger EXTEND/STOW switch: STOW	Between (8) – chassis	17 – 30 V	Bottom outrigger EXTEND/STOW switch: EXTEND or Neutral	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Bottom outrigger JACK/SLIDE switch: Other than Neutral 6) Bottom outrigger control switch: INDIVIDUAL switch (any switch) ON
		Bottom outrigger EXTEND/STOW switch: STOW			Between (8) – chassis	17 – 30 V					
	Bottom outrigger EXTEND/STOW switch: EXTEND or Neutral	Max. 1 V									
	Outrigger X/H select signal	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>X-shape</td><td rowspan="2">Between (17) – chassis</td><td>15 – 30 V</td></tr><tr><td>H-shape</td><td>Max. 1 V</td></tr></table>	X-shape	Between (17) – chassis	15 – 30 V	H-shape	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON.		
	X-shape	Between (17) – chassis	15 – 30 V								
	H-shape		Max. 1 V								
		Engine oil pressure	M03	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Engine oil pressure (start engine): Min. 0.05 MPa {0.5 kg/cm²}</td><td rowspan="2">Between (12) – chassis</td><td>15 – 30 V</td></tr><tr><td>Engine oil pressure (starting switch ON): Max. 0.05 MPa {0.5 kg/cm²}</td><td>Max. 1 V</td></tr></table>	Engine oil pressure (start engine): Min. 0.05 MPa {0.5 kg/cm ² }	Between (12) – chassis	15 – 30 V	Engine oil pressure (starting switch ON): Max. 0.05 MPa {0.5 kg/cm ² }	Max. 1 V	1) Insert T-adapter.
		Engine oil pressure (start engine): Min. 0.05 MPa {0.5 kg/cm ² }		Between (12) – chassis	15 – 30 V						
Engine oil pressure (starting switch ON): Max. 0.05 MPa {0.5 kg/cm ² }		Max. 1 V									
Brake fluid level		Measure voltage		If the condition is as shown in the table below, it is normal <table><tr><td>Brake fluid level: Correct, or brake wear within repair limit</td><td rowspan="2">Between (7) – chassis</td><td>15 – 30 V</td></tr><tr><td>Brake fluid level: Low, or brake wear at repair limit</td><td>Max. 1 V</td></tr></table>	Brake fluid level: Correct, or brake wear within repair limit	Between (7) – chassis	15 – 30 V	Brake fluid level: Low, or brake wear at repair limit	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON.	
Brake fluid level: Correct, or brake wear within repair limit	Between (7) – chassis	15 – 30 V									
Brake fluid level: Low, or brake wear at repair limit		Max. 1 V									
Charge (alternator)	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Engine running (half throttle or above)</td><td rowspan="2">Between (3) – chassis</td><td>28 ± 2 V</td></tr><tr><td>Starting switch ON</td><td>Max. 1 V</td></tr></table> ★ If the battery is deteriorated, or after starting in cold areas, the voltage may not rise for some time.	Engine running (half throttle or above)	Between (3) – chassis	28 ± 2 V	Starting switch ON	Max. 1 V	1) Insert T-adapter. 2) Start engine.			
Engine running (half throttle or above)	Between (3) – chassis	28 ± 2 V									
Starting switch ON		Max. 1 V									
Special steering mode relay check	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>More than 2 sec after starting switch ON</td><td rowspan="2">Between (1) – chassis</td><td>Max. 1 V</td></tr><tr><td>Within 2 sec after starting switch ON</td><td>15 – 30 V</td></tr></table>	More than 2 sec after starting switch ON	Between (1) – chassis	Max. 1 V	Within 2 sec after starting switch ON	15 – 30 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1			
More than 2 sec after starting switch ON	Between (1) – chassis	Max. 1 V									
Within 2 sec after starting switch ON		15 – 30 V									

023S02



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★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions	
Controller Lower MDT	M03	Reverse steering mode relay check	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.	
		More than 2 sec after starting switch ON		Between (2) – chassis	Max. 1 V		
		Within 2 sec after starting switch ON			15 – 30 V		
		Outrigger ALL control signal		Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 4) Shift lever: N 5) Bottom outrigger JACK/SLIDE switch: Other than Neutral 6) Bottom outrigger EXTEND/STOW switch: Other than Neutral
		Bottom outrigger switch: ALL (press)			Between (4) – chassis	20 – 30 V	
		Bottom outrigger switch: OFF		Max. 1 V			
		Left turn pilot		Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.
Turn signal lever: Left, and turn signal lamp lighted up	Between (16) – chassis	17 – 30 V					
Turn signal lever: OFF		Max. 1 V					
Right turn pilot	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter.			
Turn signal lever: Right, and turn signal lamp lighted up		Between (6) – chassis	17 – 30 V				
Turn signal lever: OFF	Max. 1 V						
Emergency gear shift	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.			
Emergency gear shift selector switch: ON		Between (13) – chassis	20 – 30 V				
Emergency gear shift selector switch: OFF	Max. 1 V						
Parking brake actuation signal (air pressure switch)	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Start engine. 3) Air pressure: Min. 5 kg/cm ²			
Parking brake switch: PARKING		Between (17) – chassis	15 – 30 V				
Parking brake switch: OFF	Max. 1 V						
Model selection	Measure voltage	If the condition is as shown in the table below, it is normal		1) Insert T-adapter. 2) Turn starting switch ON.			
W,Y		Between (9), (10) - chassis	Max. 1 V				
X,Z	Between (19), (20) - chassis	15 – 30 V					



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller Lower MDT		Top selection (memory cancel)	M03	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (8) – chassis</td><td>15 – 30 V</td></tr></table>	Between (8) – chassis	15 – 30 V	1) Insert T-adapter. 2) Turn starting switch ON.			
	Between (8) – chassis	15 – 30 V									
		Bottom selection	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (18) – chassis</td><td>Max. 1 V</td></tr></table>	Between (18) – chassis	Max. 1 V	1) Insert T-adapter.				
	Between (18) – chassis	Max. 1 V									
		Head lamp Hi	M04	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Lamp switch stage 2 ON, dimmer switch ON (pressed odd number of times, head lamp Hi)</td><td rowspan="2">Between (6) – chassis</td><td>17 – 30 V</td></tr><tr><td>Lamp switch: OFF</td><td>Max. 1 V</td></tr></table>	Lamp switch stage 2 ON, dimmer switch ON (pressed odd number of times, head lamp Hi)	Between (6) – chassis	17 – 30 V	Lamp switch: OFF	Max. 1 V	1) Insert T-adapter.
	Lamp switch stage 2 ON, dimmer switch ON (pressed odd number of times, head lamp Hi)	Between (6) – chassis		17 – 30 V							
	Lamp switch: OFF			Max. 1 V							
		Head lamp Lo		Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Lamp switch 2-stage ON, dimmer switch ON (pressed even number of times, head lamp Lo)</td><td rowspan="2">Between (14) – chassis</td><td>17 – 30 V</td></tr><tr><td>Lamp switch: OFF</td><td>Max. 1 V</td></tr></table>	Lamp switch 2-stage ON, dimmer switch ON (pressed even number of times, head lamp Lo)	Between (14) – chassis	17 – 30 V	Lamp switch: OFF	Max. 1 V	1) Insert T-adapter.
	Lamp switch 2-stage ON, dimmer switch ON (pressed even number of times, head lamp Lo)	Between (14) – chassis		17 – 30 V							
Lamp switch: OFF	Max. 1 V										
	Side lamp	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Lamp switch: stage 1 ON</td><td rowspan="2">Between (7) – chassis</td><td>17 – 30 V</td></tr><tr><td>Lamp switch: OFF</td><td>Max. 1 V</td></tr></table>	Lamp switch: stage 1 ON	Between (7) – chassis	17 – 30 V	Lamp switch: OFF	Max. 1 V	1) Insert T-adapter.		
Lamp switch: stage 1 ON	Between (7) – chassis	17 – 30 V									
Lamp switch: OFF		Max. 1 V									
	Left turn	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Turn signal lever: Left</td><td rowspan="2">Between (16) – chassis</td><td>17 – 30 V</td></tr><tr><td>Turn signal lever: OFF</td><td>Max. 1 V</td></tr></table>	Turn signal lever: Left	Between (16) – chassis	17 – 30 V	Turn signal lever: OFF	Max. 1 V	1) Insert T-adapter.		
Turn signal lever: Left	Between (16) – chassis	17 – 30 V									
Turn signal lever: OFF		Max. 1 V									
	Right turn	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Turn signal lever: Right</td><td rowspan="2">Between (8) – chassis</td><td>17 – 30 V</td></tr><tr><td>Turn signal lever: OFF</td><td>Max. 1 V</td></tr></table>	Turn signal lever: Right	Between (8) – chassis	17 – 30 V	Turn signal lever: OFF	Max. 1 V	1) Insert T-adapter.		
Turn signal lever: Right	Between (8) – chassis	17 – 30 V									
Turn signal lever: OFF		Max. 1 V									
	Fuel level	M05 (female) M06 (female)	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>FULL</td><td>M05 (female) (8)–</td><td>Approx. 10 Ω</td></tr><tr><td>EMPTY</td><td>M06 (female) (9)</td><td>Approx. 80 Ω</td></tr></table>	FULL	M05 (female) (8)–	Approx. 10 Ω	EMPTY	M06 (female) (9)	Approx. 80 Ω	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
FULL	M05 (female) (8)–	Approx. 10 Ω									
EMPTY	M06 (female) (9)	Approx. 80 Ω									


023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions						
Controller Lower MDT		Engine water temperature Torque converter oil temperature Hydraulic oil temperature	M05 (female) M06 (female)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Measure resistance</td><td>Oil temperature or water temperature</td><td>When normal</td></tr><tr><td>Between M05 (female) (9),(19),(20) – M06 (female) (9)</td><td>100°C 25°C</td><td>Approx. 2.5 – 4.0 kΩ Approx. 37 – 50 kΩ</td></tr></table>	Measure resistance	Oil temperature or water temperature	When normal	Between M05 (female) (9),(19),(20) – M06 (female) (9)	100°C 25°C	Approx. 2.5 – 4.0 kΩ Approx. 37 – 50 kΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Measure resistance	Oil temperature or water temperature	When normal									
	Between M05 (female) (9),(19),(20) – M06 (female) (9)	100°C 25°C	Approx. 2.5 – 4.0 kΩ Approx. 37 – 50 kΩ									
		Outrigger length sensor power source	M05	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between M06 (2) – M06 (9)</td><td>4.75 – 5.25 V</td></tr></table>	Between M06 (2) – M06 (9)	4.75 – 5.25 V	1) Insert T-adapter. 2) Turn starting switch ON.				
	Between M06 (2) – M06 (9)	4.75 – 5.25 V										
		Outrigger FL length		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between M05 (6) – M06 (9)</td><td>Approx. 0.5 - 3.9 V</td></tr></table> <div>★ Must match MIN, MAX monitor codes stored in monitor code mode of moment limiter (within ±7 of value in memory).</div>	Between M05 (6) – M06 (9)	Approx. 0.5 - 3.9 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1				
	Between M05 (6) – M06 (9)	Approx. 0.5 - 3.9 V										
	Outrigger FR length	Measure voltage		<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between M05 (7) – M06 (9)</td><td>Approx. 0.5 - 3.9 V</td></tr></table> <div>★ Must match MIN, MAX monitor codes stored in monitor code mode of moment limiter (within ±7 of value in memory).</div>	Between M05 (7) – M06 (9)	Approx. 0.5 - 3.9 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1					
Between M05 (7) – M06 (9)	Approx. 0.5 - 3.9 V											
	Outrigger RL length	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between M05 (16) – M06 (9)</td><td>Approx. 0.5 - 3.9 V</td></tr></table> <div>★ Must match MIN, MAX monitor codes stored in monitor code mode of moment limiter (within ±7 of value in memory).</div>	Between M05 (16) – M06 (9)	Approx. 0.5 - 3.9 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1						
Between M05 (16) – M06 (9)	Approx. 0.5 - 3.9 V											
	Outrigger RR length	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between M05 (17) – M06 (9)</td><td>Approx. 0.5 - 3.9 V</td></tr></table> <div>★ Must match MIN, MAX monitor codes stored in monitor code mode of moment limiter (within ±7 of value in memory).</div>	Between M05 (17) – M06 (9)	Approx. 0.5 - 3.9 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1						
Between M05 (17) – M06 (9)	Approx. 0.5 - 3.9 V											
	S-NET	M06	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (4),(12) – (10)</td><td>4 – 8 V</td></tr></table>	Between (4),(12) – (10)	4 – 8 V	1) Insert T-adapter. 2) Turn starting switch ON.					
Between (4),(12) – (10)	4 – 8 V											

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Sys-tem	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions			
Controller Lower MDT	C-NET		M06	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (5) – (6),(14)</td><td rowspan="2">7 – 11 V</td></tr><tr><td>Between (13) – (14),(6)</td></tr></table>	Between (5) – (6),(14)	7 – 11 V	Between (13) – (14),(6)	1) Insert T-adapter. 2) Turn starting switch ON.
	Between (5) – (6),(14)	7 – 11 V							
	Between (13) – (14),(6)								
Tachometer			Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (7) – (10) – chassis</td><td>Max. 0.5 V</td></tr></table>	Between (7) – (10) – chassis	Max. 0.5 V	1) Insert T-adapter. 2) Start engine.		
Between (7) – (10) – chassis	Max. 0.5 V								
Speedometer		M06 (female)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (15) – (10)</td><td>500 – 1,000 Ω</td></tr></table>	Between (15) – (10)	500 – 1,000 Ω	1) Disconnect connector.		
Between (15) – (10)	500 – 1,000 Ω								

023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Transmission	Transmission controller power source	M13	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (8),(18) – chassis</td><td colspan="2">20 – 30 V</td></tr></table>	Between (8),(18) – chassis	20 – 30 V		1) Insert T-adapter. 2) Turn starting switch ON.		
		Between (8),(18) – chassis		20 – 30 V							
		Transmission solenoid power source	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Emergency gear shift switch: OFF</td><td rowspan="2">Between (17) – chassis</td><td>20 – 30 V</td></tr><tr><td>Emergency gear shift switch: ON</td><td>Max. 1 V</td></tr></table>	Emergency gear shift switch: OFF	Between (17) – chassis	20 – 30 V	Emergency gear shift switch: ON	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON.	
		Emergency gear shift switch: OFF	Between (17) – chassis	20 – 30 V							
		Emergency gear shift switch: ON		Max. 1 V							
		Transmission solenoid power source monitor	M14	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Emergency gear shift switch: OFF</td><td rowspan="2">Between (4) – chassis</td><td>20 – 30 V</td></tr><tr><td>Emergency gear shift switch: ON</td><td>Max. 1 V</td></tr></table>	Emergency gear shift switch: OFF	Between (4) – chassis	20 – 30 V	Emergency gear shift switch: ON	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON.
		Emergency gear shift switch: OFF	Between (4) – chassis	20 – 30 V							
		Emergency gear shift switch: ON		Max. 1 V							
	S-NET	M13 (female)	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between M05 (12) – M06 (9)</td><td colspan="2">4 – 8 V</td></tr></table>	Between M05 (12) – M06 (9)	4 – 8 V		1) Insert T-adapter. 2) Turn starting switch ON.			
Between M05 (12) – M06 (9)	4 – 8 V										
R ECMV	Measure resistance		<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td rowspan="2">Between M05 (7) – M06 (16)</td><td>10 – 20 Ω</td></tr><tr><td>Min. 1 MΩ</td></tr></table>	Between M05 (7) – M06 (16)	10 – 20 Ω	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector (M13). 3) Connect T-adapter.				
Between M05 (7) – M06 (16)	10 – 20 Ω										
	Min. 1 MΩ										
F2 ECMV	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td rowspan="2">Between M05 (6) – M06 (16)</td><td>10 – 20 Ω</td></tr><tr><td>Min. 1 MΩ</td></tr></table>	Between M05 (6) – M06 (16)	10 – 20 Ω	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector (M13). 3) Connect T-adapter.					
Between M05 (6) – M06 (16)	10 – 20 Ω										
	Min. 1 MΩ										
F1 ECMV	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td rowspan="2">Between M05 (5) – M06 (15)</td><td>10 – 20 Ω</td></tr><tr><td>Min. 1 MΩ</td></tr></table>	Between M05 (5) – M06 (15)	10 – 20 Ω	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector (M13). 3) Connect T-adapter.					
Between M05 (5) – M06 (15)	10 – 20 Ω										
	Min. 1 MΩ										
F3 ECMV	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td rowspan="2">Between M05 (4) – M06 (15)</td><td>10 – 20 Ω</td></tr><tr><td>Min. 1 MΩ</td></tr></table>	Between M05 (4) – M06 (15)	10 – 20 Ω	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector (M13). 3) Connect T-adapter.					
Between M05 (4) – M06 (15)	10 – 20 Ω										
	Min. 1 MΩ										

023S02



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions		
Controller	Transmission	Torque converter lockup solenoid	M13 (female)	Measure resistance	If the condition is as shown in the table below, it is normal	<div><div>Between (3) – (14)</div><div><div>10 – 20 Ω</div><div>Min. 1 MΩ</div></div></div>	1) Turn starting switch OFF. 2) Disconnect connector (M13). 3) Insert T-adapter.	
		4WD solenoid			If the condition is as shown in the table below, it is normal		<div><div>Between (20) – chassis</div><div><div>30 – 80 Ω</div><div>Min. 1 MΩ</div></div></div>	1) Turn starting switch OFF. 2) Disconnect connector (M13). 3) Insert T-adapter.
		Lo solenoid			If the condition is as shown in the table below, it is normal		<div><div>Between (21) – chassis</div><div><div>30 – 80 Ω</div><div>Min. 1 MΩ</div></div></div>	1) Turn starting switch OFF. 2) Disconnect connector (M13).
		Special steering mode relay check	M14	Measure voltage	If the condition is as shown in the table below, it is normal	<div><div><div>More than 2 sec after starting switch ON</div><div>Between (8) – chassis</div><div>20 – 30 V</div></div><div><div>Within 2 sec after starting switch ON</div><div></div><div>Max. 1 V</div></div></div>	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1	
		Interlock (transmission lever) N signal			If the condition is as shown in the table below, it is normal	<div><div><div>Transmission lever: N</div><div>Between (3) – chassis</div><div>20 – 30 V</div></div><div><div>Transmission lever: Other</div><div></div><div>Max. 1 V</div></div></div>	1) Insert T-adapter. 2) Turn starting switch ON. 3) Emergency gear shift switch: OFF 4) PTO switch: Travel or Operation 1	
		Interlock signal (emergency gear shift F)			If the condition is as shown in the table below, it is normal	<div><div><div>Transmission lever: D, 2, L</div><div>Between (2) – chassis</div><div>20 – 30 V</div></div><div><div>Transmission lever: Other</div><div></div><div>Max. 1 V</div></div></div>	1) Insert T-adapter. 2) Turn starting switch ON.	
		Interlock signal (emergency gear shift R)			If the condition is as shown in the table below, it is normal	<div><div><div>Transmission lever: R</div><div>Between (1) – chassis</div><div>20 – 30 V</div></div><div><div>Transmission lever: Other</div><div></div><div>Max. 1 V</div></div></div>	1) Insert T-adapter. 2) Turn starting switch ON.	

023S02

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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Transmission	Steering mode solenoid a	M14	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Steering mode switch: Rear wheel mode</td><td rowspan="2">Between (13) – chassis</td><td>20 – 30 V</td></tr><tr><td>Steering mode switch: Front wheel mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Rear wheel mode	Between (13) – chassis	20 – 30 V	Steering mode switch: Front wheel mode	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering FREE 5) Travel speed: Max. 10 km/h</div>
		Steering mode switch: Rear wheel mode		Between (13) – chassis	20 – 30 V						
		Steering mode switch: Front wheel mode			Max. 1 V						
		Steering mode solenoid b		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Steering mode switch: Rear wheel mode</td><td rowspan="2">Between (12) – chassis</td><td>20 – 30 V</td></tr><tr><td>Steering mode switch: Front wheel mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Rear wheel mode	Between (12) – chassis	20 – 30 V	Steering mode switch: Front wheel mode	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering FREE 5) Travel speed: Max. 10 km/h</div>
		Steering mode switch: Rear wheel mode		Between (12) – chassis	20 – 30 V						
	Steering mode switch: Front wheel mode	Max. 1 V									
	Steering mode solenoid c	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Steering mode switch: Crab mode</td><td rowspan="2">Between (11) – chassis</td><td>20 – 30 V</td></tr><tr><td>Steering mode switch: Front wheel mode</td><td>Max. 1 V</td></tr></table>	Steering mode switch: Crab mode	Between (11) – chassis	20 – 30 V	Steering mode switch: Front wheel mode	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Rear steering FREE 5) Travel speed: Max. 10 km/h</div>		
Steering mode switch: Crab mode	Between (11) – chassis	20 – 30 V									
Steering mode switch: Front wheel mode		Max. 1 V									
Steering mode solenoid d	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Reverse steering compensation switch ON</td><td rowspan="2">Between (14) – chassis</td><td>20 – 30 V</td></tr><tr><td>Reverse steering compensation switch: OFF</td><td>Max. 1 V</td></tr></table>	Reverse steering compensation switch ON	Between (14) – chassis	20 – 30 V	Reverse steering compensation switch: OFF	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1 4) Swing angle: 180° (boom facing rear)</div>			
Reverse steering compensation switch ON	Between (14) – chassis	20 – 30 V									
Reverse steering compensation switch: OFF		Max. 1 V									
Reverse steering mode relay check	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>More than 2 sec after starting switch ON</td><td rowspan="2">Between (7) – chassis</td><td>20 – 30 V</td></tr><tr><td>Within 2 sec after starting switch ON</td><td>Max. 1 V</td></tr></table>	More than 2 sec after starting switch ON	Between (7) – chassis	20 – 30 V	Within 2 sec after starting switch ON	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1</div>			
More than 2 sec after starting switch ON	Between (7) – chassis	20 – 30 V									
Within 2 sec after starting switch ON		Max. 1 V									
Special steering mode relay		M15	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>More than 2 sec after starting switch ON</td><td rowspan="2">Between (16) – chassis</td><td>20 – 30 V</td></tr><tr><td>Within 2 sec after starting switch ON</td><td>Max. 1 V</td></tr></table>	More than 2 sec after starting switch ON	Between (16) – chassis	20 – 30 V	Within 2 sec after starting switch ON	Max. 1 V	<div>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Travel or Operation 1</div>	
More than 2 sec after starting switch ON	Between (16) – chassis	20 – 30 V									
Within 2 sec after starting switch ON		Max. 1 V									



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★ Operate the winch under no load.

★ Turn the starting switch OFF before inserting the T-adaptor or making any connections.

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions									
Controller Transmission	F2/R solenoid (ECMV) cut relay	M15 (female)	Measure resistance	If the condition is as shown in the table below, it is normal <table><tr><td>Between (7) – chassis</td><td>100 – 300 Ω</td></tr></table>	Between (7) – chassis	100 – 300 Ω	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.							
	Between (7) – chassis		100 – 300 Ω											
	F1/F3 solenoid (ECMV) cut relay	Measure resistance	If the condition is as shown in the table below, it is normal <table><tr><td>Between (15) – chassis</td><td>100 – 300 Ω</td></tr></table>	Between (15) – chassis	100 – 300 Ω	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter. 11. (female)								
	Between (15) – chassis	100 – 300 Ω												
	Backup lamp relay	M15	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Shift lever: R</td><td rowspan="2">Between (8) – chassis</td><td>20 – 30 V</td></tr><tr><td>Shift lever: Other than R</td><td>Max. 1 V</td></tr></table>	Shift lever: R	Between (8) – chassis	20 – 30 V	Shift lever: Other than R	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) Emergency gear shift switch: OFF 4) PTO switch: Travel or Operation 1				
Shift lever: R	Between (8) – chassis	20 – 30 V												
Shift lever: Other than R		Max. 1 V												
Speed sensor (signal)	M15 (female)	Measure resistance	If the condition is as shown in the table below, it is normal <table><tr><td>Between (5) – (12)</td><td>500 – 1000 Ω</td></tr></table>	Between (5) – (12)	500 – 1000 Ω	20. 1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.								
Between (5) – (12)	500 – 1000 Ω													
Accelerator potentiometer	M14 M15	Measure voltage	If the condition is as shown in the table below, it is normal The table below shows the standard value for the potentiometer voltage where the controller can recognize the throttle range normally. When adjusting the potentiometer, leave a margin for the error judgment range. In particular, the error judgment range is close at low idling, so adjust it at <u>4.3 – 4.6 V</u> . <table><tr><td>Between M14 (10) – M14 (9)</td><td colspan="2">0.25 – 5.25 V</td></tr><tr><td rowspan="3">Between M15 (9) – M14 (9)</td><td>—</td><td>0.5 – 4.75 V</td></tr><tr><td>At low idling</td><td>4.3 ± 0.3 V</td></tr><tr><td>At high idling</td><td>0.5 – [low idling voltage – 2.1V]</td></tr></table>	Between M14 (10) – M14 (9)	0.25 – 5.25 V		Between M15 (9) – M14 (9)	—	0.5 – 4.75 V	At low idling	4.3 ± 0.3 V	At high idling	0.5 – [low idling voltage – 2.1V]	1) Insert T-adapter. 2) Turn starting switch ON. 3) Emergency gear shift switch: OFF 4) PTO switch: Travel or Operation 1
Between M14 (10) – M14 (9)	0.25 – 5.25 V													
Between M15 (9) – M14 (9)	—	0.5 – 4.75 V												
	At low idling	4.3 ± 0.3 V												
	At high idling	0.5 – [low idling voltage – 2.1V]												

023S02

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- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions			
Controller	Moment limiter	NSW power source	C12	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (5) – chassis</td><td>20 – 30 V</td></tr></table>	Between (5) – chassis	20 – 30 V	1) Insert T-adapter.	
		Between (5) – chassis		20 – 30 V					
		SW power source	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (8), (16) – chassis</td><td>20 – 30 V</td></tr></table>	Between (8), (16) – chassis	20 – 30 V	1) Insert T-adapter. 2) Turn starting switch ON.		
		Between (8), (16) – chassis	20 – 30 V						
		S-NET (communication between upper MDT - moment limiter)	C15	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (3), (11) – (1), (9)</td><td>4 – 8 V</td></tr></table>	Between (3), (11) – (1), (9)	4 – 8 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2	
		Between (3), (11) – (1), (9)		4 – 8 V					
		S-NET (communication between jib - moment limiter)	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (5), (13) – (1), (9)</td><td>9 – 13 V</td></tr></table>	Between (5), (13) – (1), (9)	9 – 13 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2		
	Between (5), (13) – (1), (9)	9 – 13 V							
	S-NET (communication between moment limiter controller - moment limiter monitor)	C12	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Between (11), (21) – (8), (18)</td><td>4 – 8 V</td></tr></table>	Between (11), (21) – (8), (18)	4 – 8 V	1) Insert T-adapter. 2) Turn starting switch ON.		
	Between (11), (21) – (8), (18)	4 – 8 V							
Main unload solenoid	C11	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Work equipment lever stand raised</td><td rowspan="2">Between (5) – chassis</td><td>20 – 30 V</td></tr><tr><td>Work equipment lever stand lowered Max. 1 V</td><td>Max. 1 V</td></tr></table>	Work equipment lever stand raised	Between (5) – chassis	20 – 30 V	Work equipment lever stand lowered Max. 1 V	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Automatic stop cancel switch: Automatic 5) No error or warning message displayed
Work equipment lever stand raised			Between (5) – chassis	20 – 30 V					
Work equipment lever stand lowered Max. 1 V				Max. 1 V					
PPC unload solenoid (jib LOWER)	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Top mode: Jib mode</td><td rowspan="2">Between (6) – chassis</td><td>20 – 30 V</td></tr><tr><td>Top mode: Boom mode Max. 1 V</td><td>Max. 1 V</td></tr></table>	Top mode: Jib mode	Between (6) – chassis	20 – 30 V	Top mode: Boom mode Max. 1 V	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Work equipment lever stand raised (operated)	
Top mode: Jib mode		Between (6) – chassis	20 – 30 V						
Top mode: Boom mode Max. 1 V	Max. 1 V								
Boom telescope (order selector) solenoid	Measure voltage	If the condition is as shown in the table below, it is normal <table><tr><td>Boom select switch: Top</td><td rowspan="2">Between (17) – chassis</td><td>20 – 30 V</td></tr><tr><td>Boom Select switch: 2nd Max. 1 V</td><td>Max. 1 V</td></tr></table>	Boom select switch: Top	Between (17) – chassis	20 – 30 V	Boom Select switch: 2nd Max. 1 V	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) No error or warning message displayed	
Boom select switch: Top	Between (17) – chassis	20 – 30 V							
Boom Select switch: 2nd Max. 1 V		Max. 1 V							

023S02

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- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adaptor or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Moment limiter	Automatic stop cancel prohibition relay	C11	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Work equipment lever stand lowered</td><td rowspan="2">Between (7) – chassis</td><td>20 – 30 V</td></tr><tr><td>Work equipment lever stand raised</td><td>Max. 1 V</td></tr></table>	Work equipment lever stand lowered	Between (7) – chassis	20 – 30 V	Work equipment lever stand raised	Max. 1 V	<p>1) Turn starting switch ON. 2) PTO switch: Operation 1 or Operation 2 3) Top mode switch: Boom; Bottom mode switch: Outrigger 4) Outrigger fully extended</p>
		Work equipment lever stand lowered		Between (7) – chassis	20 – 30 V						
		Work equipment lever stand raised			Max. 1 V						
		Jib EXTEND/STOW relay	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Top working mode switch: Preparation</td><td rowspan="2">Between (20) – chassis</td><td>17 – 30 V</td></tr><tr><td>Top working mode switch: Other than preparation</td><td>Max. 1 V</td></tr></table>	Top working mode switch: Preparation	Between (20) – chassis	17 – 30 V	Top working mode switch: Other than preparation	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Bottom working mode switch: Outrigger</p>	
		Top working mode switch: Preparation	Between (20) – chassis	17 – 30 V							
		Top working mode switch: Other than preparation		Max. 1 V							
Jib rotation permission relay	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Jib tilt angle $\geq 70^{\circ}$ AND boom angle $\leq 30^{\circ}$</td><td rowspan="2">Between (10) – chassis</td><td>17 – 30 V</td></tr><tr><td>Other than above</td><td>Max. 1 V</td></tr></table>	Jib tilt angle $\geq 70^{\circ}$ AND boom angle $\leq 30^{\circ}$	Between (10) – chassis	17 – 30 V	Other than above	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Bottom working mode switch: Outrigger 5) Top working mode switch: Preparation</p>			
Jib tilt angle $\geq 70^{\circ}$ AND boom angle $\leq 30^{\circ}$	Between (10) – chassis	17 – 30 V									
Other than above		Max. 1 V									
Moment limiter monitor power source	C12	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (7), (17) - (9), (19)</td><td>20 - 30 V</td></tr></table>	Between (7), (17) - (9), (19)	20 - 30 V	<p>1) Insert T-adapter. 2) Turn starting switch ON.</p>					
Between (7), (17) - (9), (19)		20 - 30 V									
Emergency warning buzzer moment limiter buzzer	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Buzzer sounding</td><td rowspan="2">Between (1), (12) – chassis</td><td>20 – 30 V</td></tr><tr><td>Buzzer stopped</td><td>Max. 1 V</td></tr></table> <p>★ Buzzer sounds alarm 3 sec. after check mode IN.</p>	Buzzer sounding	Between (1), (12) – chassis	20 – 30 V	Buzzer stopped	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2</p>			
Buzzer sounding	Between (1), (12) – chassis	20 – 30 V									
Buzzer stopped		Max. 1 V									
PPC pressure switch (boom RAISE)	C13	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Boom hoist control lever: boom RAISE</td><td rowspan="2">Between (1) – chassis</td><td>15 – 30 V</td></tr><tr><td>Boom hoist control lever: HOLD Max. 1 V</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Boom hoist control lever: boom RAISE	Between (1) – chassis	15 – 30 V	Boom hoist control lever: HOLD Max. 1 V	Max. 1 V	<p>1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2</p>		
Boom hoist control lever: boom RAISE	Between (1) – chassis	15 – 30 V									
Boom hoist control lever: HOLD Max. 1 V		Max. 1 V									

023S02

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- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions							
Controller Moment limiter	C13	PPC pressure switch (boom LOWER)	Measure voltage	If the condition is as shown in the table below, it is normal	<table><tr><td>Boom hoist control lever: boom LOWER</td><td rowspan="2">Between (9) – chassis</td><td>15 – 30 V</td></tr><tr><td>Boom hoist control lever: HOLD</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Boom hoist control lever: boom LOWER	Between (9) – chassis	15 – 30 V	Boom hoist control lever: HOLD	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2		
		Boom hoist control lever: boom LOWER			Between (9) – chassis	15 – 30 V							
		Boom hoist control lever: HOLD				Max. 1 V							
		PPC pressure switch (boom EXTEND)			Measure voltage	If the condition is as shown in the table below, it is normal	<table><tr><td>Boom telescope control lever: boom EXTEND</td><td rowspan="2">Between (2) – chassis</td><td>15 – 30 V</td></tr><tr><td>Boom telescope control lever: HOLD</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Boom telescope control lever: boom EXTEND	Between (2) – chassis	15 – 30 V	Boom telescope control lever: HOLD	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2
		Boom telescope control lever: boom EXTEND					Between (2) – chassis	15 – 30 V					
		Boom telescope control lever: HOLD			Max. 1 V								
PPC pressure switch (boom RETRACT)	Measure voltage	If the condition is as shown in the table below, it is normal	<table><tr><td>Boom telescope control lever: boom RETRACT</td><td rowspan="2">Between (10) – chassis</td><td>15 – 30 V</td></tr><tr><td>Boom telescope control lever: HOLD</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Boom telescope control lever: boom RETRACT	Between (10) – chassis	15 – 30 V	Boom telescope control lever: HOLD	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2				
Boom telescope control lever: boom RETRACT			Between (10) – chassis	15 – 30 V									
Boom telescope control lever: HOLD	Max. 1 V												
PPC pressure switch (main winch WIND IN)	Measure voltage	If the condition is as shown in the table below, it is normal	<table><tr><td>Main winch control lever: WIND IN</td><td rowspan="2">Between (6) – chassis</td><td>15 – 30 V</td></tr><tr><td>Main winch control lever: Neutral</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Main winch control lever: WIND IN	Between (6) – chassis	15 – 30 V	Main winch control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2				
Main winch control lever: WIND IN			Between (6) – chassis	15 – 30 V									
Main winch control lever: Neutral	Max. 1 V												
PPC pressure switch (main winch WIND OUT)	Measure voltage	If the condition is as shown in the table below, it is normal	<table><tr><td>Main winch control lever: WIND OUT</td><td rowspan="2">Between (14) – chassis</td><td>15 – 30 V</td></tr><tr><td>Main winch control lever: Neutral</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Main winch control lever: WIND OUT	Between (14) – chassis	15 – 30 V	Main winch control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2				
Main winch control lever: WIND OUT			Between (14) – chassis	15 – 30 V									
Main winch control lever: Neutral	Max. 1 V												
PPC pressure switch (auxiliary winch WIND IN)	Measure voltage	If the condition is as shown in the table below, it is normal	<table><tr><td>Auxiliary winch control lever: WIND IN</td><td rowspan="2">Between (7) – chassis</td><td>15 – 30 V</td></tr><tr><td>Auxiliary winch control lever: Neutral</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Auxiliary winch control lever: WIND IN	Between (7) – chassis	15 – 30 V	Auxiliary winch control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2				
Auxiliary winch control lever: WIND IN	Between (7) – chassis	15 – 30 V											
Auxiliary winch control lever: Neutral		Max. 1 V											



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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Moment limiter	PPC pressure switch (auxiliary winch WIND OUT)	C13	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Auxiliary winch control lever: WIND OUT</td><td rowspan="2">Between (15) – chassis</td><td>15 – 30 V</td></tr><tr><td>Auxiliary winch control lever: Neutral</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Auxiliary winch control lever: WIND OUT	Between (15) – chassis	15 – 30 V	Auxiliary winch control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2
		Auxiliary winch control lever: WIND OUT		Between (15) – chassis	15 – 30 V						
		Auxiliary winch control lever: Neutral			Max. 1 V						
		PPC pressure switch (jib RAISE)		Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Power tilt jib control lever: Tilt RAISE</td><td rowspan="2">Between (3) – chassis</td><td>15 – 30 V</td></tr><tr><td>Power tilt jib control lever: Neutral</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Power tilt jib control lever: Tilt RAISE	Between (3) – chassis	15 – 30 V	Power tilt jib control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2
		Power tilt jib control lever: Tilt RAISE		Between (3) – chassis	15 – 30 V						
		Power tilt jib control lever: Neutral			Max. 1 V						
PPC pressure switch (jib LOWER)	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Power tilt jib control lever: Tilt LOWER</td><td rowspan="2">Between (11) – chassis</td><td>15 – 30 V</td></tr><tr><td>Power tilt jib control lever: Neutral</td><td>Max. 1 V</td></tr></table> <p>★ It is possible to operate the lever in small movements (not enough to move the work equipment, but enough to detect PPC pressure signal)</p>	Power tilt jib control lever: Tilt LOWER	Between (11) – chassis	15 – 30 V	Power tilt jib control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2			
Power tilt jib control lever: Tilt LOWER	Between (11) – chassis	15 – 30 V									
Power tilt jib control lever: Neutral		Max. 1 V									
PPC pressure switch (swing left)	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Swing control lever: Swing left</td><td rowspan="2">Between (13) – chassis</td><td>15 – 30 V</td></tr><tr><td>Swing control lever: Neutral</td><td>Max. 1 V</td></tr></table>	Swing control lever: Swing left	Between (13) – chassis	15 – 30 V	Swing control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2			
Swing control lever: Swing left	Between (13) – chassis	15 – 30 V									
Swing control lever: Neutral		Max. 1 V									
PPC pressure switch (swing right)	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Swing control lever: Swing right</td><td rowspan="2">Between (5) – chassis</td><td>15 – 30 V</td></tr><tr><td>Swing control lever: Neutral</td><td>Max. 1 V</td></tr></table>	Swing control lever: Swing right	Between (5) – chassis	15 – 30 V	Swing control lever: Neutral	Max. 1 V	1) Insert T-adapter. 2) Start engine. 3) PTO switch: Operation 1 or Operation 2			
Swing control lever: Swing right	Between (5) – chassis	15 – 30 V									
Swing control lever: Neutral		Max. 1 V									
Jib cable connection detection signal	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Jib (wiring harness) not connected</td><td rowspan="2">Between (12) – chassis</td><td>15 – 30 V</td></tr><tr><td>Jib (wiring harness) connected</td><td>Max. 1 V</td></tr></table>	Jib (wiring harness) not connected	Between (12) – chassis	15 – 30 V	Jib (wiring harness) connected	Max. 1 V	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2			
Jib (wiring harness) not connected	Between (12) – chassis	15 – 30 V									
Jib (wiring harness) connected		Max. 1 V									

023S02

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System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Moment limiter	Connection selector Z	C14	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (20) – chassis</td><td>15 – 30 V</td></tr></table>	Between (20) – chassis	15 – 30 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>			
		Between (20) – chassis		15 – 30 V							
		Travel mode		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>PTO switch: Travel</td><td rowspan="2">Between (8) – chassis</td><td>20 – 30 V</td></tr><tr><td>PTO switch: Operation 1or Operation 2</td><td>Max. 1 V</td></tr></table>	PTO switch: Travel	Between (8) – chassis	20 – 30 V	PTO switch: Operation 1or Operation 2	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>
		PTO switch: Travel		Between (8) – chassis	20 – 30 V						
		PTO switch: Operation 1or Operation 2			Max. 1 V						
		Working mode		Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>PTO switch: Operation 1or Operation 2</td><td rowspan="2">Between (18) – chassis</td><td>20 – 30 V</td></tr><tr><td>PTO switch: Travel</td><td>Max. 1 V</td></tr></table>	PTO switch: Operation 1or Operation 2	Between (18) – chassis	20 – 30 V	PTO switch: Travel	Max. 1 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>
		PTO switch: Operation 1or Operation 2		Between (18) – chassis	20 – 30 V						
		PTO switch: Travel			Max. 1 V						
Boom selector switch (top)	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Boom selector switch: Top ON (pressed)</td><td rowspan="2">Between (4) – chassis</td><td>Max. 1 V</td></tr><tr><td>Boom selector switch: Neutral:</td><td>15 – 30 V</td></tr></table>	Boom selector switch: Top ON (pressed)	Between (4) – chassis	Max. 1 V	Boom selector switch: Neutral:	15 – 30 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>			
Boom selector switch: Top ON (pressed)	Between (4) – chassis	Max. 1 V									
Boom selector switch: Neutral:		15 – 30 V									
Boom selector switch (2nd)	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Boom selector switch: 2nd ON (pressed)</td><td rowspan="2">Between (14) – chassis</td><td>Max. 1 V</td></tr><tr><td>Boom selector switch: Neutral:</td><td>15 – 30 V</td></tr></table>	Boom selector switch: 2nd ON (pressed)	Between (14) – chassis	Max. 1 V	Boom selector switch: Neutral:	15 – 30 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>			
Boom selector switch: 2nd ON (pressed)	Between (14) – chassis	Max. 1 V									
Boom selector switch: Neutral:		15 – 30 V									
Work equipment lever stand (hoist lever)	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Work equipment lever stand: Raised</td><td rowspan="2">Between (12) – chassis</td><td>Max. 1 V</td></tr><tr><td>Work equipment lever stand: Lowered</td><td>15 – 30 V</td></tr></table>	Work equipment lever stand: Raised	Between (12) – chassis	Max. 1 V	Work equipment lever stand: Lowered	15 – 30 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>			
Work equipment lever stand: Raised	Between (12) – chassis	Max. 1 V									
Work equipment lever stand: Lowered		15 – 30 V									
Swing front detection limit switch	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Upper structure: facing front</td><td rowspan="2">Between (11) – chassis</td><td>Max. 1 V</td></tr><tr><td>Upper structure: Not facing front</td><td>15 – 30 V</td></tr></table>	Upper structure: facing front	Between (11) – chassis	Max. 1 V	Upper structure: Not facing front	15 – 30 V	<div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div>			
Upper structure: facing front	Between (11) – chassis	Max. 1 V									
Upper structure: Not facing front		15 – 30 V									

023S02

⚠ Check carefully that there is no one in the surrounding area before starting inspection.

★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.

★ Operate the winch under no load.

★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions		
Controller	Moment limiter	Overwind detection limit switch	C14	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON.		
		<table><tr><td>Main (auxiliary) winch wound in fully (overwind limit switch ON)</td><td rowspan="2">Between (1) – chassis</td><td>15 – 30 V</td></tr><tr><td>Main (auxiliary) winch not wound in fully</td><td>Max. 1 V</td></tr></table>			Main (auxiliary) winch wound in fully (overwind limit switch ON)		Between (1) – chassis	15 – 30 V
		Main (auxiliary) winch wound in fully (overwind limit switch ON)		Between (1) – chassis	15 – 30 V			
		Main (auxiliary) winch not wound in fully			Max. 1 V			
		Boom limit switch (top boom limit switch)		Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON.		
	<table><tr><td>Top boom stowed</td><td rowspan="2">Between (2) – chassis</td><td>Max. 1 V</td></tr><tr><td>Top boom extended</td><td>15 – 30 V</td></tr></table>	Top boom stowed	Between (2) – chassis		Max. 1 V		Top boom extended	15 – 30 V
	Top boom stowed	Between (2) – chassis		Max. 1 V				
	Top boom extended		15 – 30 V					
	Left lock pin input signal (jib)	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Connect jib wiring harness.				
<table><tr><td>Locked</td><td rowspan="2">Between (5) – chassis</td><td>15 – 30 V</td></tr><tr><td>Not locked</td><td>Max. 1 V</td></tr></table>	Locked		Between (5) – chassis		15 – 30 V	Not locked	Max. 1 V	
Locked	Between (5) – chassis	15 – 30 V						
Not locked		Max. 1 V						
Moment limiter automatic stop cancel switch	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON. 3) PTO switch: Operation 1 or Operation 2 4) Work equipment lever stand: Raised					
<table><tr><td>Automatic stop cancel switch: Cancel</td><td rowspan="2">Between (15) – chassis</td><td>20 – 30 V</td></tr><tr><td>Automatic stop cancel switch: Automatic</td><td>Max. 1 V</td></tr></table>		Automatic stop cancel switch: Cancel		Between (15) – chassis	20 – 30 V	Automatic stop cancel switch: Automatic	Max. 1 V	
Automatic stop cancel switch: Cancel	Between (15) – chassis	20 – 30 V						
Automatic stop cancel switch: Automatic		Max. 1 V						
Sensor power source (10 V)	C16	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON.				
<table><tr><td>Between (1), (11) – (10)</td><td>9.5 - 10.5 V</td></tr></table>			Between (1), (11) – (10)		9.5 - 10.5 V			
Between (1), (11) – (10)		9.5 - 10.5 V						
Sensor power source (15 V)	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) Turn starting switch ON.					
<table><tr><td>Between (8), (18) – (20)</td><td>13 – 17 V</td></tr></table>		Between (8), (18) – (20)		13 – 17 V				
Between (8), (18) – (20)	13 – 17 V							
Head pressure sensor (boom hoist cylinder head pressure)	Measure voltage	If the condition is as shown in the table below, it is normal	1) Insert T-adapter. 2) PTO switch: Operation 1 or Operation 2 3) Start engine. 4) Jib lowered, boom fully retracted, winch fully wound in, outriggers extended 5) Automatic stop prohibition cancel switch: Cancel					
<table><tr><td>Between (2) – (20)</td><td>0.7 – 5.3 V</td></tr></table> Reference: When released to atmosphere: 0.7 – 1.3 V		Between (2) – (20)		0.7 – 5.3 V				
Between (2) – (20)	0.7 – 5.3 V							

023S02

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- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions					
Controller	Moment limiter		C16	Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (12) – (20)</td><td>0.7 – 5.3 V</td></tr></table> <p>Reference: When released to atmosphere: 0.7 – 1.3 V</p>	Between (12) – (20)	0.7 – 5.3 V	<p>1) Insert T-adapter. 2) PTO switch: Operation 1 or Operation 2 3) Start engine. 4) Jib lowered, boom fully retracted, winch fully wound in, outriggers extended 5) Automatic stop prohibition cancel switch: Cancel</p>			
	Between (12) – (20)	0.7 – 5.3 V									
	Boom angle sensor			Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Boom angle: 0°</td><td rowspan="2">Between (4) – (10)</td><td>Approx. 8.5 V</td></tr><tr><td>Boom angle: 83°</td><td>Approx. 1.6 V</td></tr></table> <p>★ Present monitor code matches monitoring code in memory when boom is set to posture stored in MIN, MAX adjustment mode of monitoring code mode (within ±7 of value in memory).</p>	Boom angle: 0°	Between (4) – (10)	Approx. 8.5 V	Boom angle: 83°	Approx. 1.6 V	<p>1) Insert T-adapter. 2) PTO mode: Operation 1 or Operation 2 3) Start engine. 4) Jib lowered, winch fully wound in, outriggers extended 5) Use range where automatic stop is not carried out.</p>
	Boom angle: 0°	Between (4) – (10)		Approx. 8.5 V							
	Boom angle: 83°			Approx. 1.6 V							
Boom length sensor		Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Boom fully extended</td><td rowspan="2">Between (4) – (10)</td><td>Approx. 2 V</td></tr><tr><td>Boom fully retracted</td><td>Approx. 7.6 V</td></tr></table> <p>★ Present monitoring code matches MIN, MAX monitor codes stored in monitor code mode (within ±10 of value in memory).</p>	Boom fully extended	Between (4) – (10)	Approx. 2 V	Boom fully retracted	Approx. 7.6 V	<p>1) Insert T-adapter. 2) PTO mode: Operation 1 or Operation 2 3) Start engine. 4) Jib lowered, boom fully retracted, winch fully wound in, outriggers extended 5) Use range where automatic stop is not carried out.</p>		
Boom fully extended	Between (4) – (10)	Approx. 2 V									
Boom fully retracted		Approx. 7.6 V									
Swing angle 1		Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (3) – (10)</td><td>0 – 10.5 V</td></tr></table> <p>★ For details, see Remarks on page 20-52.</p>	Between (3) – (10)	0 – 10.5 V	<p>1) Insert T-adapter. 2) Turn starting switch ON.</p>					
Between (3) – (10)	0 – 10.5 V										
Swing angle 2		Measure voltage	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (13) – (10)</td><td>0 – 10.5 V</td></tr></table> <p>★ For details, see Remarks on page 20-52.</p>	Between (13) – (10)	0 – 10.5 V	<p>1) Insert T-adapter. 2) Turn starting switch ON.</p>					
Between (13) – (10)	0 – 10.5 V										

023S02



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- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions							
Lower MDT related	PTO solenoid	L90 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	20 – 60 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>			
	Between (1) – (2)	20 – 60 Ω										
Between (1), (2) – chassis	Min. 1 MΩ											
	Parking brake solenoid	L73 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	20 – 60 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>			
Between (1) – (2)	20 – 60 Ω											
Between (1), (2) – chassis	Min. 1 MΩ											
Controller	Accelerator potentiometer	E02	Measure voltage, resistance	<div>If the condition is as shown in the table below, it is normal</div> <div>Measure voltage</div> <table><tr><td rowspan="2">Between (1) – (2)</td><td>(Accelerator (MAX))</td><td>0.5 – 2.0 V</td></tr><tr><td>(Accelerator MIN)</td><td>4.3 ± 0.3 V</td></tr></table> <div>Measure resistance</div> <table><tr><td>Between (male) (2) – (3)</td><td>4,000 – 6,000 Ω</td></tr></table>	Between (1) – (2)	(Accelerator (MAX))	0.5 – 2.0 V	(Accelerator MIN)	4.3 ± 0.3 V	Between (male) (2) – (3)	4,000 – 6,000 Ω	<div>When measuring voltage</div> <div>1) Insert T-adapter.</div> <div>2) Turn starting switch ON.</div> <div>When measuring resistance</div> <div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>
	Between (1) – (2)	(Accelerator (MAX))	0.5 – 2.0 V									
		(Accelerator MIN)	4.3 ± 0.3 V									
	Between (male) (2) – (3)	4,000 – 6,000 Ω										
	Auxiliary (service) brake solenoid	L71 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	20 – 60 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>			
	Between (1) – (2)	20 – 60 Ω										
	Between (1), (2) – chassis	Min. 1 MΩ										
Exhaust brake solenoid	L57 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	20 – 60 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>				
Between (1) – (2)	20 – 60 Ω											
Between (1), (2) – chassis	Min. 1 MΩ											
Swing pump merge solenoid	L08 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>				
Between (1) – (2)	10 – 20 Ω											
Between (1), (2) – chassis	Min. 1 MΩ											
Rear steering LOCK solenoid	L12 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>				
Between (1) – (2)	10 – 20 Ω											
Between (1), (2) – chassis	Min. 1 MΩ											
Rear steering FREE solenoid	L13 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>				
Between (1) – (2)	10 – 20 Ω											
Between (1), (2) – chassis	Min. 1 MΩ											

023S02

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- ★ Turn the starting switch OFF before inserting the T-adaptor or making any connections.

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions				
Lower MDT related	4-wheel steering solenoid (c)	L19 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 20 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	Crab steering solenoid (b)	L20 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 20 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	Rear wheel steering solenoid (a)	L23 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 20 Ω							
Between (1), (2) – chassis	Min. 1 MΩ								
Reverse steering solenoid (d)	L25 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 20 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Suspension lock front solenoid	L27 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	20 – 60 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	20 – 60 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Suspension lock rear solenoid	L29 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	20 – 60 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	20 – 60 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
32. Suspension lift solenoid	L31 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 30 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Outrigger jack solenoid RR (X-shaped) RL (H-shaped)	L34 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 30 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								

023S02

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- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions					
Lower MDT related	Outrigger jack solenoid RL (X-shape) RR (H-shape)	L37 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
	Between (1) – (2)	10 – 30 Ω								
	Between (1), (2) – chassis	Min. 1 MΩ								
	Outrigger jack solenoid FL (X-shape) FR (H-shape)	L40 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
	Between (1) – (2)	10 – 30 Ω								
	Between (1), (2) – chassis	Min. 1 MΩ								
	Outrigger jack solenoid FR (X-shape) FL (H-shape)	L43 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 30 Ω									
Between (1), (2) – chassis	Min. 1 MΩ									
Outrigger length sensor RL	L33 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (3)</td><td>1,900 – 2,100Ω</td></tr><tr><td>Between (2) – (3) (MIN)</td><td>100 – 300Ω</td></tr><tr><td>Between (2) – (3) (MAX)</td><td>1,400 – 1,700Ω</td></tr></table>	Between (1) – (3)	1,900 – 2,100Ω	Between (2) – (3) (MIN)	100 – 300Ω	Between (2) – (3) (MAX)	1,400 – 1,700Ω	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
Between (1) – (3)	1,900 – 2,100Ω									
Between (2) – (3) (MIN)	100 – 300Ω									
Between (2) – (3) (MAX)	1,400 – 1,700Ω									
Outrigger length sensor RR	L36 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (3)</td><td>1,900 – 2,100Ω</td></tr><tr><td>Between (2) – (3) (MIN)</td><td>100 – 300Ω</td></tr><tr><td>Between (2) – (3) (MAX)</td><td>1,400 – 1,700Ω</td></tr></table>	Between (1) – (3)	1,900 – 2,100Ω	Between (2) – (3) (MIN)	100 – 300Ω	Between (2) – (3) (MAX)	1,400 – 1,700Ω	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
Between (1) – (3)	1,900 – 2,100Ω									
Between (2) – (3) (MIN)	100 – 300Ω									
Between (2) – (3) (MAX)	1,400 – 1,700Ω									
Outrigger length sensor FR	L39 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (3)</td><td>1,900 – 2,100Ω</td></tr><tr><td>Between (2) – (3) (MIN)</td><td>100 – 300Ω</td></tr><tr><td>Between (2) – (3) (MAX)</td><td>1,400 – 1,700Ω</td></tr></table>	Between (1) – (3)	1,900 – 2,100Ω	Between (2) – (3) (MIN)	100 – 300Ω	Between (2) – (3) (MAX)	1,400 – 1,700Ω	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
Between (1) – (3)	1,900 – 2,100Ω									
Between (2) – (3) (MIN)	100 – 300Ω									
Between (2) – (3) (MAX)	1,400 – 1,700Ω									
Outrigger length sensor FL	L42 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (3)</td><td>1,900 – 2,100Ω</td></tr><tr><td>Between (2) – (3) (MIN)</td><td>100 – 300Ω</td></tr><tr><td>Between (2) – (3) (MAX)</td><td>1,400 – 1,700Ω</td></tr></table>	Between (1) – (3)	1,900 – 2,100Ω	Between (2) – (3) (MIN)	100 – 300Ω	Between (2) – (3) (MAX)	1,400 – 1,700Ω	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
Between (1) – (3)	1,900 – 2,100Ω									
Between (2) – (3) (MIN)	100 – 300Ω									
Between (2) – (3) (MAX)	1,400 – 1,700Ω									

023S02



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System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions				
Lower MDT related	Outrigger slide solenoid FR	L151 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 30 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	Outrigger slide solenoid FL	L152 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 30 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	Outrigger slide solenoid RR	L153 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 30 Ω							
Between (1), (2) – chassis	Min. 1 MΩ								
Outrigger slide solenoid RL	L154 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 30 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Outrigger EXTEND/STOW (telescope) select solenoid (EXTEND)	L16 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>30 – 80 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	30 – 80 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	30 – 80 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Outrigger EXTEND/STOW (telescope) select solenoid (RETRACT)	L140 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>30 – 80 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	30 – 80 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	30 – 80 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Sub engine control solenoid	L59 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>50 – 90 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	50 – 90 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	50 – 90 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Auto grease solenoid	L83 (male) L84 (female)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>L83 (male) – L84 (female)</td><td>10 – 40 Ω</td></tr><tr><td>Between L83 (male), L84 (female) – chassis</td><td>Min. 1 MΩ</td></tr></table>	L83 (male) – L84 (female)	10 – 40 Ω	Between L83 (male), L84 (female) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
L83 (male) – L84 (female)	10 – 40 Ω								
Between L83 (male), L84 (female) – chassis	Min. 1 MΩ								

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★ Operate the winch under no load.

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System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions				
Automatic gear shift control related	Torque converter lockup solenoid (ECMV)	L92 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 20 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	F1 solenoid (ECMV)	L93 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 20 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	F3 solenoid (ECMV)	L94 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 20 Ω							
Between (1), (2) – chassis	Min. 1 MΩ								
F2 solenoid (ECMV)	L95 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 20 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
R solenoid (ECMV)	L97 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 20 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 20 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 20 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Hi-Lo solenoid	L99 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>30 – 80 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	30 – 80 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	30 – 80 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
4WD solenoid	L101 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>30 – 80 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	30 – 80 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	30 – 80 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Speed sensor	L104 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>500 – 1,000Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	500 – 1,000Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
		Between (1) – (2)	500 – 1,000Ω						
Between (1), (2) – chassis	Min. 1 MΩ								
Adjust	1) Screw in speed sensor until it contacts ring gear, then turn back 1/2 - 1 turn and tighten locknut. 2) Works properly after above adjustment.								

023S02

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Sys-tem	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions				
Moment limiter related	Main unload solenoid	R54 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 40 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 40 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 40 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	Power tilt (jib LOWER PPC) unload solenoid	R52 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>30 – 80 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	30 – 80 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	30 – 80 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
	Boom telescope selector valve solenoid	R48 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 40 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 40 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Between (1) – (2)	10 – 40 Ω							
	Between (1), (2) – chassis	Min. 1 MΩ							
Pedal, lever selector solenoid (RETRACT, RAISE)	R49 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 30 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Pedal, lever selector solenoid (EXTEND, LOWER)	R50 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	10 – 30 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Main winch free-fall interlock solenoid	C120 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>50 – 90 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	50 – 90 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	50 – 90 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Auxiliary winch free-fall interlock solenoid	C121 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>50 – 90 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	50 – 90 Ω	Between (1), (2) – chassis	Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.	
Between (1) – (2)	50 – 90 Ω								
Between (1), (2) – chassis	Min. 1 MΩ								
Boom hoist cylinder head pressure sensor	R36	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>0.7 – 5.3 V</td></tr></table> <div>Reference: When released to atmosphere: 0.7 - 1.3 V</div>	Between (1) – (2)	0.7 – 5.3 V	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.			
Between (1) – (2)	0.7 – 5.3 V								
Boom hoist cylinder bottom pressure sensor	R37	Measure voltage	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>0.7 – 5.3 V</td></tr></table> <div>Reference: When released to atmosphere: 0.7 – 1.3 V</div>	Between (1) – (2)	0.7 – 5.3 V	1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.			
Between (1) – (2)	0.7 – 5.3 V								

023S02



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System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions								
Moment limiter related	Boom angle sensor	R65	Measure voltage, measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <p>Measure voltage</p> <table><tr><td>Between (2) – (3)</td><td>(Boom raised to MAX height)</td><td>1.0 – 2.0 V</td></tr><tr><td></td><td>(Boom raised to MIN height)</td><td>8.0 – 9.0 V</td></tr></table> <p>Measure resistance</p> <table><tr><td>Between (male) (1) – (3)</td><td>400 – 600 Ω</td></tr></table>	Between (2) – (3)	(Boom raised to MAX height)	1.0 – 2.0 V		(Boom raised to MIN height)	8.0 – 9.0 V	Between (male) (1) – (3)	400 – 600 Ω	<p>When measuring voltage</p> <p>1) Insert T-adapter.</p> <p>2) Turn starting switch ON.</p> <p>When measuring resistance</p> <p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>
	Between (2) – (3)	(Boom raised to MAX height)	1.0 – 2.0 V										
		(Boom raised to MIN height)	8.0 – 9.0 V										
	Between (male) (1) – (3)	400 – 600 Ω											
	Boom length sensor	B14 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (3)</td><td>4,750 – 5,250Ω</td></tr><tr><td>Between (2) – (3) (Boom fully extended)</td><td>3,600 – 4,000Ω</td></tr><tr><td>Between (2) – (3) (Boom fully retracted)</td><td>950 – 1,050Ω</td></tr></table>	Between (1) – (3)	4,750 – 5,250Ω	Between (2) – (3) (Boom fully extended)	3,600 – 4,000Ω	Between (2) – (3) (Boom fully retracted)	950 – 1,050Ω	<p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>		
	Between (1) – (3)	4,750 – 5,250Ω											
	Between (2) – (3) (Boom fully extended)	3,600 – 4,000Ω											
	Between (2) – (3) (Boom fully retracted)	950 – 1,050Ω											
Jib selector solenoid	J12 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>					
Between (1) – (2)	10 – 30 Ω												
Between (1), (2) – chassis	Min. 1 MΩ												
Rotating cylinder solenoid (jib)	J08 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>					
Between (1) – (2)	10 – 30 Ω												
Between (1), (2) – chassis	Min. 1 MΩ												
Rotating cylinder solenoid (jib)	J09 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>					
Between (1) – (2)	10 – 30 Ω												
Between (1), (2) – chassis	Min. 1 MΩ												
Lock cylinder (left) solenoid (jib)	J06 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>					
Between (1) – (2)	10 – 30 Ω												
Between (1), (2) – chassis	Min. 1 MΩ												
Lock cylinder (left) solenoid (jib)	J07 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>					
Between (1) – (2)	10 – 30 Ω												
Between (1), (2) – chassis	Min. 1 MΩ												
Lock cylinder (right) solenoid (jib)	J10 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<p>1) Turn starting switch OFF.</p> <p>2) Disconnect connector.</p> <p>3) Connect T-adapter.</p>					
Between (1) – (2)	10 – 30 Ω												
Between (1), (2) – chassis	Min. 1 MΩ												

023S02

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- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions						
Moment limiter related	Lock cylinder (right) solenoid (jib)	J11 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>10 – 30 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	10 – 30 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>		
	Between (1) – (2)	10 – 30 Ω									
	Between (1), (2) – chassis	Min. 1 MΩ									
	Jib tilt angle sensor	J03 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (3)</td><td>4 – 6 kΩ</td></tr><tr><td>Between (2) – (3) (tilt angle 5°)</td><td>2.5 – 4.5 kΩ</td></tr><tr><td>Between (2) – (3) (tilt angle 60°)</td><td>1.5 – 2.6 kΩ</td></tr></table>	Between (1) – (3)	4 – 6 kΩ	Between (2) – (3) (tilt angle 5°)	2.5 – 4.5 kΩ	Between (2) – (3) (tilt angle 60°)	1.5 – 2.6 kΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>
	Between (1) – (3)	4 – 6 kΩ									
Between (2) – (3) (tilt angle 5°)	2.5 – 4.5 kΩ										
Between (2) – (3) (tilt angle 60°)	1.5 – 2.6 kΩ										
Swing brake solenoid	R38 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>30 – 80 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	30 – 80 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>			
Between (1) – (2)	30 – 80 Ω										
Between (1), (2) – chassis	Min. 1 MΩ										
Swing FREE/LOCK solenoid	R42 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1), (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	20 – 60 Ω	Between (1), (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>			
Between (1) – (2)	20 – 60 Ω										
Between (1), (2) – chassis	Min. 1 MΩ										
Swing angle sensor	J03 (male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (3)</td><td>8 – 12 Ω</td></tr><tr><td>Between (2) – (3)</td><td>3.5 – 5.5 Ω</td></tr><tr><td>Between (4) – (3)</td><td>3.5 – 5.5 Ω</td></tr></table>	Between (1) – (3)	8 – 12 Ω	Between (2) – (3)	3.5 – 5.5 Ω	Between (4) – (3)	3.5 – 5.5 Ω	<div>1) Upper structure facing front</div> <div>2) Turn starting switch OFF.</div> <div>3) Disconnect connector.</div> <div>4) Connect T-adapter.</div>	
Between (1) – (3)	8 – 12 Ω										
Between (2) – (3)	3.5 – 5.5 Ω										
Between (4) – (3)	3.5 – 5.5 Ω										

- | System | Name of component | Connector No. | Inspection method | Judgement table | Measurement conditions | | | | | | |
|--------------------------------------|--|---|--|---|---------------------------|----------------------------------|-------------------------|---|---|-----------------------|--|
| Monitor related
Lower MDT related | Fuel level sensor | L85 (female)
L86 (female) | Measure resistance | <p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>
BLL00404 </td> <td>Push float up to stopper</td> <td>Max.
approx.
12 Ω</td> </tr> <tr> <td>
BLL00405 </td> <td>Push float down to stopper</td> <td>Approx.
85 – 110 Ω</td> </tr> </table> |
BLL00404 | Push float up to stopper | Max.
approx.
12 Ω |
BLL00405 | Push float down to stopper | Approx.
85 – 110 Ω | <ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect connector 3) Drain fuel and remove sensor. 4) Connect T-adapter to sensor connector. <p>※ Connect the T-adapter to the connector and the sensor flange</p> |
| |
BLL00404 | Push float up to stopper | Max.
approx.
12 Ω | | | | | | | | |
| |
BLL00405 | Push float down to stopper | Approx.
85 – 110 Ω | | | | | | | | |
| | Engine water temperature
Torque converter oil temperature sensor
Hydraulic oil temperature sensor | E04(male)
L105 (male)
L108 (male) | Measure resistance | <p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>Normal temperature (25°C)</td> <td>Approx. 37 – 50 kΩ</td> </tr> <tr> <td>100°C</td> <td>Approx. 3.5 – 4.0 kΩ</td> </tr> </table> | Normal temperature (25°C) | Approx. 37 – 50 kΩ | 100°C | Approx. 3.5 – 4.0 kΩ | <ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter to sensor connector. | | |
| | Normal temperature (25°C) | Approx. 37 – 50 kΩ | | | | | | | | | |
| | 100°C | Approx. 3.5 – 4.0 kΩ | | | | | | | | | |
| Engine speed sensor | E01 | Measure voltage | <p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>Between E01 (male) (1) – (2)</td> <td>100 - 500 Ω</td> </tr> <tr> <td>Between E01 (male) (2) – chassis</td> <td>Min. 1 MΩ</td> </tr> </table> | Between E01 (male) (1) – (2) | 100 - 500 Ω | Between E01 (male) (2) – chassis | Min. 1 MΩ | <ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter. | | | |
| | | Between E01 (male) (1) – (2) | 100 - 500 Ω | | | | | | | | |
| Between E01 (male) (2) – chassis | Min. 1 MΩ | | | | | | | | | | |
| Measure voltage | <p>Measure with AC range</p> <table border="1"> <tr> <td>Between (1) – (2)</td> <td>Min. 0.5 V</td> </tr> </table> | Between (1) – (2) | Min. 0.5 V | <ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Insert T-adapter. 3) Start engine. | | | | | | | |
| Between (1) – (2) | Min. 0.5 V | | | | | | | | | | |

- ⚠ Check carefully that there is no one in the surrounding area before starting inspection.
- ★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.
- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

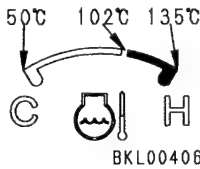
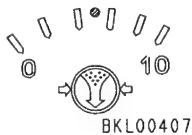
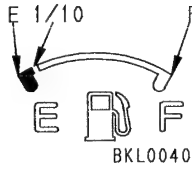
System	Name of component		Connector No.	Inspection method	Judgement table	Measurement conditions										
Monitor related	Lower MDT related	Speed sensor	L103(male)	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Between (1) – (2)</td><td>500 – 1,000Ω</td></tr><tr><td>Between (2) – chassis</td><td>Min. 1 MΩ</td></tr></table>	Between (1) – (2)	500 – 1,000Ω	Between (2) – chassis	Min. 1 MΩ	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter.</div>						
				Between (1) – (2)	500 – 1,000Ω											
				Between (2) – chassis	Min. 1 MΩ											
	Measure voltage	<div>Measure with AC range</div> <table><tr><td>Between (1) – (2)</td><td>Min. 2.0 V</td></tr></table>	Between (1) – (2)	Min. 2.0 V	<div>1) Start engine.</div> <div>2) Insert T-adapter.</div> <div>3) Wheels rotating under no load with machine jacked up, or with machine traveling</div>											
Between (1) – (2)	Min. 2.0 V															
Adjust	<div>1) Screw in speed sensor until it contacts ring gear, then turn back 1/2 – 1 turn.</div> <div>2) Works properly after above adjustment.</div>															
		Air pressure sensor	C114	Measure resistance	<div>If the condition is as shown in the table below, it is normal</div> <table><tr><td>Air pressure MPa {kg/cm²}</td><td>Between (1) – (2)</td></tr><tr><td>0 {0}</td><td>Approx. 80 Ω</td></tr><tr><td>0.2 {2}</td><td>Approx. 54 Ω</td></tr><tr><td>0.5 {5}</td><td>Approx. 32 Ω</td></tr><tr><td>1.0 {10}</td><td>Approx. 10 Ω</td></tr></table>	Air pressure MPa {kg/cm ² }	Between (1) – (2)	0 {0}	Approx. 80 Ω	0.2 {2}	Approx. 54 Ω	0.5 {5}	Approx. 32 Ω	1.0 {10}	Approx. 10 Ω	<div>1) Turn starting switch OFF.</div> <div>2) Disconnect connector.</div> <div>3) Connect T-adapter to sensor connector.</div> <div>4) Start engine.</div>
Air pressure MPa {kg/cm ² }	Between (1) – (2)															
0 {0}	Approx. 80 Ω															
0.2 {2}	Approx. 54 Ω															
0.5 {5}	Approx. 32 Ω															
1.0 {10}	Approx. 10 Ω															

- ⚠ Check carefully that there is no one in the surrounding area before starting inspection.
- ★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.
- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adaptor or making any connections.

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions	
Machine monitor	Check, caution portion	If the condition is as shown in Table 1, it is normal			1) Connect T-adapter.	
		Table 1 (Check, caution portion)				
		Monitor item (input connector)	Measurement item	Display		Sensor signal input
		Engine oil pressure (between C80 (9) – chassis)	Start engine	ON		Max. 1 V
				OFF		20 – 30 V
		Charge level (between C80 (6) – (8))	Start engine	ON		20 – 30 V
				OFF		Max. 1 V
		Drop in air pressure (between C80 (11) – C79 (4))	Start engine	ON		20 – 30 V
				OFF		Max. 1 V
		Preheating (between C80 (4) – chassis)	Stop engine Turn starting switch ON.	ON		Max. 1 V
				OFF		20 – 30 V
		Brake fluid level (between C79 (9) – (11))	Stop engine. Turn starting switch ON.	ON		20 – 30 V
				OFF		Max. 1 V
		Torque converter oil temperature (between C80 (10) – chassis)	Stop engine. Turn starting switch ON.	ON		Max. 1 V
				OFF		20 – 30 V
		Parking brake (between C79 (13) – chassis)	Stop engine. Turn starting switch ON.	ON		Max. 1 V
				OFF		20 – 30 V
		Auxiliary (service) brake (between C79 (12) – (4))	Stop engine. Turn starting switch ON.	ON		20 – 30 V
				OFF		Max. 1 V
		Exhaust brake (between C80 (12) – C79 (4))	Stop engine. Turn starting switch ON.	ON		20 – 30 V
				OFF		Max. 1 V
		(Magnetic) Retarder (opt) (between C79 (8) – (7))	Stop engine. Turn starting switch ON.	ON		Max. 1 V
				OFF		17 – 30 V

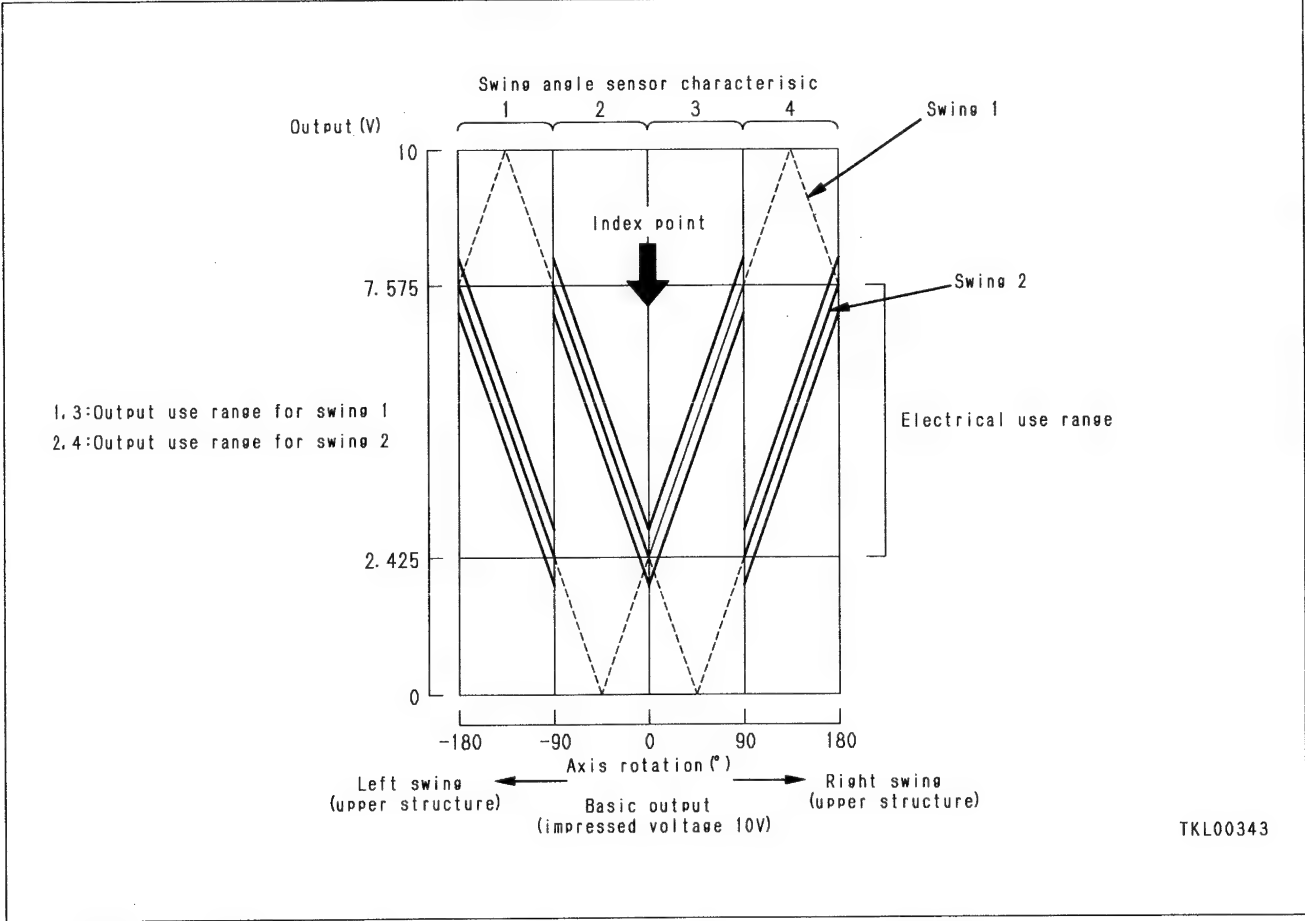
023S02

- ⚠ Check carefully that there is no one in the surrounding area before starting inspection.
- ★ When carrying out operations during inspection, raise the work equipment control lever stand for operations, and lower it when traveling.
- ★ Operate the winch under no load.
- ★ Turn the starting switch OFF before inserting the T-adapter or making any connections.

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions										
Machine monitor related Monitor panel display portion	Engine water temperature gauge	E04 (male)	Measure resistance	<table><tr><th>Coolant temperature</th><th>Sensor resistance value</th></tr><tr><td>50°C</td><td>Approx. 17 kΩ</td></tr><tr><td>90°C</td><td>Approx. 5 kΩ</td></tr><tr><td>102°C</td><td>Approx. 3.7 kΩ</td></tr><tr><td>135°C</td><td>Approx. 1.5 kΩ</td></tr></table> 	Coolant temperature	Sensor resistance value	50°C	Approx. 17 kΩ	90°C	Approx. 5 kΩ	102°C	Approx. 3.7 kΩ	135°C	Approx. 1.5 kΩ	1) Turn starting switch OFF and insert dummy resistance or measure resistance of sensor. 2) Turn starting switch ON and check display. 3) Disconnect connector.
	Coolant temperature	Sensor resistance value													
	50°C	Approx. 17 kΩ													
90°C	Approx. 5 kΩ														
102°C	Approx. 3.7 kΩ														
135°C	Approx. 1.5 kΩ														
Air pressure gauge	C114 (male)	Measure resistance	<table><tr><th>Air pressure MPa {kg/cm²}</th><th>Sensor resistance value</th></tr><tr><td>0 { 0 }</td><td>Approx. 80 kΩ</td></tr><tr><td>0.49 { 5 }</td><td>Approx. 32 kΩ</td></tr><tr><td>0.98 {10}</td><td>Approx. 10 kΩ</td></tr></table> 	Air pressure MPa {kg/cm²}	Sensor resistance value	0 { 0 }	Approx. 80 kΩ	0.49 { 5 }	Approx. 32 kΩ	0.98 {10}	Approx. 10 kΩ	1) Turn starting switch OFF and insert dummy resistance or measure resistance of sensor. 2) Turn starting switch ON and check display. 2) Disconnect connector.			
Air pressure MPa {kg/cm²}	Sensor resistance value														
0 { 0 }	Approx. 80 kΩ														
0.49 { 5 }	Approx. 32 kΩ														
0.98 {10}	Approx. 10 kΩ														
Fuel gauge	L85 (male) L86 (male)		<table><tr><th>Fuel level</th><th>Sensor resistance value</th></tr><tr><td>E</td><td>Approx. 82 kΩ</td></tr><tr><td>1/2</td><td>Approx. 70 kΩ</td></tr><tr><td>F</td><td>Approx. 12 kΩ</td></tr></table> 	Fuel level	Sensor resistance value	E	Approx. 82 kΩ	1/2	Approx. 70 kΩ	F	Approx. 12 kΩ	1) Turn starting switch OFF and insert dummy resistance or measure resistance of sensor. 2) Turn starting switch ON and check display. 3) Disconnect connector.			
Fuel level	Sensor resistance value														
E	Approx. 82 kΩ														
1/2	Approx. 70 kΩ														
F	Approx. 12 kΩ														

023S02

Remarks



023S02

TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING FOR ENGINE

Check or measure- ment item	Symbol		Part No.	Part Name	Remarks
Engine speed	A		799-203-8001	Multi-tachometer	Kit Part No. : 799-203-9000
			799-203-8901	Clamp set	Digital display L : 60 – 2,000 rpm H : 60 – 19,999 prm
Coolant, oil and exhaust gas temperatures	B		799-101-1502	Digital temperature gauge	–99.9 – 1,299°C
Oil pressure	C	1	799-101-5002	Hydraulic tester	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
			790-261-1203	Digital hydraulic tester	Pressure gauge: 68.6 MPa {700 kg/cm ² }
		2	793-520-1804	Brake test kit	Pressure gauge: 19.6 MPa{200 kg/cm ² }
		3	799-401-2320	Gauge	Pressure gauge: 1.0 MPa{10 kg/cm ² }
		4	790-261-1311	Adapter	Male, female: Both 14 x 1.5 (female PT 1/8)
		5	790-261-1321	Adapter	Male, female: Both 18 x 1.5 (female PT 1/8)
		6	790-261-1331	Adapter	Male, female: Both 22 x 1.5 (female PT 1/8)
		7	790-301-1210	Joint	Male: 14 x 1.5 (female PT 1/8)
Compression pressure	D	1	795-502-1590	Compression gauge	0 – 6.9 MPa{0 – 70 kg/cm ² } (Kit Part No.: 795-502-1205)
		2	795-502-1360	Adapter	
Blowby pressure	E	1	799-201-1511	Nozzle	0 – 4.9 kPa{0 – 500 mmH ₂ O} (Kit Part No.: 799-201-1504)
		2	799-201-1450	Adapter	
		3	799-201-1571	Tube	
		4	799-201-1541	Gauge	
Valve clearance	F		795-125-1360	Feeler gauge	
Exhaust color	G	1	799-201-9000	Handy Smoke Checker	Discoloration 0 – 70 % (with standard color) (Discoloration x 1/10 = Bosch index)
		2	Commercially available	Smoke meter	
Adjusting fuel injection timing	H		795-471-1200	Gauge assembly	Dial gauge is commercially available product
Operating force	I		79A-264-0020	Push-pull scale	0 – 294.2 N{0 – 30 kg}
			79A-264-0090		0 – 490.3 N{0 – 50 kg}
Travel, hydraulic drift	J		Commercially available	Scale	
Work equipment speed	K		Commercially available	Stop watch	
Measuring voltage and resistance	L		79A-264-0211	Tester	
Boom hoist angle	M		799-402-3800	Angle gauge assembly, angle gauge	
			• 799-402-3830		
Troubleshooting wiring harnesses and sensors	N	1	799-601-7100	T-adapter assembly	
		2	799-601-2720	Adapter	For MIC 13-pin
			799-601-7190		For 040-12-pin
			799-601-7310		For SWP 12-pin
			799-601-7070		For SWP 14-pin
			799-601-7320		For SWP 16-pin
			799-601-7340		For M8-pin
			799-601-7350		For S 12-pin (white)
			799-601-7330		For S 16-pin (white)

023S02

ADJUSTING VALVE CLEARANCE

! Extend the outriggers and set securely so that the machine cannot move, then swing the revolving frame 90°.

1. Disconnect fuel injection pipe (1) and spill pipe (2), then remove cylinder head cover (3).

★ When removing No. 1 cylinder head cover, remove cover (4) and exhaust muffler (5).

★ When removing No. 4 cylinder head cover, disconnect clamps (6) and remove the air intake connector (7).

2. Rotate the crankshaft in the normal direction to align the "1.6" TOP line on damper (8) with pointer (9) when No. 1 cylinder is at compression top dead center. When rotating, check the movement of the valves.

3. When No. 1 cylinder is at compression top dead center, adjust the valves marked ●. Next, rotate the crankshaft one turn in the normal direction and adjust the valve clearance of the valves marked ○.

★ Valve arrangement

Cylinder No.	1	2	3	4	5	6
Exhaust valve	●	●	○	●	○	○
Intake valve	○	○	●	○	●	○

4. To adjust the valve clearance, loosen locknut (13) of adjustment screw (12), then insert feeler gauge **F** between rocker arm (10) and crosshead (11), and turn adjustment screw (12) until the clearance is a sliding fit.

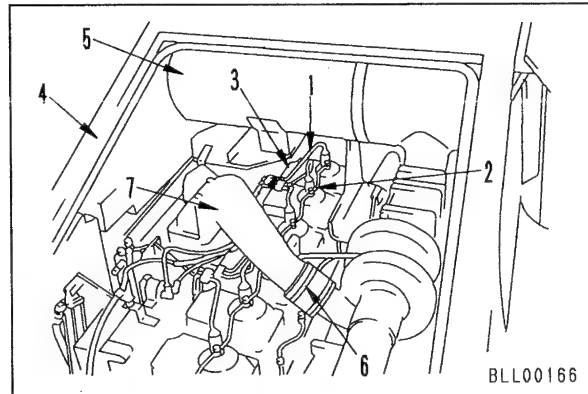
5. Tighten locknut (13) to hold adjustment screw (12) in position.

kgm Locknut : $68.6 \pm 4.9 \text{ Nm}$ { $7 \pm 0.5 \text{ kgm}$ }

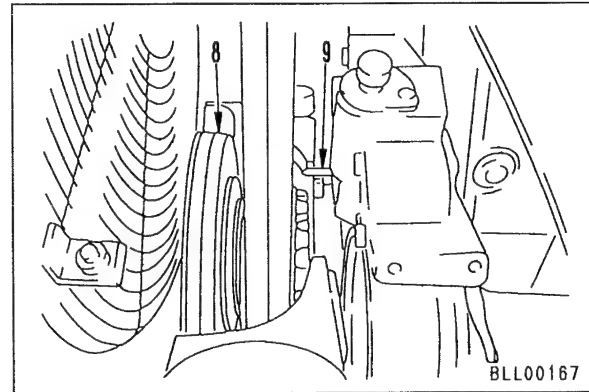
- ★ After adjusting No. 1 cylinder at compression top dead center, it is also possible to turn the crankshaft 120° each time and adjust the valve clearance of each cylinder according to the firing order.

• Firing order : 1-5-3-6-2-4

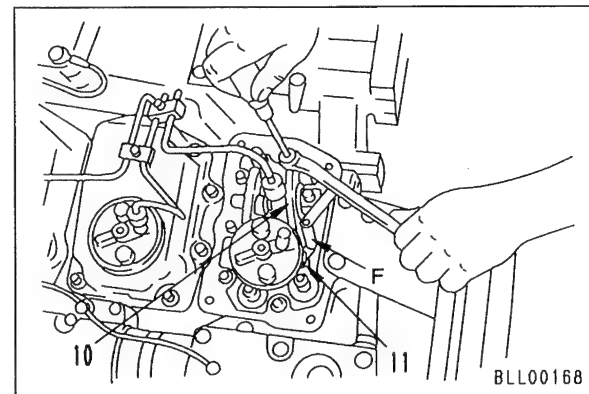
- ★ After tightening the locknut, check the valve clearance again.



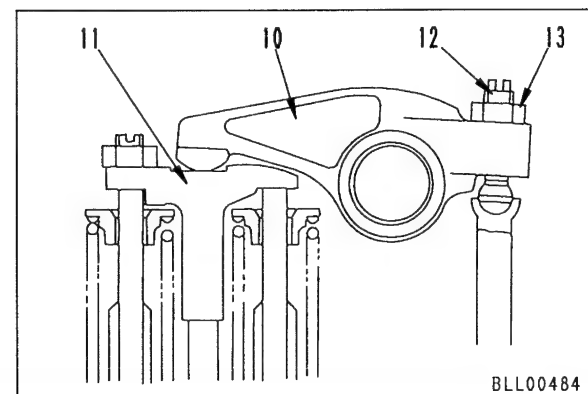
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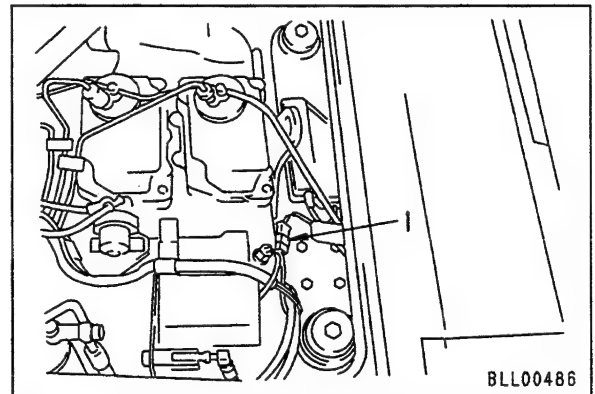
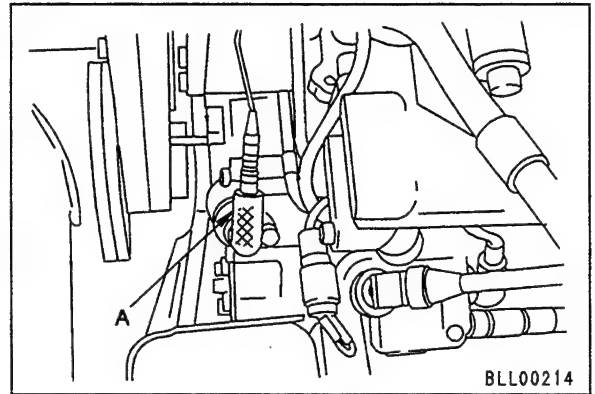
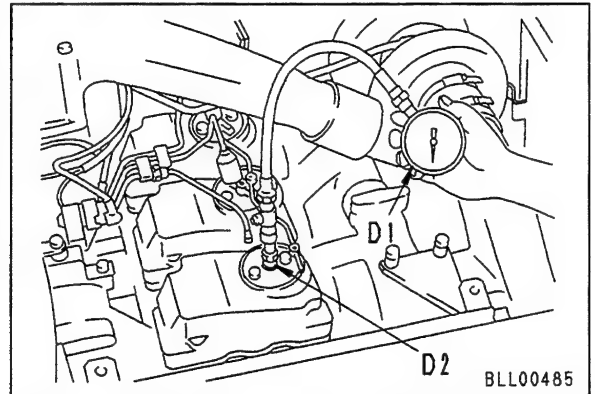


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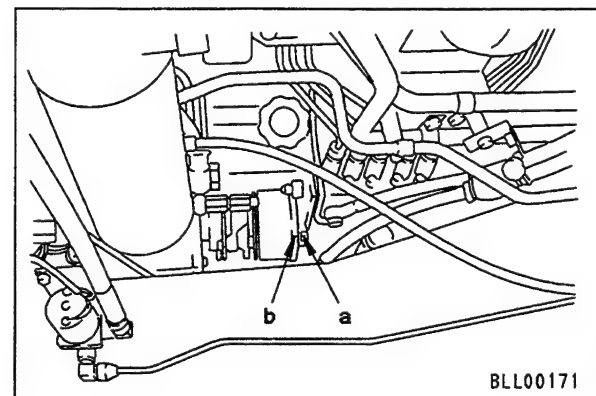
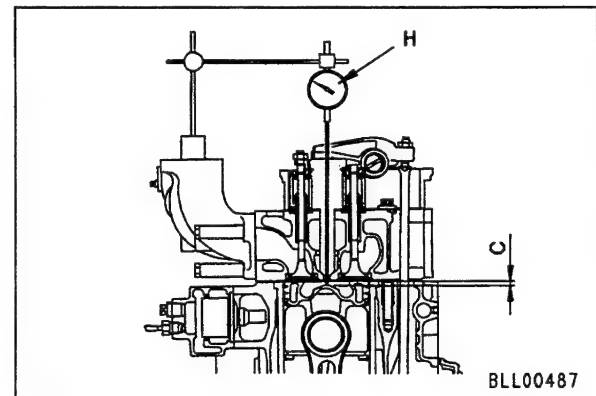
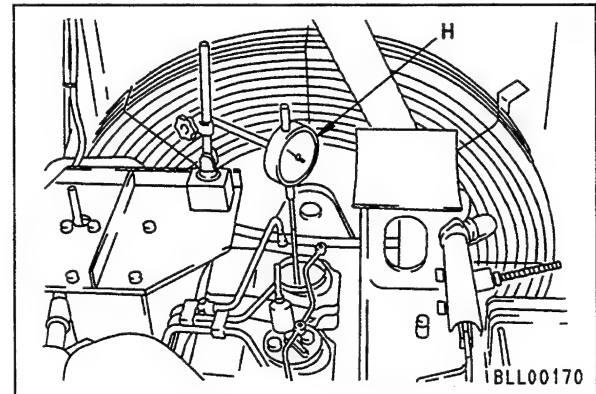
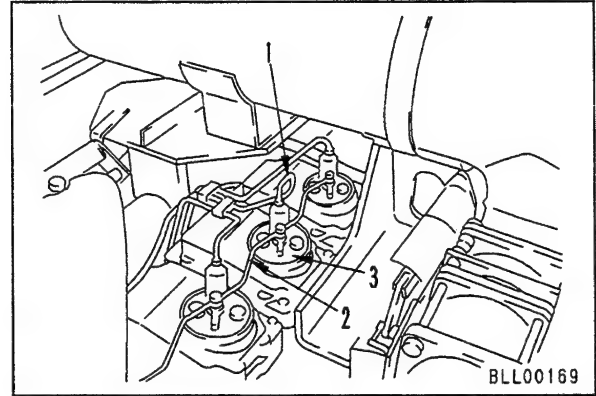
MEASURING COMPRESSION PRESSURE

-  When measuring the compression pressure, be careful not to touch the exhaust manifold or muffler, or to get your clothes caught in the fan, fan belt or other rotating parts.
1. Adjust the valve clearance.
For details, see ADJUSTING VALVE CLEARANCE.
 2. Warm up the engine to make the oil temperature 40 – 60°C.
 3. Remove the nozzle holder assembly from the cylinder to be measured.
For details, see REMOVAL OF NOZZLE HOLDER ASSEMBLY.
 - ★ When removing the No. 1 and No. 4 nozzle holder assemblies, remove the exhaust muffler and intake connector before starting the operation.
For details, see ADJUSTING VALVE CLEARANCE.
 4. Install adapter **D2** to nozzle holder mount, then connect pressure gauge **D1**
 5. Set multi-tachometer **A** in position.
 - ★ For details, see MEASURING ENGINE SPEED.
 6. Disconnect connector (1) of the stop motor, then crank the engine with the starting motor and measure the compression pressure.
 - ★ Measure the compression pressure at the point where the pressure gauge indicator remains steady.
 - ★ When measuring the compression pressure, measure the engine speed to confirm that it is within the specified range.
 - ★ After measuring the compression pressure, install the nozzle holder assembly.
For details, see INSTALLATION OF NOZZLE HOLDER ASSEMBLY.




TESTING AND ADJUSTING FUEL INJECTION TIMING

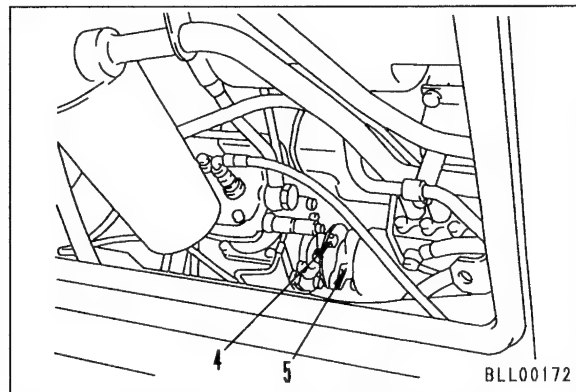
1. Disconnect fuel injection pipe (1) and spill tube (2) of the No. 1 piston, then remove No. 1 nozzle holder assembly (3).
 - ★ When removing the No. 1 nozzle holder assembly, remove the exhaust muffler and intake connector before starting the operation. For details, see ADJUSTING VALVE CLEARANCE.
2. Align No. 1 cylinder with the compression top dead center line (1.6).
 - ★ When doing this, check that the fuel injection timing line on the fuel injection pump is near the line on the fuel injection pump body.
3. Set dial gauge (H) to the nozzle holder hole where the nozzle holder assembly has been removed. (See the diagram.)
4. Set the long indicator on dial gauge (H) to 0 when the piston is at top dead center.
 - ★ Rotate the crankshaft in the normal direction and in the reverse direction in turn to align the top dead center.
 - ★ Record the value indicated by the short indicator on the dial gauge.
5. Rotate the crankshaft approx. 45° in the reverse direction from the No. 1 cylinder TOP position.
6. Rotate the crankshaft again slowly in the normal direction and set to specified dimension "C".
 - ★ Specified dimension **C**: 3.8 ± 0.2 mm
 - ★ Always rotate the crankshaft in the normal direction to align the position.
 - ★ Continue to rotate in the normal direction and check that the scale on the dial gauge reads 0 ± 0.2 mm when the No. 1 cylinder is at the top dead center (the position where the indicator of the dial gauge starts to move back in the opposite direction). If it is not 0 ± 0.2 mm, carry out the operation again from Step 4.
7. When the specified dimension is reached, check that fuel injection timing line "a" on the fuel injection pump is aligned with line "b" on the coupling.



023S02

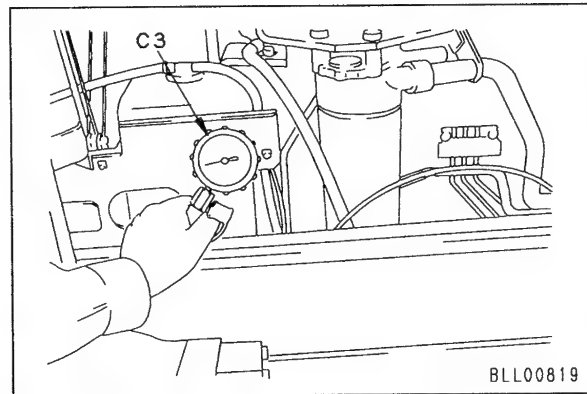
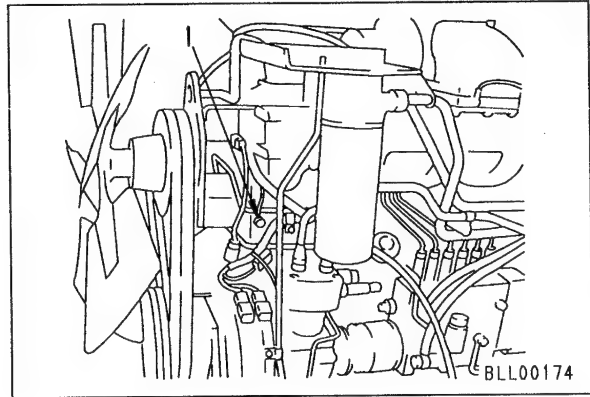
8. If the lines are not aligned, loosen bolt (4) in the oblong hole, move coupling (5) to align the lines, then tighten bolt (4).

 **Bolt (4): $78.5 \pm 5 \text{ Nm}$ $\{8 \pm 0.5 \text{ kgm}\}$**



MEASURING ENGINE OIL PRESSURE

- ★ When measuring, be careful not to let your clothes get caught in any rotating part.
- ★ Always stop the engine before removing or installing any oil pressure sensor or oil pressure gauge.
- ★ When measuring the oil pressure, always measure at the specified oil temperature.
 - 1) Remove oil pressure sensor (1).
 - 2) Install tool **C3** [gauge: 1.0 MPa (10 kg/cm²)].
 - 3) Start the engine, and measure the oil pressure.



023S02

TESTING AND ADJUSTING FAN BELT TENSION

1. Testing fan belt tension

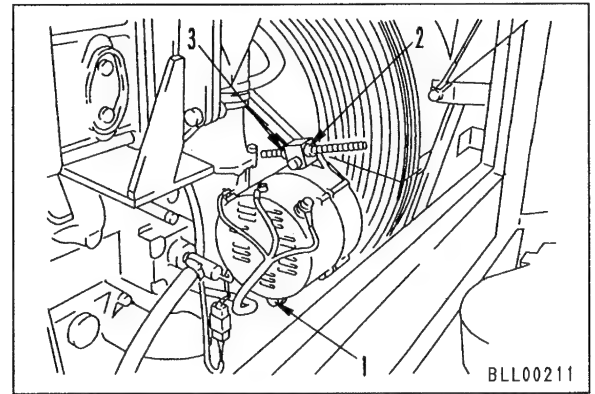
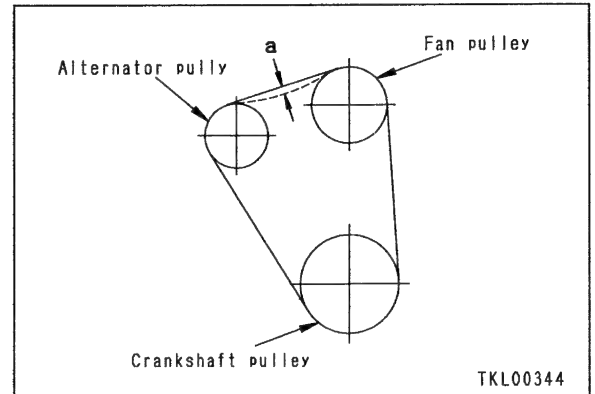
Check that the deflection of the belt is within the standard value when it is pressed with a finger force of approx. 59 N {6 kgf} at a point midway between the alternator pulley and the fan pulley.

★ Deflection *a* of belt (standard value):

8 – 12 mm

2. Adjusting fan belt tension

- 1) Loosen alternator mounting bolt (1) and lock-nut (2).
- 2) Turn adjustment nut (3) to adjust the tension of the belt.
- 3) After the belt tension is adjusted to the specified value, tighten locknut (2) first, then tighten alternator mounting bolt (1).



TESTING AND ADJUSTING AIR CONDITIONER COMPRESSOR BELT TENSION

★ If the deflection of the belt is not within the standard value when it is pressed at a point midway between motor pulley (1) and compressor pulley (2), or if the belt has been replaced or other maintenance has been carried out, adjust as follows.

1. Testing air conditioner belt tension

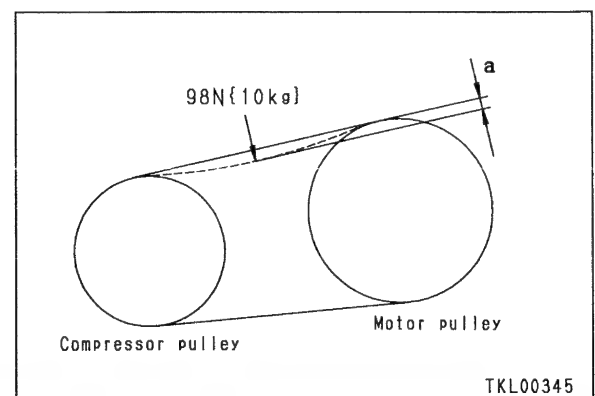
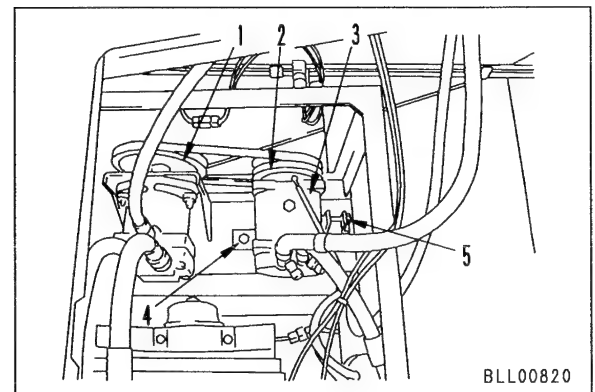
Check that the deflection of the belt is within the standard value when it is pressed with a finger force of approx. 98 N {10 kgf} at a point midway between the compressor pulley and the air conditioner hydraulic motor pulley.

★ Deflection *a* of belt (standard value):

8 – 12 mm

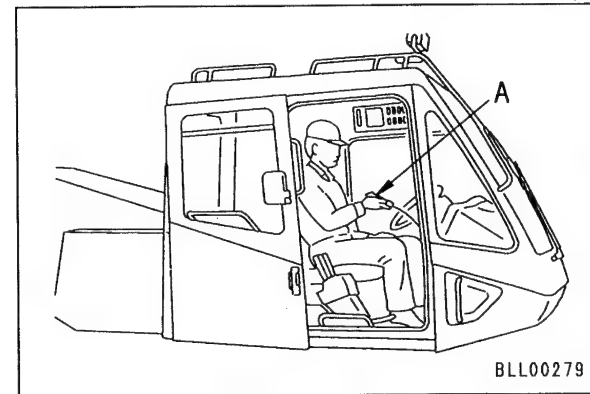
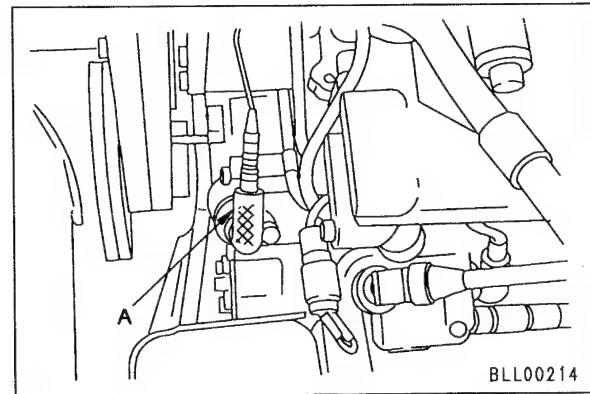
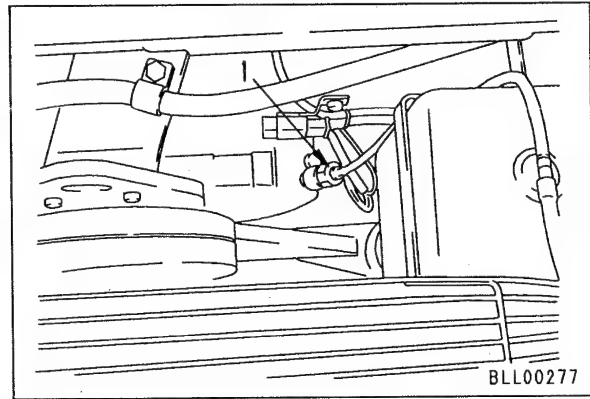
2. Adjusting air conditioner belt tension

- 1) Loosen 2 mounting bolts (4) of compressor assembly (3).
- 2) Turn adjustment bolt (5) to adjust the tension of the belt, then tighten mounting bolts (4).



MEASURING ENGINE SPEED

- ⚠** When removing or installing the measuring equipment, be careful not to touch any high temperature parts.
- ★ Measure the engine speed under the following conditions.
- 1) Coolant temperature: Within operating range
 - 2) Hydraulic oil temperature : 45 – 55°C
1. Remove speed pick-up sensor (1) at the chassis end, then install the adapter of tachometer **A**.
 2. Connect tachometer **A** and the adapter with the cable.
- ⚠** When carrying out the measurement, be careful not to touch any high temperature parts or rotating parts.
3. Start the engine, and measure the engine speed when the engine is at low idling and high idling.
- ★ When measuring items other than the above (during torque converter stall), see the procedure for each item.

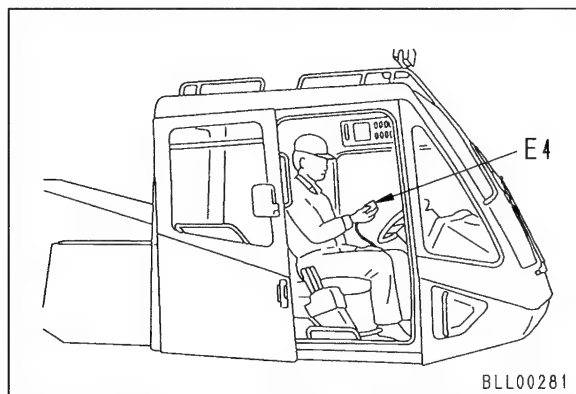
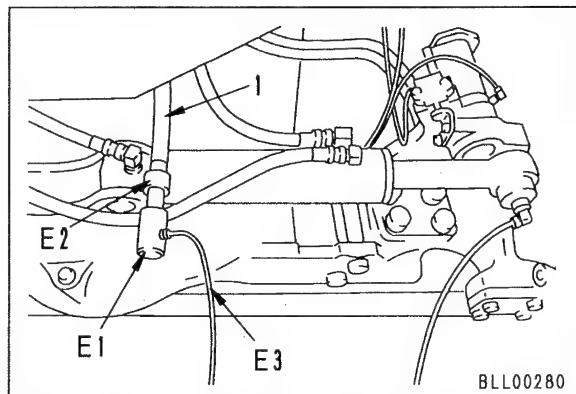


023S02

MEASURING BLOW-BY PRESSURE

PROCEDURE FOR MEASURING BLOW-BY

1. Warm up the engine thoroughly so that the water temperature is within the operating range when measuring the blow-by.
2. Stop the engine, install adapter **E2** to tool **E1**, then install to breather hose (1).
3. Install tube **E3** to tool **E1**, and connect to tool **E4** (0 – 500 mmH₂O).
4. Carry out the torque converter stall for the engine and measure the blow-by pressure.



PRECAUTIONS WHEN MEASURING BLOW-BY

- ★ The blow-by should be measured with the engine running at rated output.
- When measuring in the field, a similar value can be obtained at stall speed.
- If it is impossible to check at rated output or stall speed, measure at high idling.
In this case, the blow-by value will be about 80% of the value at rated output.
- ★ Blow-by varies greatly according to the condition of the engine. Therefore, if the blow-by value is considered abnormal, check for problems connected with defective blow-by, such as excessive oil consumption, defective exhaust gas color, and prematurely dirty or deteriorated oil.

023S02

MEASURING EXHAUST TEMPERATURE

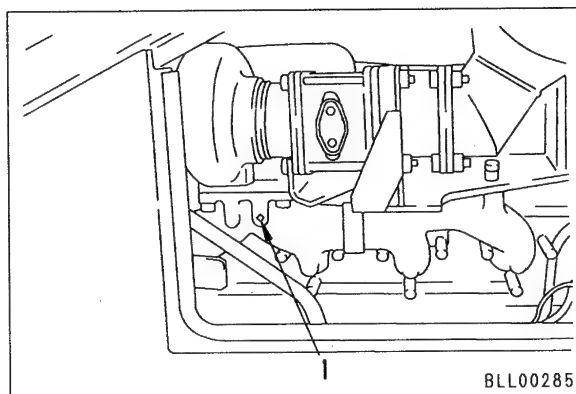
⚠ The temperature sensor is installed to the exhaust manifold, so if the machine has been operated, wait for the manifold temperature to drop before installing the sensor.

★ Raise the coolant temperature to the operating range before measuring.

1. Remove plug (1) from the exhaust manifold, and install temperature sensor (2).

- Temperature sensor: 6215-11-8180
(cable length 610 mm)

2. Connect to digital temperature gauge **B** with the wiring harness.



MEASUREMENT PROCEDURE

1) When measuring with the torque converter stalled

★ The conditions are only for torque converter stall, so when measuring the exhaust temperature, the core of the sensor will heat up and the torque converter will overheat before a stable value is obtained.

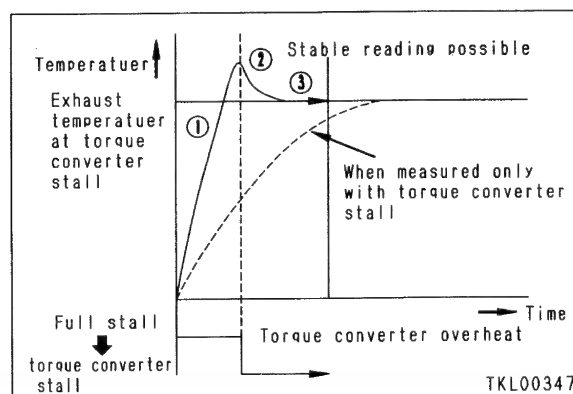
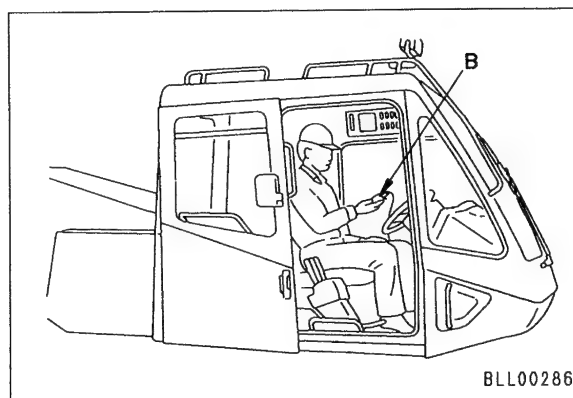
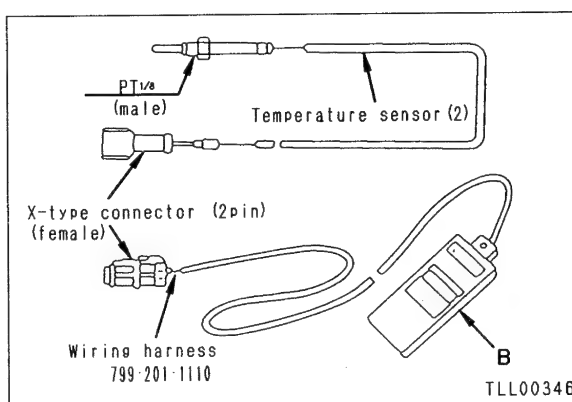
① Raise the exhaust temperature by using full stall (torque converter stall + hydraulic pump relief) (standard value: Approx. 650°C).

② In the above condition, cancel the hydraulic relief, and carry out only torque converter stall. (If the temperature starts to go down, or goes up without going down, repeat Step ① to raise the set temperature.)

③ Note the stable temperature when the temperature starts to go down.

2) When measuring the maximum value for the exhaust temperature
Carry out actual work and measure the maximum value during operation.

★ Use the PEAK mode (it can store the maximum value in memory) of the temperature gauge function.



023S02

MEASURING EXHAUST COLOR

- When measuring in the field when there is no air or electric power supply, use handy smoker checker **G1**; when recording official data, use smoke meter **G2**.

★ Raise the coolant temperature to the operating range before measuring.

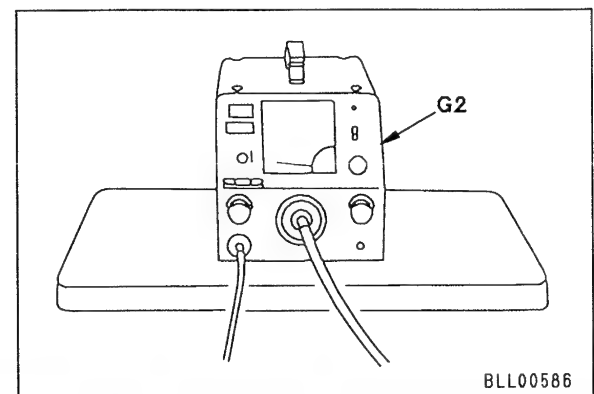
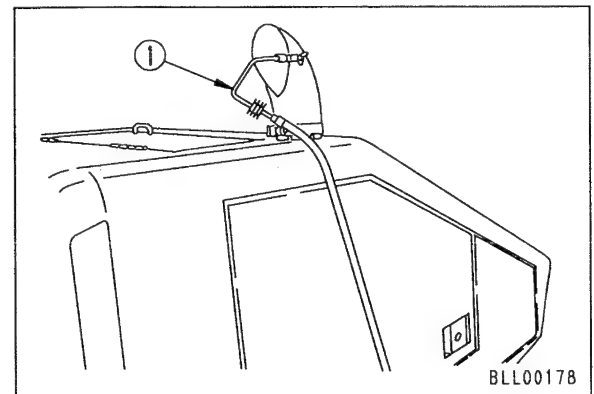
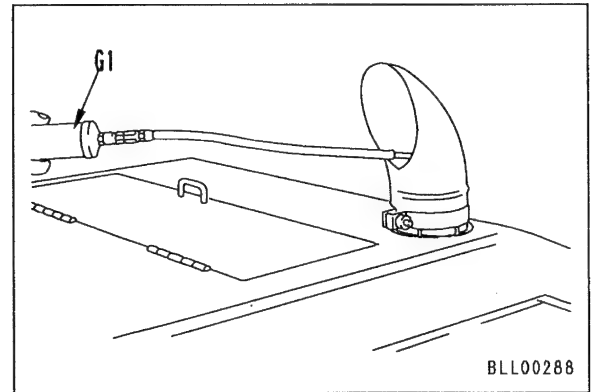
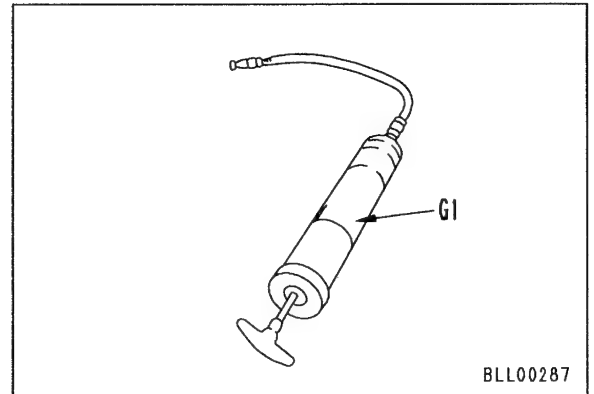
! Be careful not to touch any hot parts when removing or installing the measuring tools.

1. Measuring with Handy Smoke Checker G1.

- 1) Install filter paper to Handy Smoke Checker **G1**.
- 2) Insert the exhaust gas suction port into the exhaust pipe, accelerate the engine suddenly, and operate the handle of Handy Smoke Checker **G1** at the same time to collect the exhaust gas on the filter paper.
- 3) Remove the filter paper and compare it with the scale supplied to judge the condition.

2. Measuring with smoke meter G2

- 1) Insert probe (1) of smoke meter **G2** into the outlet port of the exhaust pipe, and tighten the clip to secure it to the exhaust pipe.
- 2) Connect the probe hose, accelerator switch socket, and air hose to smoke meter **G2**.
 - ★ Keep the pressure of the air supply below 1.5 MPa {15 kg/cm²}.
- 3) Connect the power cord to the AC100V socket.
 - ★ When connecting the cord, check that the power switch of smoke meter **G2** is OFF.
- 4) Loosen the cap nut of the suction pump, and fit the filter paper.
- ★ Fit the filter paper securely so that the exhaust gas cannot leak.
- 5) Turn the power switch of smoke meter **G2** ON.
- 6) Accelerate the engine suddenly, and depress the accelerator pedal of smoke meter **G2** at the same time to collect the exhaust gas color on the filter.
- 7) Place the filter paper used to catch the exhaust gas color on top of at least 10 sheets of unused filter paper inside the filter paper holder, and read the value shown.



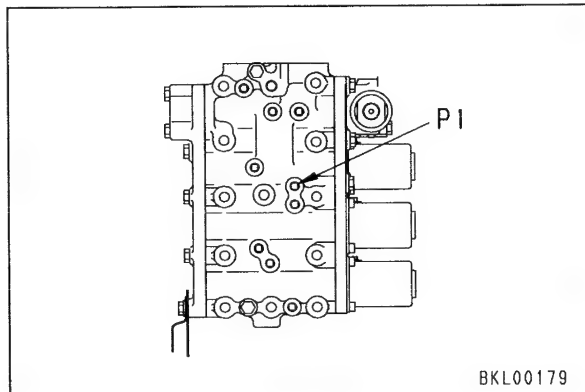
MEASURING OIL PRESSURE

- ⚠ Extend the outriggers and set securely so that the machine cannot move, then swing the revolving frame 90°C.
- ★ Set the transmission oil temperature to 60 – 80°C.
- ⚠ Always stop the engine before removing the plug or oil pressure gauge.
- ⚠ Be careful of the surrounding area when measuring, and after measuring, set the parking brake switch to the PARKING position.

1. Torque converter lockup clutch pressure

- 1) Remove plug (P1), then install tool **C1** [gauge: 2.45 MPa {25 kg/cm²}].
- 2) Start the engine, set the gear shift lever to the **D** position and the travel mode selector switch to the **2WD Hi** position.
- ⚠ Set the outriggers securely, check that the tires are raised off the ground, and be careful of the surrounding area.
- 3) Release the parking brake, raise the engine speed slowly, and measure the clutch pressure at the fixed speed.
- ★ If the speed is below the fixed speed, it is impossible to measure the oil pressure.
- ★ When measuring the oil pressure, set the PTO switch to "TRAVEL".

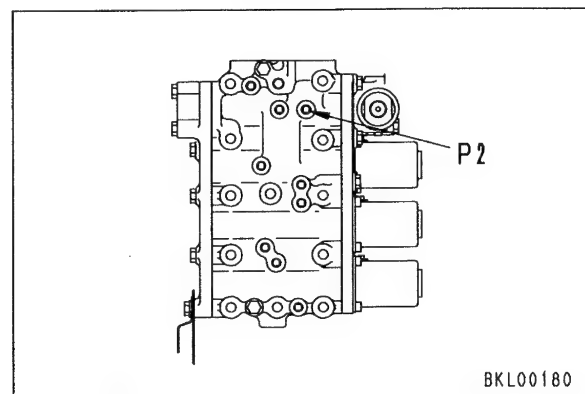
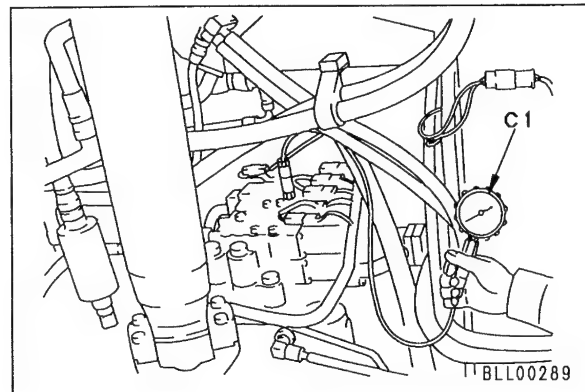
 Plug: **Gasket sealant (LG-1)**



2. Priority pressure

- 1) Remove plug (P2), then install tool **C1** (gauge: 5.9 MPa {60 kg/cm²}).
- 2) Start the engine, set the gear shift lever to the **N** position, and measure the pressure with the engine at low idling and rated speed.
- ★ When measuring the oil pressure, set the PTO switch to "TRAVEL".

 Plug: **Gasket sealant (LG-1)**



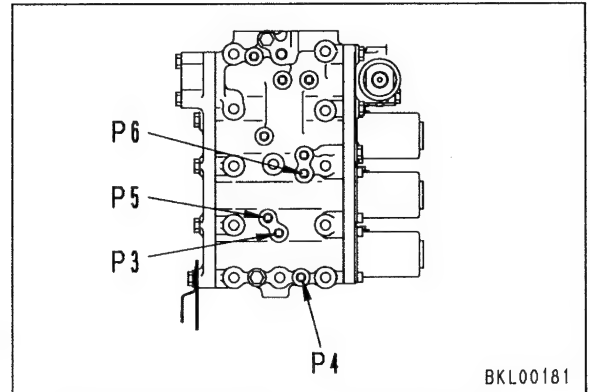
023S02

3. Transmission clutch pressure

- 1) Measure the priority pressure, and check that it is normal.
- 2) Remove the plug of the clutch to be measured, then install tool **C1** [gauge: 5.9 MPa {60 kg/cm²}].
P3 (F1 clutch), P4 (F2 clutch)
P5 (F3 clutch), P6 (R clutch)
- 3) Start the engine, set the gear shift lever to the **D** and **R** position, and measure the pressure with the engine at low idling and rated speed.
★ When measuring the oil pressure, set the PTO switch to "Travel".

⚠ Set the outriggers securely, check that the tires are raised off the ground, and be careful of the surrounding area.

 Plug: **Gasket sealant (LG-1)**

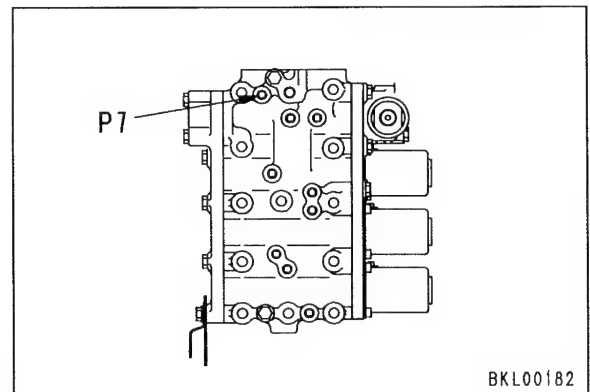


BKL00181

4. Torque converter relief pressure

- 1) Remove plug (P7), then install tool **C1** [gauge: 2.45 MPa {25 kg/cm²}].
- 2) Start the engine, set the gear shift lever to the **N** position, and measure the pressure with the engine at rated speed.
★ When measuring the oil pressure, set the PTO switch to "TRAVEL".


 Plug: **Gasket sealant (LG-1)**

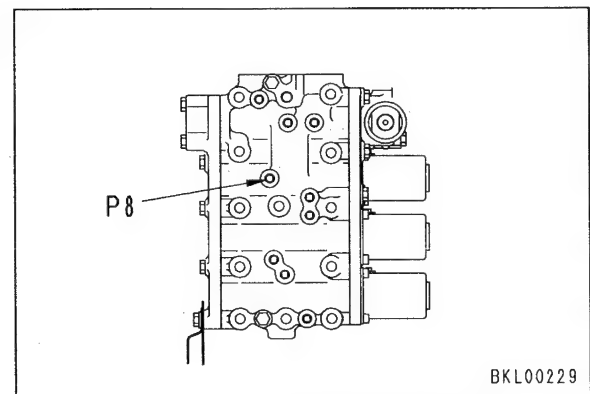


BKL00182

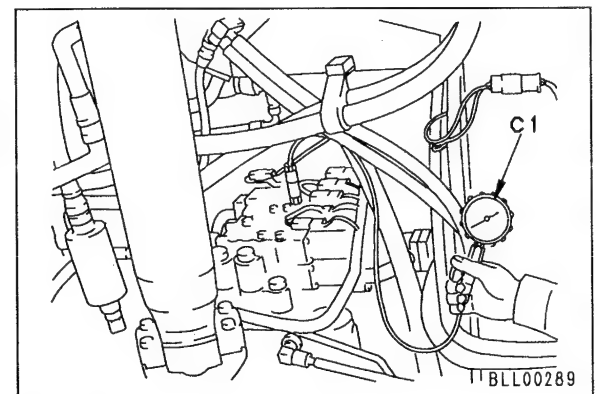
5. Torque converter inlet port pressure

- 1) Remove plug (P8), then install tool **C1** [gauge: 2.45 MPa {25 kg/cm²}].
- 2) Start the engine, set the gear shift lever to the **N** position, and measure the pressure with the engine at high idling.
★ When measuring the oil pressure, set the PTO switch to "TRAVEL".

 Plug: **Gasket sealant (LG-1)**



BKL00229

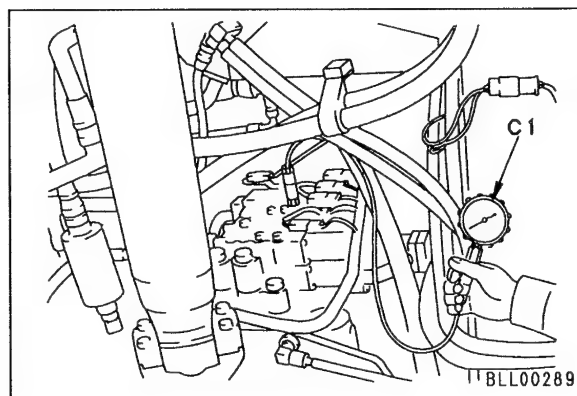
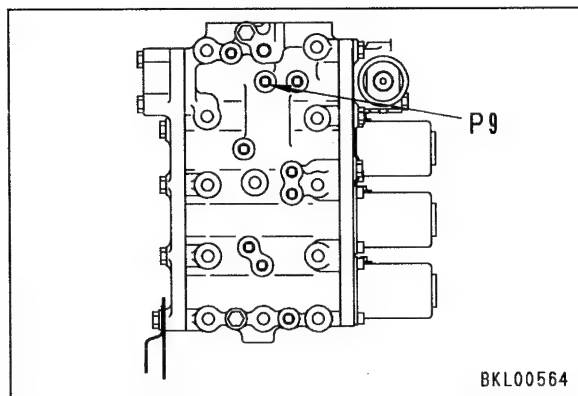


BLL00289


6. Transmission relief pressure

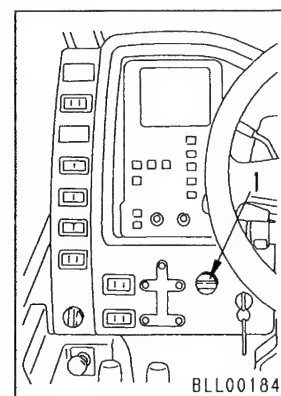
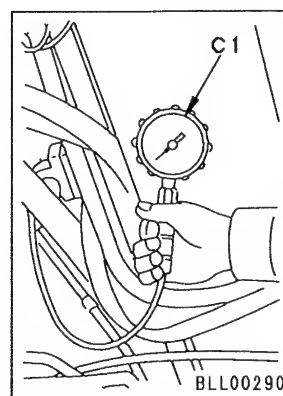
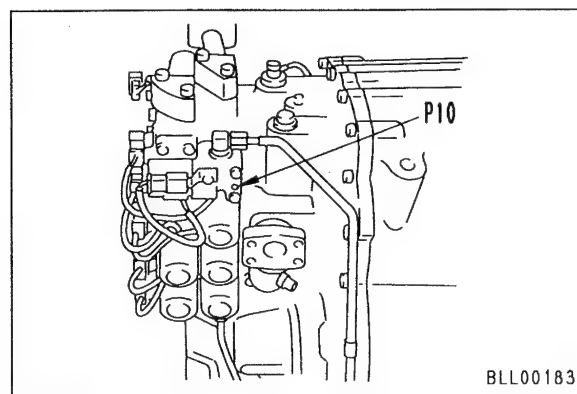
- 1) Remove plug (P9), then install tool **C1** [gauge: 5.9 MPa {60 kg/cm²}].
 - 2) Start the engine, set the gear shift lever to the **N** position, and measure the pressure with the engine at rated speed.
- ★ When measuring the oil pressure, set the PTO switch to "TRAVEL".

 Plug: **Gasket sealant (LG-1)**

**7. PTO clutch pressure**

- 1) Remove plug (P10), then install tool **C1** [gauge: 5.9 MPa {60 kg/cm²}].
 - 2) Start the engine and set PTO switch (1) to the "OPERATION 1" position. (Run the engine at high idling.)
 - 3) Measure the PTO clutch pressure in the above condition.
- ★ When PTO switch (1) is set to the "OPERATION 1" or "OPERATION 2" position, check that the pressure drops momentarily and then goes to the specified pressure.

 Plug: **Gasket sealant (LG-1)**



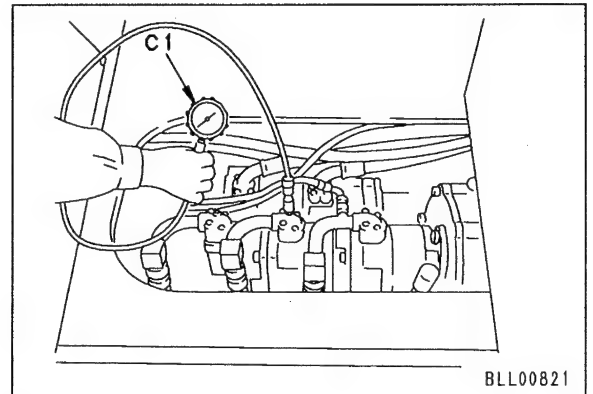
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8. Outrigger pressure**Measuring**

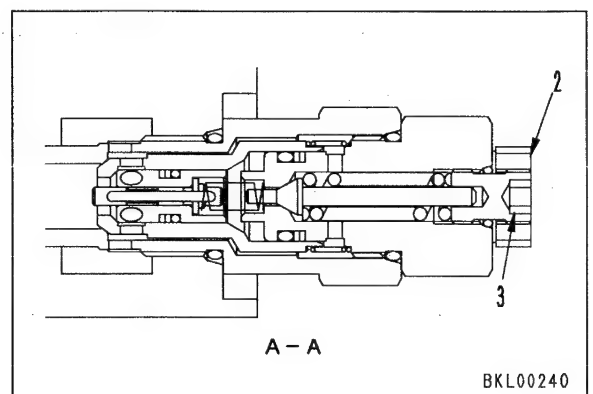
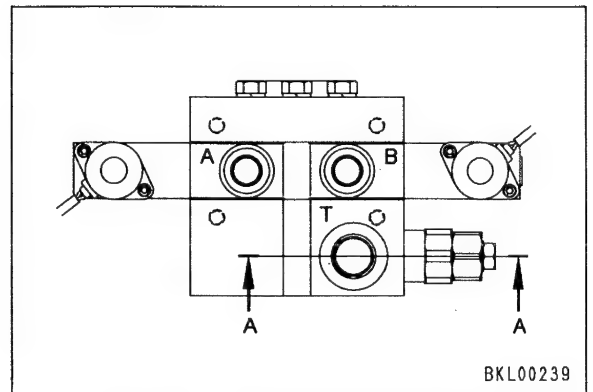
- ★ Set the hydraulic oil temperature to 45 – 55°C.
- ★ Swing the revolving frame 90°.
- 1) Remove the plug, then install tool **C1** [gauge: 39.2 MPa {400 kg/cm²}].
- 2) Start the engine and set the PTO switch to the "OPERATION 1" position, then use the ALL switch for the jack cylinders on the outrigger control panel to operate to EXTEND and relieve the circuit.
- 3) Depress the accelerator pedal and run the engine at high idling.
- 4) Measure the outrigger set pressure in the above condition.

 Plug: **Gasket sealant (LG-1)**

- ★ If the set pressure exceeds $20.6^{+2.5}_{-0}$ MPa { 210^{+25}_{-0} kg/cm²}, adjust as follows.

**Adjusting****Outrigger selector valve**

- 1) Loosen locknut (2).
 - 2) Turn adjustment screw (3) to adjust.
 - ★ Turn the adjustment screw to adjust as follows.
To INCREASE pressure, turn CLOCKWISE
To DECREASE pressure, turn COUNTER-CLOCKWISE
 - ★ One turn of the adjustment screw adjusts the pressure by 19.9 MPa {203 kg/cm²}.
 - 3) After adjusting, tighten locknut (2).
-  Locknut: 19.6 ± 2.0 Nm { 2 ± 0.2 kgm}
- ★ After tightening the locknut, check the pres-



9. Boom hoist cylinder pressure

- ★ Set the hydraulic oil temperature to 45 – 55°C.
- ★ Retract the boom fully.
- ★ Swing the revolving frame 90°.

Measuring

1) LOWER actuation pressure

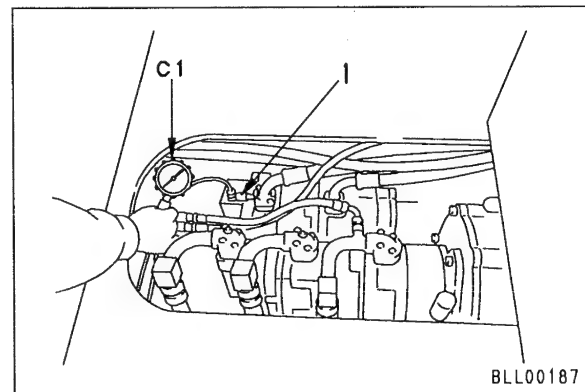
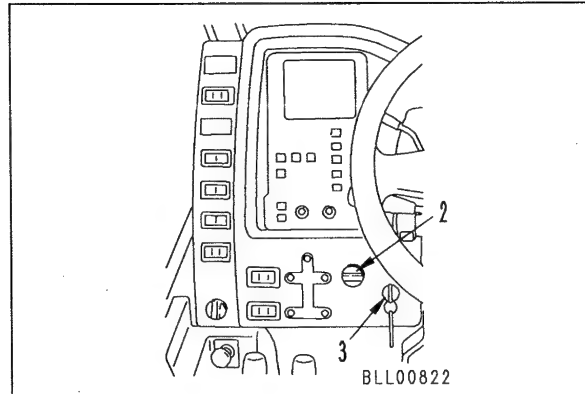
- i) Start the engine and set PTO switch (2) to the "OPERATION 1" or "OPERATION 2" position, then operate the boom hoist lever to the LOWER position to lower the boom.
- ★ Read the cylinder head pressure on the moment limiter (overload prevention device) when the boom angle is near 45°.
- ★ For details of the method of displaying the cylinder pressure, see SERVICE MODE DISPLAY METHOD FOR OVERLOAD PREVENTION DEVICE.
- ii) Run the engine at high idling and low idling and measure the set pressure.
- iii) After measuring the pressure, check that the boom LOWER speed is within the standard range.

2) LOWER relief pressure

- i) Start the engine and set PTO switch (2) to the "OPERATION 1" or "OPERATION 2" position, then operate the boom hoist lever to the LOWER position to lower the boom.
- ★ If the boom angle becomes a negative value, the buzzer will sound and it will be impossible to operate the boom LOWER circuit.
- ii) Next, set automatic stop cancel switch (3) to CANCEL, operate the boom hoist lever to the LOWER position, lower the boom completely, and relieve the circuit.
- iii) After that, depress the accelerator pedal, raise the engine speed to high idling, then measure the set pressure.
- ★ Read the cylinder head pressure on the moment limiter.
- ★ If the pressure displayed on the moment limiter is not within a range of 7.2 ± 1.0 MPa { 73 ± 10 kg/cm²}, adjust the valve.

3) RAISE relief pressure

- 1) Remove plug (1) at tandem pump boom end, then install tool C1 [gauge: 39.2 MPa {400 kg/cm²}].
- ii) Start the engine and set PTO switch (2) to the "OPERATION 1" or "OPERATION 2" position, then operate the boom hoist lever to the RAISE position to raise the boom.



- ★ When the boom angle reaches 83°, the buzzer will sound and it will be impossible to operate the boom RAISE circuit.
- iii) Next, set automatic stop cancel switch (3) to CANCEL, operate the boom hoist lever to the RAISE position, raise the boom completely, and relieve the circuit.
- iv) After that, depress the accelerator pedal, raise the engine speed to high idling, then measure the set pressure.




Plug: Gasket sealant (LG-1)

- ★ If the set pressure exceeds $20.6^{+2.5}_0$ MPa { 210^{+25}_0 kg/cm²}, adjust as follows.


023S02

Adjusting

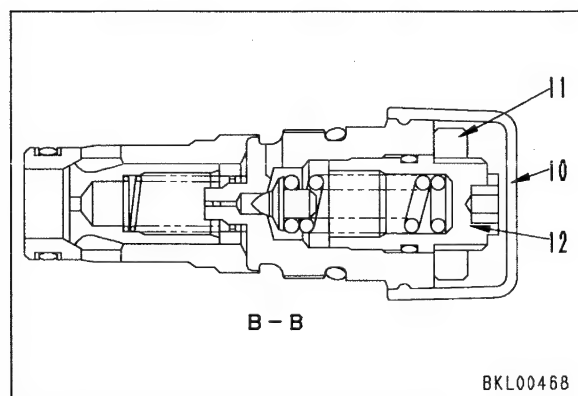
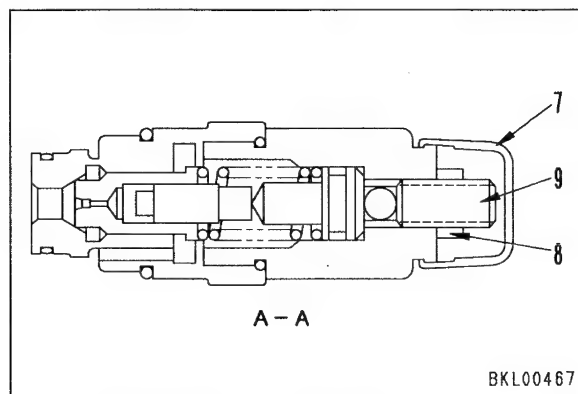
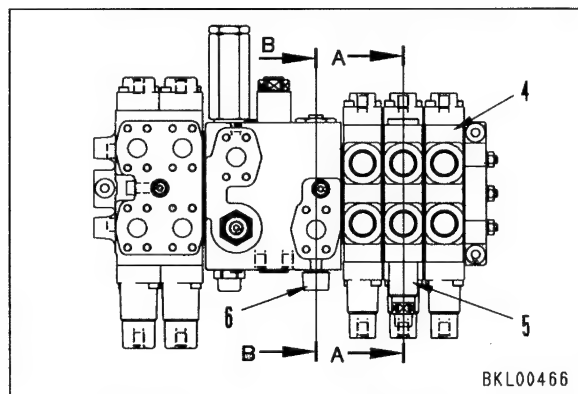
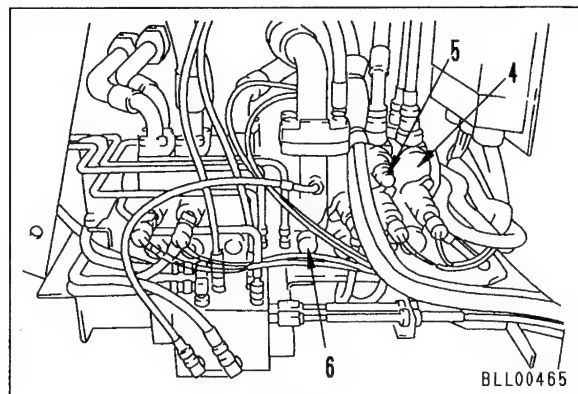
- 1) Adjusting pressure at cylinder LOWER end
 - i) Remove cap (7) of relief valve (5) at boom LOWER end of main control valve (4).
 - ii) Loosen locknut (8), then turn adjustment screw (8) to adjust.
 - ★ Turn the adjustment screw to adjust as follows.
To INCREASE pressure, turn CLOCKWISE
To DECREASE pressure, turn COUNTER-CLOCKWISE
 - ★ One turn of the adjustment screw adjusts the pressure by 3.6 MPa {37 kg/cm²}.
 - iii) After adjusting, tighten locknut (8) and install cap (7).

 Locknut: $9.8 \pm 1.0 \text{ Nm}$ { $1 \pm 0.1 \text{ kgm}$ }


 - ★ After tightening the locknut, check the pressure again.
- 2) Adjusting pressure at cylinder RAISE end.
 - i) Remove cap (10) of relief valve (6) at boom RAISE end of main control valve (4).
 - ii) Loosen locknut (11), then turn adjustment screw (12) to adjust.
 - ★ Turn the adjustment screw to adjust as follows.
To INCREASE pressure, turn CLOCKWISE
To DECREASE pressure, turn COUNTER-CLOCKWISE
 - ★ One turn of the adjustment screw adjusts the pressure by 14.7 MPa {150 kg/cm²}.
 - iii) After adjusting, tighten locknut (11) and install cap (10).

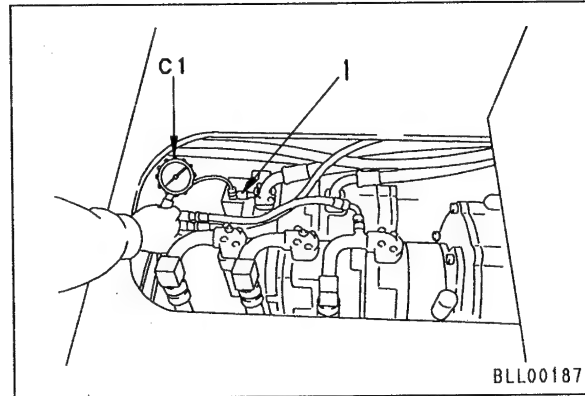
 Locknut: $9.8 \pm 1.0 \text{ Nm}$ { $1 \pm 0.1 \text{ kgm}$ }

 - ★ After tightening the locknut, check the pressure again.
 - This relief valve is the main relief valve for the boom circuit. It also adjusts the oil pressure in the boom telescope and power tilt circuits.




10. Boom telescope cylinder pressure

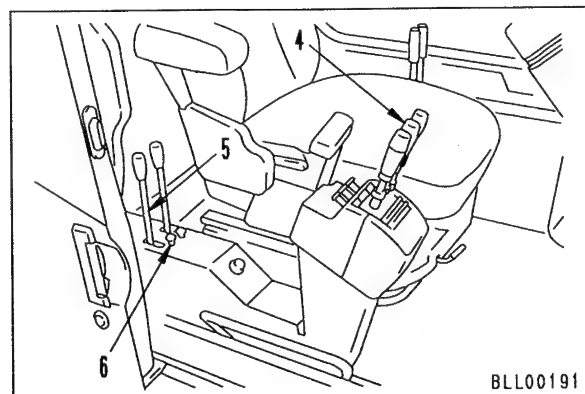
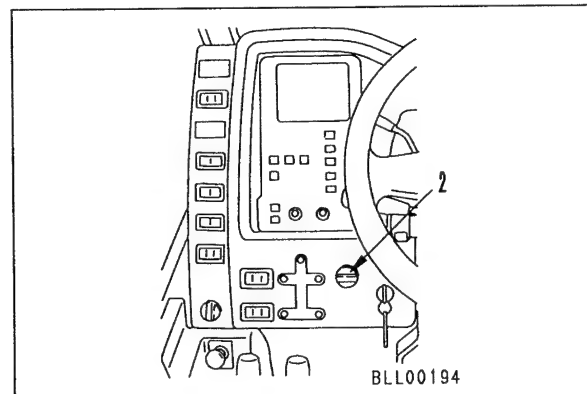
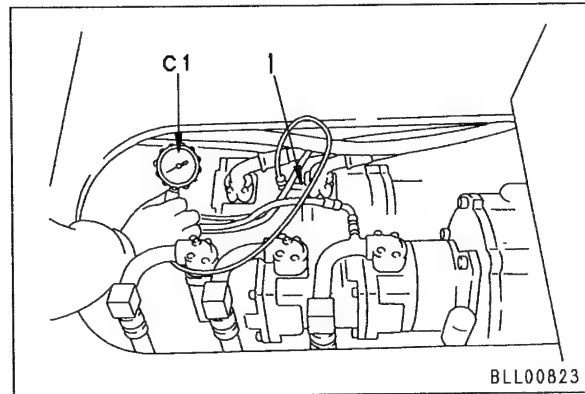
- ★ Set the hydraulic oil temperature to 45 – 55°C.
 - ★ Swing the revolving frame 90°.
 - 1) Remove plug (1), then install tool **C1** [gauge: 39.2 MPa {400 kg/cm²}].
 - 2) Start the engine and set the PTO switch to the "OPERATION 1" or "OPERATION 2" position, then operate the boom telescope lever to the RETRACT position to retract the boom, and relieve the circuit.
 - 3) Depress the accelerator pedal gradually, raise the engine speed to high idling, then measure the set pressure.
 - ★ If the set pressure exceeds $20.6^{+2.5}_0$ MPa { 210^{+25}_0 kg/cm²}, adjust as follows.
-  Plug: **Gasket sealant (LG-1)**



11. Winch pressure

- ★ Set the hydraulic oil temperature to 45 – 55°C.
- Measuring
- 1) Carry out the measurement at the WIND OUT side as follows.
 - i) Remove plug (1) at the tandem pump winch end, then install tool C1 (gauge: 39.2 MPa {400 kg/cm²}).
 - ii) Start the engine and set PTO switch (2) to the "Operation 1" or "Operation 2" position, then set main winch clutch lever (5) to the ON position and winch lock lever (6) to the LOCK position.
 - iii) In this condition, depress winch brake pedal (3).
 - iv) Operate main winch lever (4) to the WIND OUT position, relieve the circuit, then depress the accelerator pedal gradually, raise the engine speed to high idling, and measure the set pressure.

 Plug: **Gasket sealant (LG-1)**
 - 2) Normally, the same relief valve is used for WIND OUT and WIND IN, so it is enough to measure the WIND OUT pressure, but if there is any problem with the WIND IN side, measure the WIND IN pressure also.
- Procedure for measuring at WIND IN side
- i) Remove the plug, then install tool **C1** [gauge: 39.2 MPa {400 kg/cm²}].

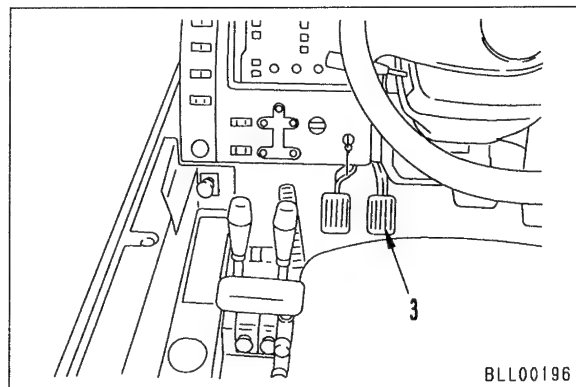


023S02

- ii) Start the engine and set PTO switch (2) to the "OPERATION 1" or "OPERATION 2" position.
- iii) In this condition, depress winch brake pedal (3).
- iv) Operate main winch lever (4) to the WIND IN position and relieve the circuit.
- v) Depress the accelerator pedal, raise the engine speed to high idling, and measure the set pressure.

 Plug: **Gasket sealant (LG-1)**

- ★ If the set pressure exceeds $20.6^{+2.5}_0$ MPa (210^{+25}_0 kg/cm²), adjust as follows.



Adjusting

- 1) Adjust winch relief valve (8) of main control valve (7).
- 2) Loosen locknut (9), then turn adjustment screw (10) to adjust.

- ★ Turn the adjustment screw to adjust as follows.

To INCREASE pressure, turn CLOCKWISE
To DECREASE pressure, turn COUNTER-CLOCKWISE

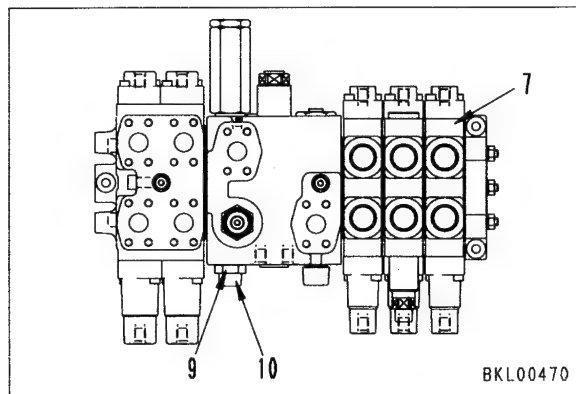
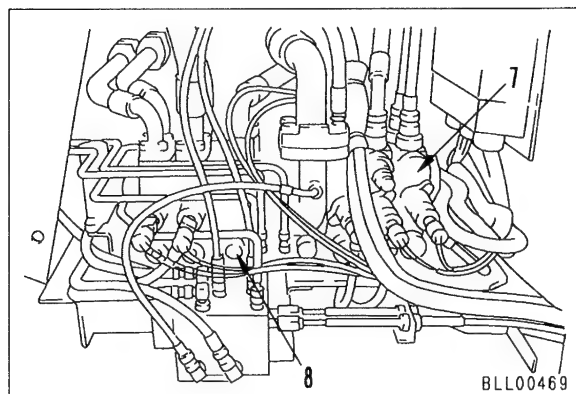
- ★ One turn of the adjustment screw adjusts the pressure by 14.7 MPa {150 kg/cm²}.

- 3) After adjusting, tighten locknut (9).

 Locknut:

9.8 ± 1.0 Nm {1 ± 0.1 kgm}

- ★ After tightening the locknut, check the pressure again.

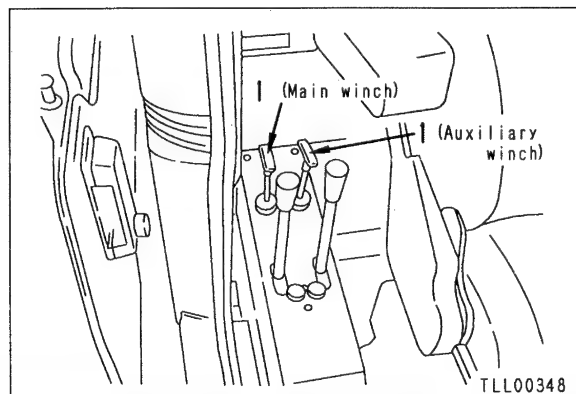


12. Accumulator charge pressure

- ★ Set the hydraulic oil temperature to 45 – 55°C.
- ★ Set winch drum lock lever (1) to the LOCK position.
- ★ Turn the air conditioner switch OFF.

Measuring

- 1) With the starting switch at the ON position, depress the winch brake pedal and operate winch clutch lever (2) repeatedly between the ON and OFF positions to release the pressure from the accumulator.



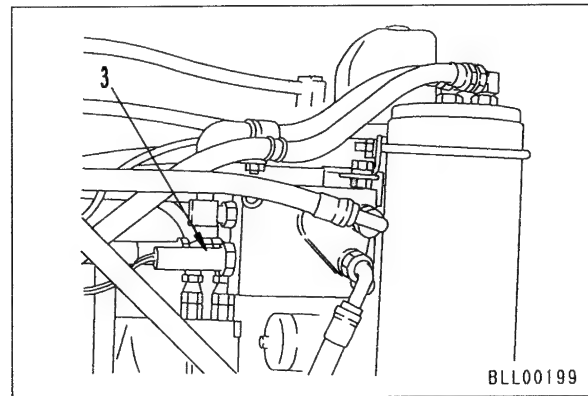
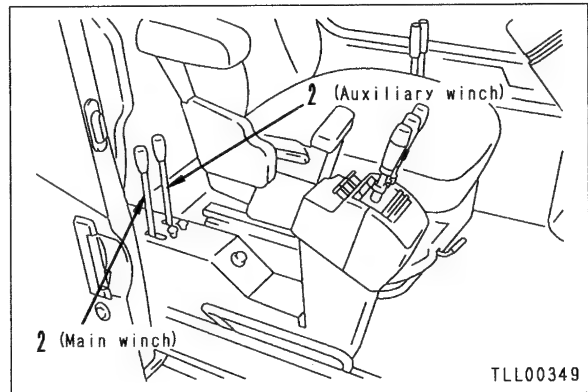
- 2) Set winch clutch lever (2) to the ON position.
- 3) Remove pressure switch (3), then install tools **C7** (joint) and **C1** [gauge: 39.2 MPa {400 kg/cm²}].
- 4) Set the PTO switch to the "OPERATION 1" or "OPERATION 2" position, start the engine, run the engine at low idling, then measure the cut-out pressure.
- 5) Next, depress the winch brake pedal, operate winch clutch lever (2) repeatedly between the ON and OFF position, gradually lower the pressure in the circuit, and measure the cut-in pressure.

★ Cut-in pressure:

$13.7^{+1.0}_0$ MPa { 140^{+10}_0 kg/cm²}


Cut-out pressure:

$11.8^{+1.0}_0$ MPa { 120^{+10}_0 kg/cm²}



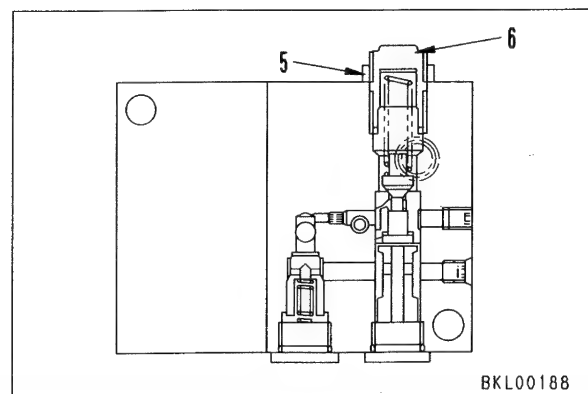
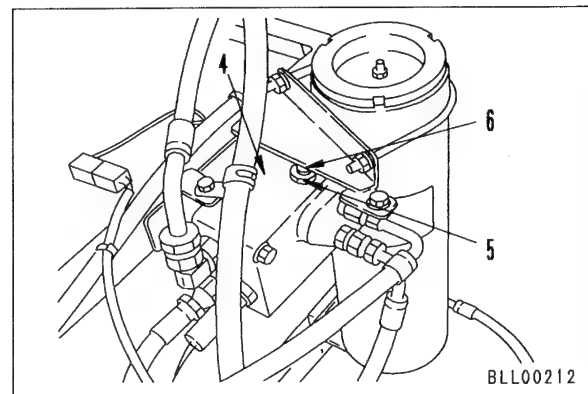
Adjusting

- Remove the cover on the left side of the revolving frame.
- 1) Loosen nut (5) of charge valve (4), then turn adjustment screw (6) to adjust.
 - ★ Turn the adjustment screw to adjust as follows.
 - To INCREASE pressure, turn CLOCKWISE
 - To DECREASE pressure, turn COUNTER-CLOCKWISE
 - ★ One turn of the adjustment screw adjusts the pressure by 6.4 MPa {65 kg/cm²}.
- 2) After adjusting, tighten nut (5).

 kgm Locknut:

10.8 ± 1.0 Nm { 1.1 ± 0.1 kgm}

- ★ After tightening the nut, check the pressure again.



023S02

13. Swing pressure

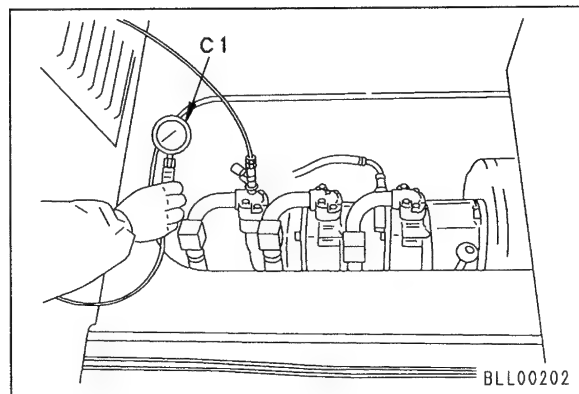
- ★ Set the hydraulic oil temperature to 45 – 55°C.
- ★ Swing the revolving frame 90°.

Measuring

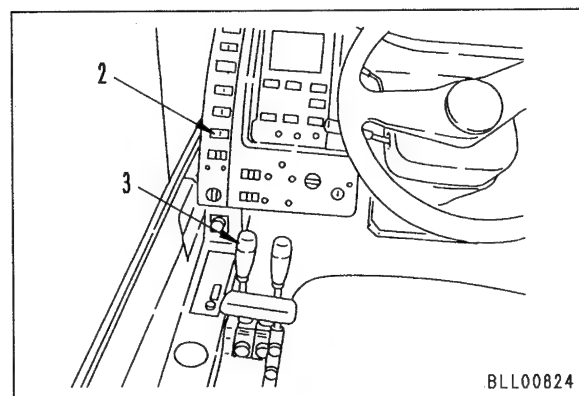
- 1) Remove the plug from the tandem pump swing end and install tool **C1** [gauge: 39.2 MPa {400 kg/cm²}].
- 2) Start the engine and set the PTO switch to the "OPERATION 1" or "OPERATION 2" position, then set swing brake switch (2) to the ON position and operate swing lever (3) to relieve the circuit.
- 3) Depress the accelerator pedal, raise the engine speed to high idling, then measure the set pressure.

 Plug: **Gasket sealant (LG-1)**

- ★ If the set pressure exceeds $20.6^{+2.5}_0$ MPa { 210^{+25}_0 kg/cm²}, adjust as follows.




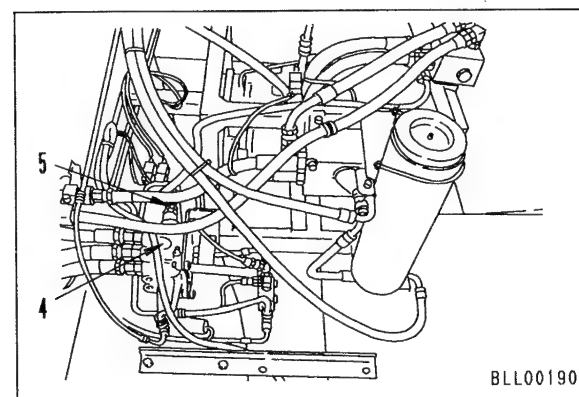
BLL00202



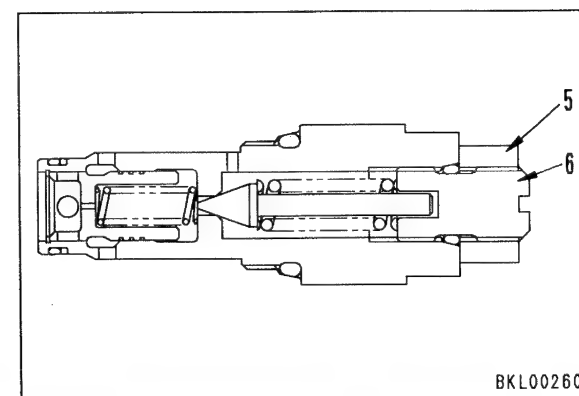
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Adjusting

- Remove the cover on the left side of the revolving frame.
- 1) Loosen locknut (5) of swing valve (4), then turn adjustment screw (6) to adjust.
 - ★ Turn the adjustment screw to adjust as follows.
To INCREASE pressure, turn CLOCKWISE
To DECREASE pressure, turn COUNTER-CLOCKWISE
 - ★ One turn of the adjustment screw adjusts the pressure by 12.6 MPa {128 kg/cm²}.
 - 2) After adjusting, tighten locknut (5).
 -  Locknut: **69 ± 10 Nm {7 ± 1 kgm}**
 - ★ After tightening the locknut, check the pressure again.



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14. Swing pressure

- ★ Set the hydraulic oil temperature to 45 – 55°C.
- ★ Swing the revolving frame 90°.


Measuring

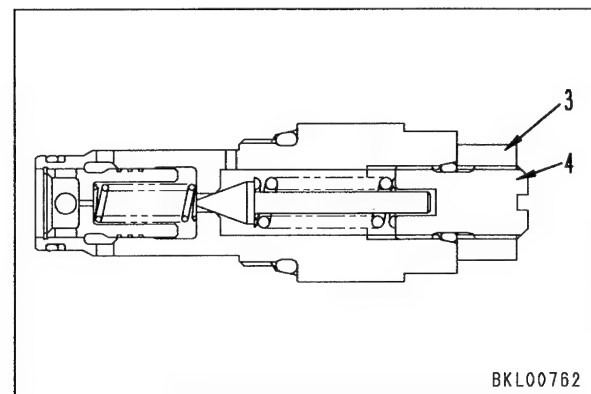
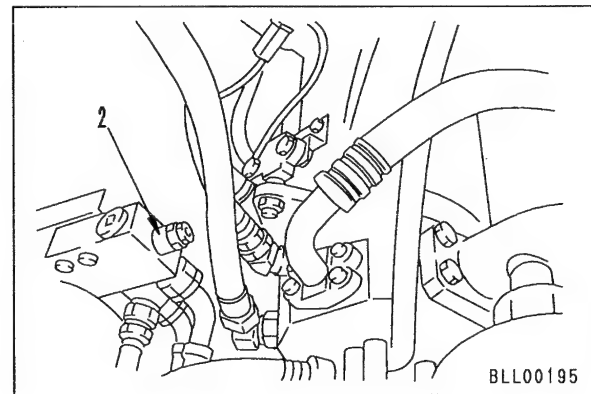
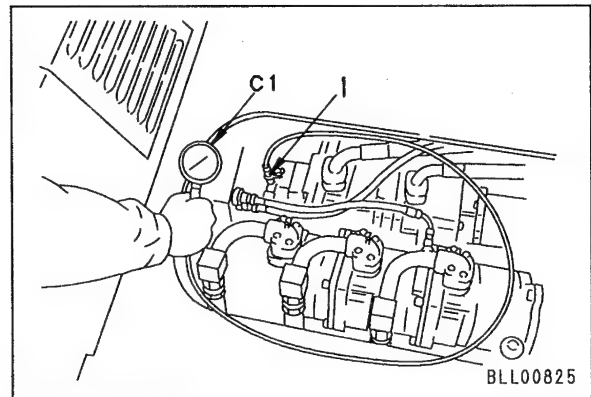
- 1) Remove plug (1) from the tandem pump PPC end and install tool **C1** [gauge: 5.9 MPa {60 kg/cm²}].
- 2) Start the engine and set the PTO switch to the "OPERATION 1" or "OPERATION 2" position, then operate each lever fully and relieve the circuit.
- 3) Raise the engine speed to high idling, then measure the set pressure.

 Plug: **Gasket sealant (LG-1)**

- ★ If the outlet port pressure is less than 2.6 MPa {27 kg/cm²}, adjust as follows.

Adjusting


- 1) Loosen locknut (3) of PPC relief valve (2), then turn adjustment screw (4) to adjust.
 - ★ Turn the adjustment screw to adjust as follows.
 - To INCREASE pressure, turn CLOCKWISE
 - To DECREASE pressure, turn COUNTER-CLOCKWISE
 - ★ One turn of the adjustment screw adjusts the pressure by 1 MPa {10.4 kg/cm²}.
 - 2) After adjusting, tighten locknut (3).
-  Locknut: **69 ± 10 Nm {7 ± 1 kgm}**
- ★ After tightening the locknut, check the pressure again.



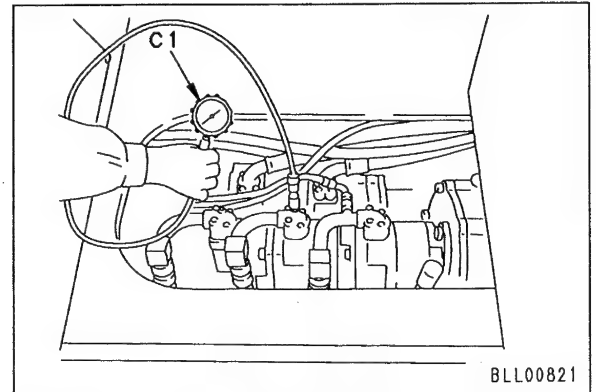
023S02

15. Steering pressure**Measuring**

- ★ Set the hydraulic oil temperature to 45 – 55°C.
- 1) Remove the plug at the tandem pump steering end, then install tool **C1** [gauge: 39.2 MPa {400 kg/cm²}].
- 2) Start the engine, turn the steering wheel fully and relieve the circuit.
- ★ Carry out this operation on tire and turn the steering with the machine stationary.
- 3) Run the engine at low idling and measure the set pressure of the steering circuit.


 Plug: **Gasket sealant (LG-1)**

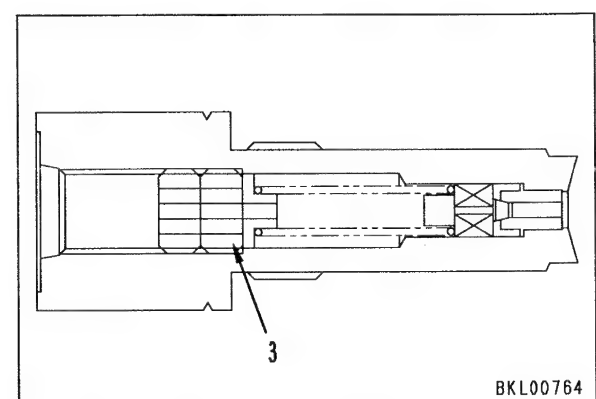
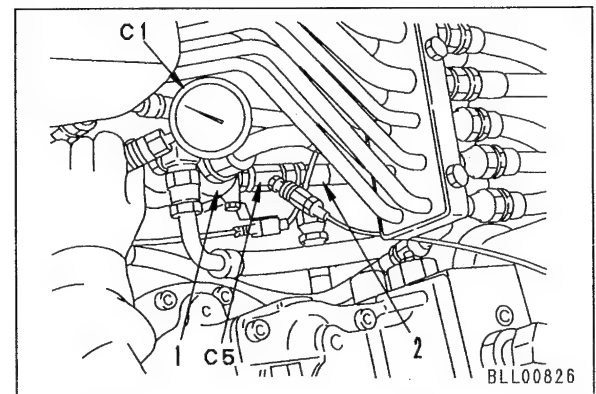
- ★ If the set pressure is not within 18.6 ± 1.0 MPa { 190 ± 10 kg/cm²}, adjust the steering priority valve.

**16. Steering priority valve pressure****Measuring**

- ★ Set the hydraulic oil temperature to 45 – 55°C.
- 1) Remove LS port piping (2) of priority valve (1), install tools **C5** (adapter) and **C1** [gauge: 39.2 MPa {400 kg/cm²}], then install LS port piping (2) to adapter.
- 2) Start the engine and turn the steering wheel fully.
- ★ Carry out this operation on tire and turn the steering with the machine stationary.
- 3) Run the engine at low idling and measure the hydraulic pressure when the steering is being operated.

Adjusting

- 1) Turn set screw (3) to adjust.
- ★ Turn the set screw to adjust as follows.
To INCREASE pressure, turn CLOCKWISE
To DECREASE pressure, turn COUNTER-CLOCKWISE
- ★ One turn of the adjustment screw adjusts the pressure by 6.9 MPa {70 kg/cm²}.
-  Set screw: **Coat 2 or 3 threads with small amount of thread tightener (LT-2)**



17. Winch brake, clutch pressure

Measuring

★ Set the hydraulic oil temperature to 45 – 55°C.

1) Winch clutch pressure

- i) Remove winch clutch hose (1), then install tools **C7** (adapter) and **C1** [gauge: 39.2 MPa {400 kg/cm²}].

• This diagram shows the main winch (installed to the left side of the revolving frame).

The auxiliary winch is installed to the right side.

- ii) Start the engine, set the PTO switch to the "OPERATION 2" position, then set winch clutch lever (2) to the ON position.

- iii) Run the engine at low idling and measure the hydraulic pressure after charging the accumulator.

★ If the set pressure is less than 11.8 MPa {120 kg/cm²}, carry out adjustment.

For details, see ADJUSTING ACCUMULATOR CHARGE VALVE.

2) Winch brake pressure

- i) Remove winch brake hose (1) at the winch brake caliper portion, then install tools **C5** (adapter) and **C1** [gauge: 39.2 MPa {400 kg/cm²}].

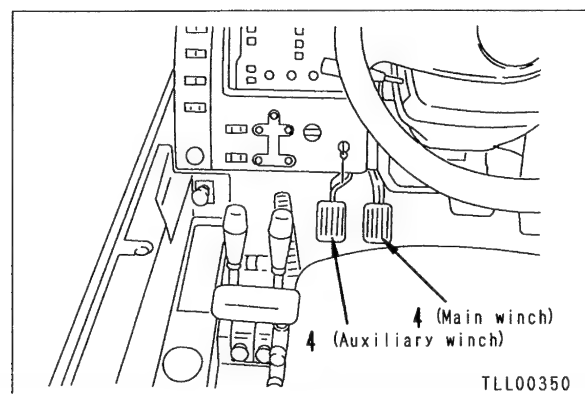
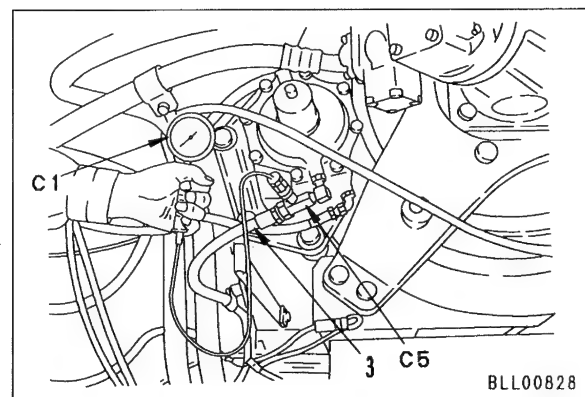
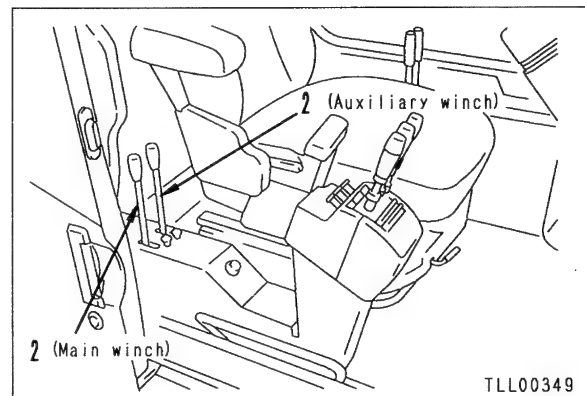
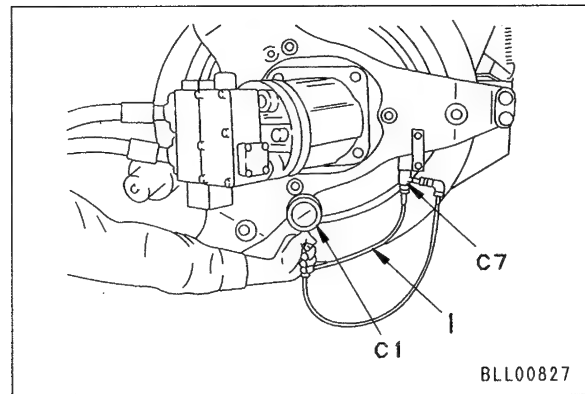
• This diagram shows the main winch (installed to the left side of the revolving frame).

The auxiliary winch is installed to the right side.

- ii) Start the engine, set the PTO switch to the "OPERATION 2" position, then depress winch brake pedal (4).

- iii) Measure the hydraulic pressure when the brake pedal is depressed with an operating effort of 294 N {30 kgf}.

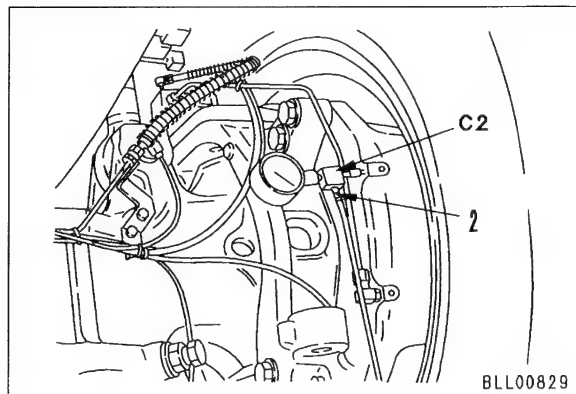
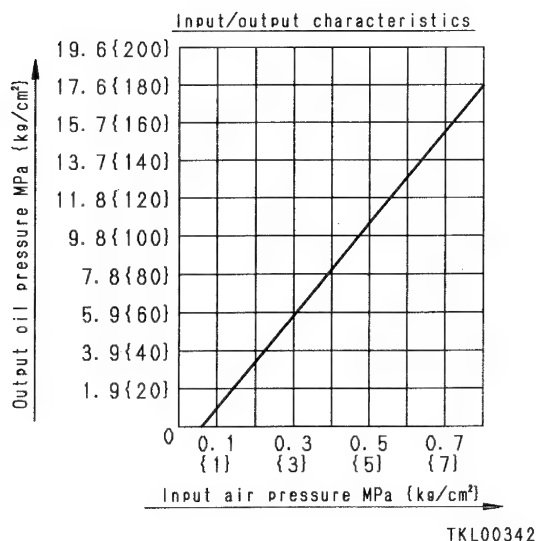
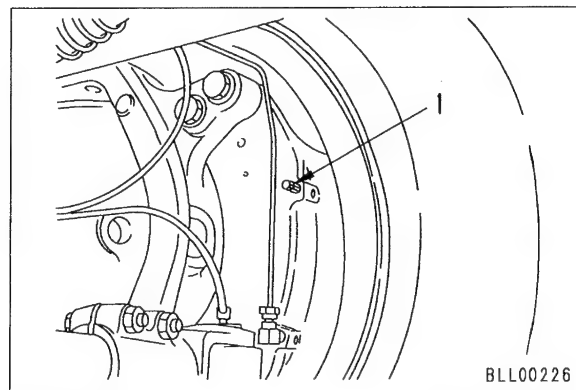
When the operating effort is 294 N {30 kgf}, the brake hydraulic pressure must be at least 6.9 Nm {70 kg/cm²}.



023S02

18. Brake oil pressure (travel)**Measuring**

- 1) Remove bleeder screw (1) and install tool **C2** to the mount.
- 2) Start the engine and bleed the air.
 - ★ Carry out this operation with two workers: one worker depresses the brake pedal and the other worker bleeds the air from bleeder screw (2).
- 3) Depress the brake pedal and measure the front brake and rear brake oil pressure.



- 4) After measuring, stop the engine, loosen bleeder screw (2), lower the pressure, then remove tool **C2**.
 - ★ After completing the operation, bleed the air from the brake circuit again.
 - For details of the input air pressure, see MEASURING AIR PRESSURE.

023S02

MEASURING LEAKAGE OF OIL

★ Hydraulic oil temperature : 45 – 55°C

1. Work equipment cylinder

★ If the hydraulic drift of the work equipment is not within the standard value, measure the amount of leakage inside the cylinder as follows to judge if the cause of the hydraulic drift is in the cylinder or in the control valve.

- If the amount of leakage is within the standard value, the problem is with the control valve.
- If the amount of leakage is not within the standard value, the problem is with the cylinder.

1) Fully extend the rod of the cylinder to be measured, then stop the engine.

2) Disconnect piping (1) at the head end, and block the piping at the chassis end with a blind plug.

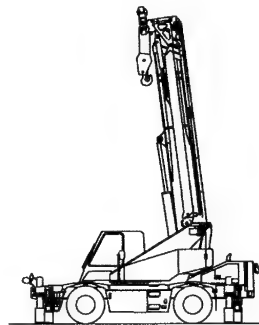


Be careful not to disconnect the piping at the bottom end.

3) Start the engine, then run the engine at high idling and apply the relief pressure to the bottom end of the cylinder.

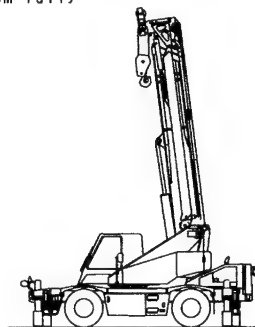
4) Wait for 30 seconds, then measure the amount of oil that leaks during the next minute.

Posture when measuring boom hoist cylinder



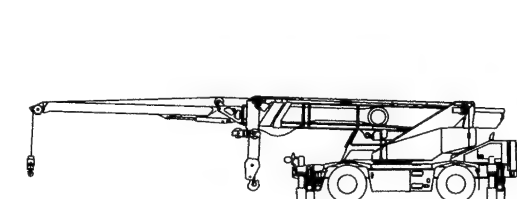
TLL00351

Posture when measuring boom telescope cylinder
Extend boom fully



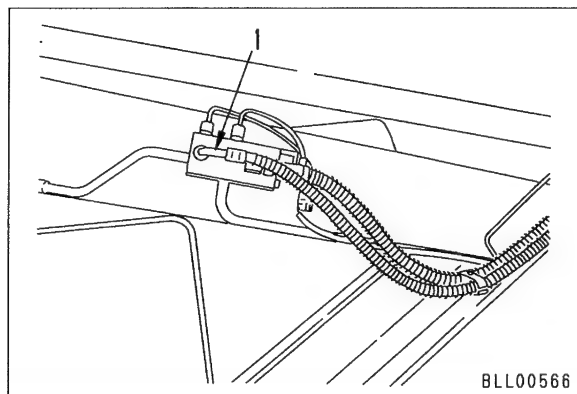
TLL00352

Posture when measuring power tilt cylinder



TLL00353

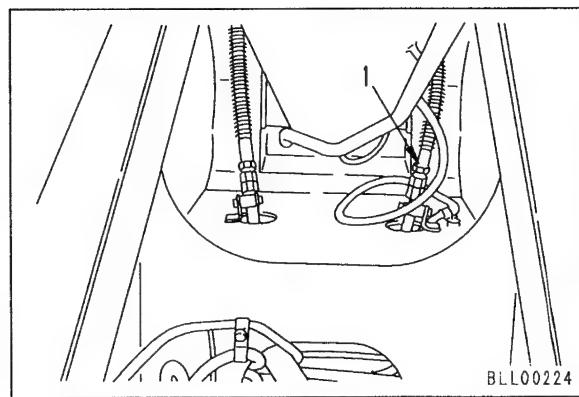
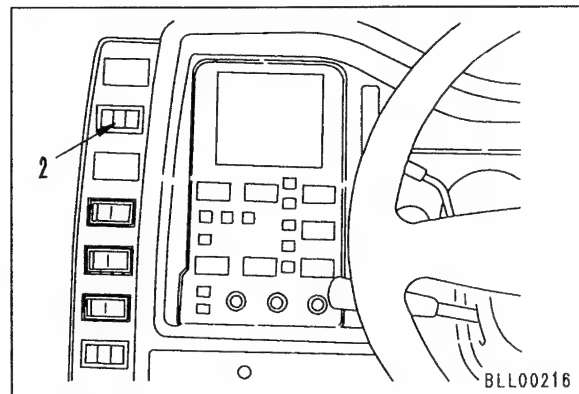
i) Boom hoist cylinder: Operate RAISE



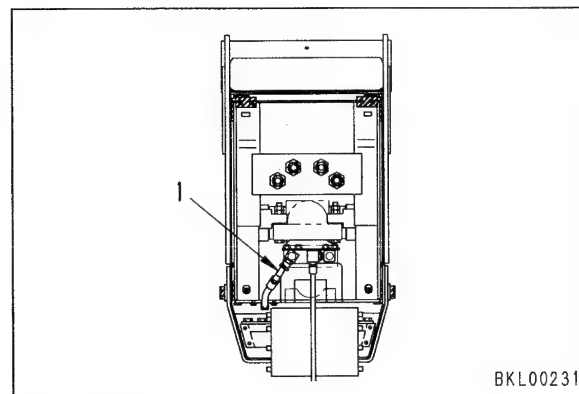
BLL00566

023S02

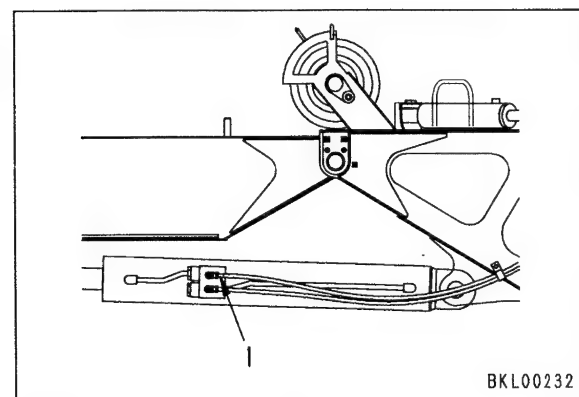
- i) Boom telescope cylinder: Operate EX-TEND
- a. 2nd boom telescope cylinder
 - Set boom select switch (2) to 2ND.



- b. 3rd, 4th, 5th boom telescope cylinder
- Set boom select switch (2) to TOP.

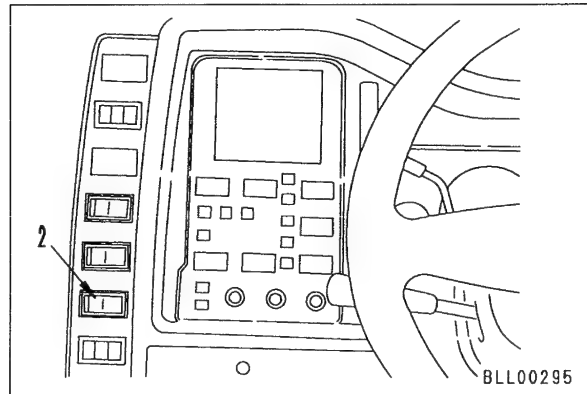
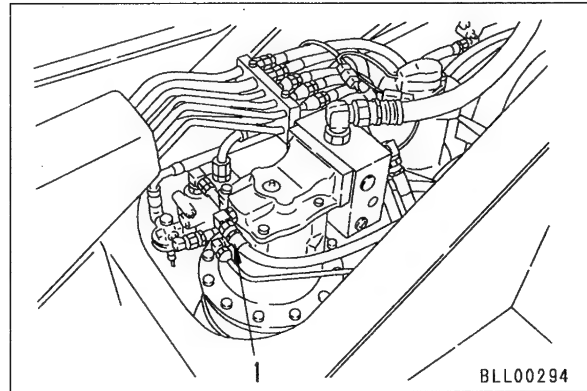


- iii) Power tilt cylinder

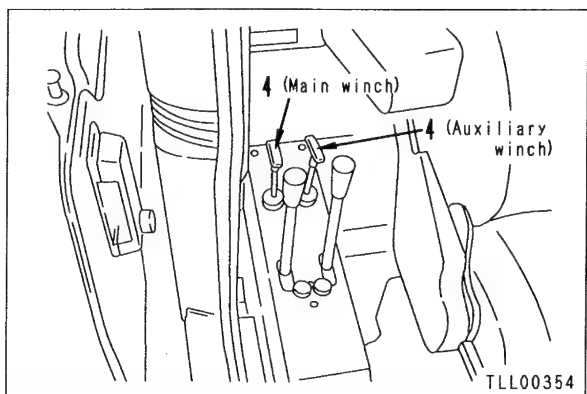
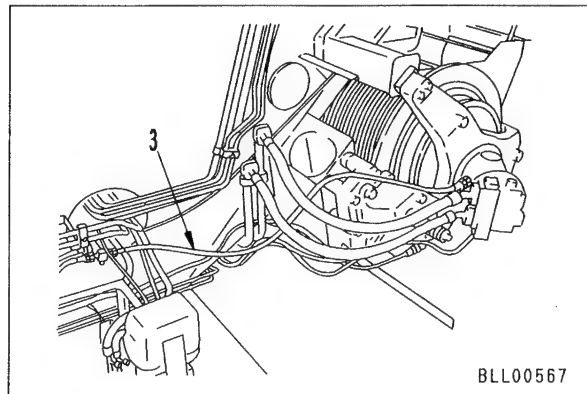


2. Hydraulic motor**1) Swing motor**

- i) Disconnect swing motor drain hose (1) and install a blind plug at the tank end.
 - ii) Set swing brake switch (2) to the ON position.
 - iii) Start the engine, then run the engine at high idling and relieve the swing circuit.
 - iv) Wait for 30 seconds, then measure the amount of oil that leaks during the next minute.
- ★ After measuring once, swing 180° and measure again.

**2) Winch motor**

- i) Disconnect winch motor drain hose (3) and install a blind plug at the tank end.
 - ii) Set winch drum lock lever (4) to the LOCK position.
 - iii) Start the engine, then run the engine at high idling, operate the WIND OUT, and relieve the winch circuit.
 - iv) Wait for 30 seconds, then measure the amount of oil that leaks during the next minute.
- ★ The illustration shows the motor for the main winch. Carry out the same procedure for the auxiliary winch motor.



023S02

PROCEDURE FOR FLUSHING HYDRAULIC OIL

★ To carry out cleaning of the hydraulic oil in the field using the large-sized oil cleaner (790-610-4100), do as follows.

1. Procedure for flushing oil in hydraulic circuit
In the following cases, always carry out oil flushing after completing the operation.

- 1) When the hydraulic oil filter has been replaced or the hydraulic oil has been changed.
- 2) When the piping has been removed to carry out inspection or replacement of parts.

2. Circuits to carry out oil flushing

- 1) Boom hoist cylinder circuit
- 2) Boom telescope cylinder circuit
- 3) Outrigger slide cylinder circuit
- 4) Outrigger jack cylinder circuit
- 5) Jib hoist cylinder circuit (power tilt jib specification machines)
- 6) Steering circuit
- 7) Suspension lock circuit

3. Operation when carrying out replacement work


- 1) For the engine, raise and lower the speed between low idling and 1500 rpm when carrying out the operation.
- 2) Operate the work equipment control levers fully.
- 3) Relieve the circuit at the end of the stroke for 5 seconds.
- 4) Set the work equipment at the front of the machine.
 - Depending on the flushing, the front left is also possible.
 - Before carrying out the flushing operation, bleed the air from the hydraulic circuit.
(For details, see the air bleeding procedure for each hydraulic component.)

4. Procedure when operating work equipment

- 1) Boom hoist cylinder
 - Extend the outriggers fully and set securely in contact with the ground.
 - i) Raise the boom to the maximum height and relieve the circuit for 5 seconds at the end of the stroke.
 - ii) Lower the boom and relieve the circuit for 5 seconds at the end of the stroke.
 - iii) Repeat the operation in Steps i) and ii) 10 times.
- 2) Boom telescope cylinder
 - i) Set the boom angle to 70 – 80°.

- ii) Extend the boom fully and relieve the circuit for 5 seconds at the end of the stroke.

- iii) Retract the boom and relieve the circuit for 5 seconds at the end of the stroke.

 When extending or retracting the boom, operate the winch to adjust the position of the main and auxiliary winch hooks.

- iv) Repeat the operation in Steps ii) – iii) 10 times.

3) Outrigger slide cylinder

- i) Operate with the INDIVIDUAL control.
- ii) Extend the slide cylinder fully and relieve the circuit for 5 seconds at the end of the stroke.

- iii) Retract the slide cylinder fully and relieve the circuit for 5 seconds at the end of the stroke.

- iv) Repeat the operation in Steps i) – iii) 10 times for each outrigger.

4) Outrigger jack cylinder

- Extend the outrigger slide cylinders fully.

- i) Operate with the ALL control.

- ii) Extend the jack cylinders fully and relieve the circuit for 5 seconds at the end of the stroke.

- iii) Retract the jack cylinders fully and relieve the circuit for 5 seconds at the end of the stroke.

- iv) Repeat the operation in Steps ii) – iii) 10 times for each outrigger.

5) Jib hoist cylinder

- Extend the outriggers fully and set securely in contact with the ground.

- i) Raise the jib to the maximum height and relieve the circuit for 5 seconds at the end of the stroke.

- ii) Lower the jib and relieve the circuit for 5 seconds at the end of the stroke.

- iii) Repeat the operation in Steps i) and ii) 10 times.


6) Steering cylinder

- Extend the outriggers fully and set securely in contact with the ground.

- i) Set to 2-wheel steering, operate the steering cylinder to the left and right, and relieve the circuit for 5 seconds at the end of the stroke.

- ii) Switch to 4-wheel drive and repeat the operation in Step i).

- iii) Repeat Steps i) and ii) 10 times.

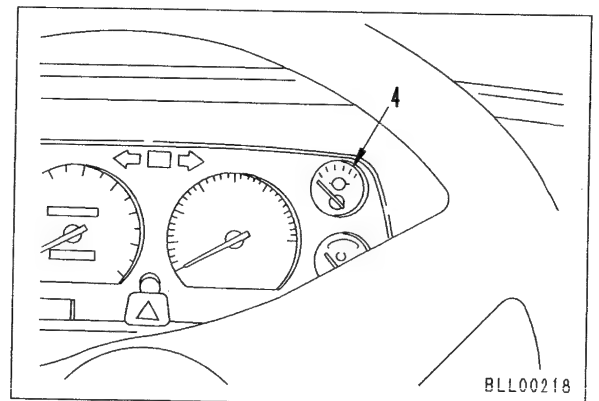
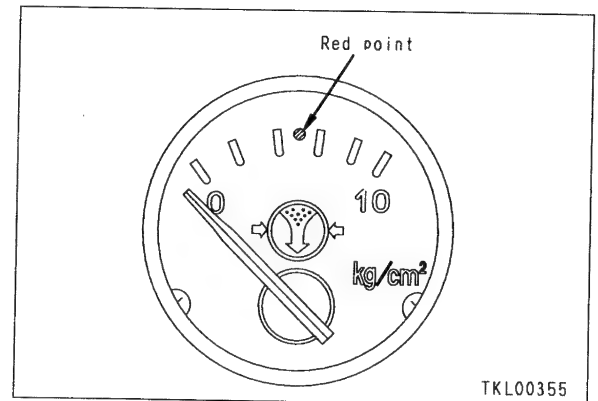
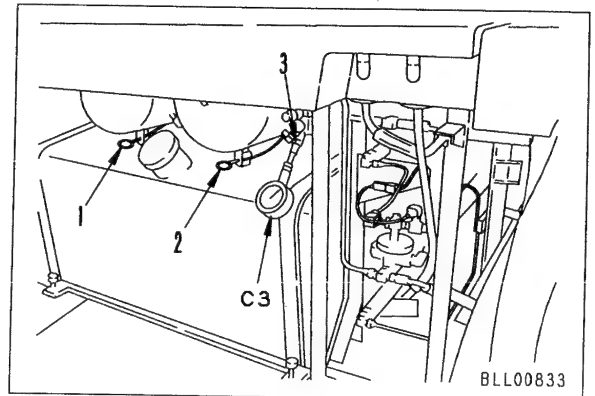
- 7) Suspension lock cylinder
 - Set to on-tire travel.
 - i) Turn the suspension lift switch ON and relieve the circuit for 5 seconds at the end of the stroke.
 - ii) Switch to suspension FREE to cancel the suspension.
 - iii) Repeat Steps i) and ii) 10 times.
 - 8) Repeat Operations 1) to 7) 5 times each.
 - 9) After completing Operations 1) to 8), run the engine at low idling for 30 minutes. (This acts to cool the hydraulic oil.)
5. **Remove the oil cleaner device.**
-  When removing the air cleaner device, be extremely careful not to let dirt or dust get inside the tank.

MEASURING AND ADJUSTING AIR PRESSURE

⚠ Extend the outriggers and set securely so that the machine cannot move.

1. Measuring air charge pressure

- 1) Operate the air tank auxiliary and wet tank drain valve (1), and release the air completely.
- 2) Operate drain valve (2) of the air tank (for front and rear brakes), and release the air completely.
 - ★ After draining the air from one air tank, close the drain valve, then operate the drain valve of the other tank.
- 3) Install tool **C3** [gauge 1.0 MPa {10 kg/cm²} in air tank socket (3).
- 4) Set the starting switch to the ON position, and check that the caution buzzer sounds, the caution lamp lights up, and air pressure gauge indicator (4) points to 0.
- 5) Start the engine and measure the pressure when the buzzer stops.
 - ★ When this happens, check that the indicator on the panel air gauge is above the red point.
- 6) If the above condition is continued, the charging will also continue. Measure the maximum charge pressure when the charging is stopped.
 - ★ When this is done, the meter indicator will start to rise again and will stop near the 0.88 MPa {9 kg/cm²} point.
 - ★ Max. charge pressure:
 $0.86^{+0.01}_{-0.05}$ MPa { $8.8^{+0.1}_{-0.5}$ kg/cm²}
- 7) Depress and release the brake pedal once or twice to lower the pressure inside the tank, and measure the governor set pressure when the charging starts again.
 - ★ Run the engine at high idling when doing this.
 - ★ Governor set pressure:
 $0.74^{+0.01}_{-0.05}$ MPa { $7.6^{+0.1}_{-0.5}$ kg/cm²}



023S02

2. Adjusting governor set pressure

If the governor set pressure is not within the standard value, adjust the governor set pressure as follows.

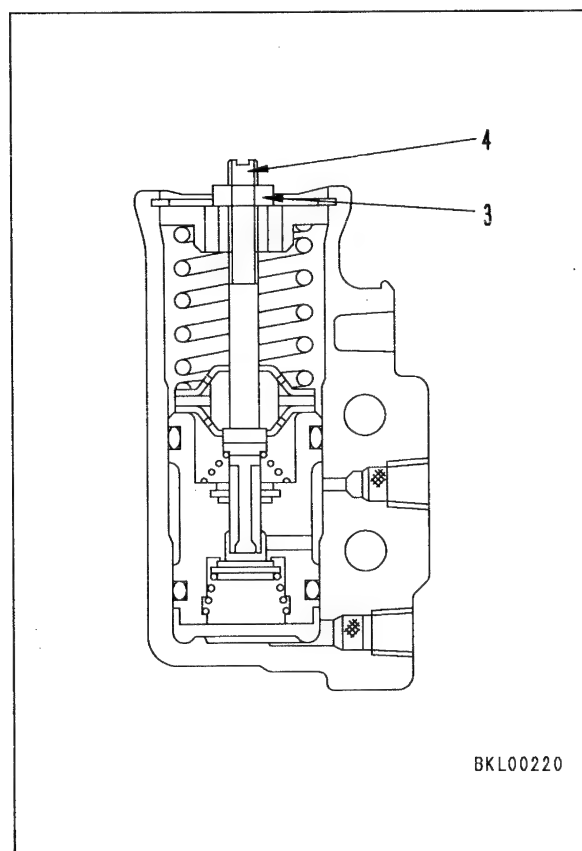
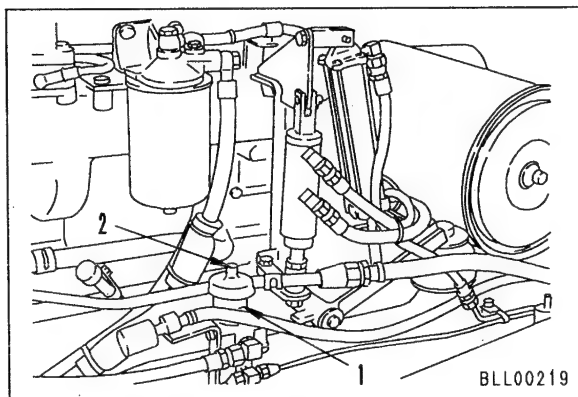
- 1) Remove cover (2) from air governor (1).
- 2) Loosen locknut (3) and adjust with adjustment screw (4).

★ Turn the adjustment screw to adjust the governor set pressure as follows.

To DECREASE pressure, turn CLOCKWISE

To INCREASE pressure, turn COUNTER-CLOCKWISE

- 3) Tighten locknut (3) and install cover (2).

**3. Measuring brake (travel) air pressure**

- 1) Remove front brake pilot hose (1) and install tools **C6** (adapter) and **C3** [gauge 1.0 MPa {10 kg/cm²}].
- 2) Start the engine and raise the air pressure until the air pressure gauge enters the range marked by the arrow.
- 3) Depress the brake pedal and measure the air pressure.

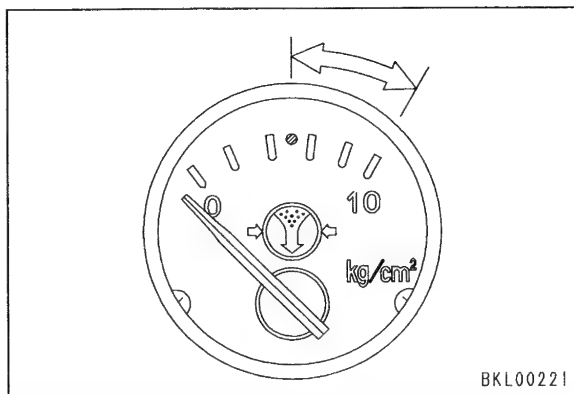
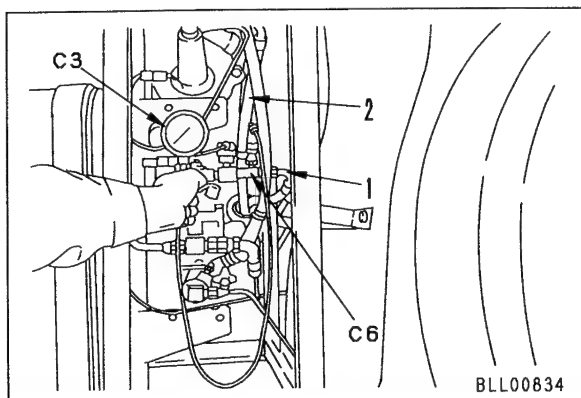
Front air pressure:

0.7 ± 0.03 MPa { 7.4 ± 0.3 kg/cm²}

- ★ When measuring the rear brake pilot pressure, remove hose (2) and carry out the measurement in the same way as for the front air pressure.

Rear air pressure:

0.6 ± 0.03 MPa { 5.9 ± 0.3 kg/cm²}



023S02

BLEEDING AIR

1. Bleeding air from wheel brake

! Extend the outriggers and set securely so that the machine cannot move.

1) Start the engine and raise the air pressure until the air pressure gauge is in the range marked by the arrow.

2) Add brake oil to oil reservoir (1).



Brake oil: **1.6 l (FMVSS DOT-5)**

3) Remove the cap of front brake booster air bleed plug (2), insert a vinyl hose, then insert the other end of the hose in an oil container.

4) Depress the brake pedal, and loosen air bleed plug (2) slowly 1/2 of a turn.

5) Tighten the air bleed plug and release the brake pedal.

6) Repeat Steps 4) and 5), and continue until no more bubbles come out from the air bleed plug.

★ Repeat the same procedure to bleed the air from air bleed plug (3) of the rear brake booster.

7) Repeat the same procedure as when bleeding air from the brake booster, and bleed the air from air bleed plug (4) of the wheel cylinders (front: 2 places on each side; rear: 1 place on each side).

★ While bleeding the air, supply engine oil to the oil reservoir and check that it is always at least half full.

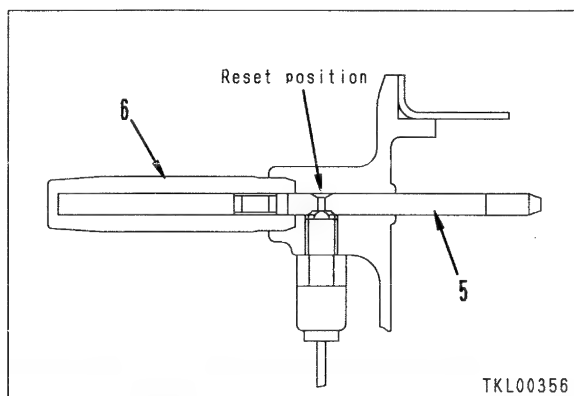
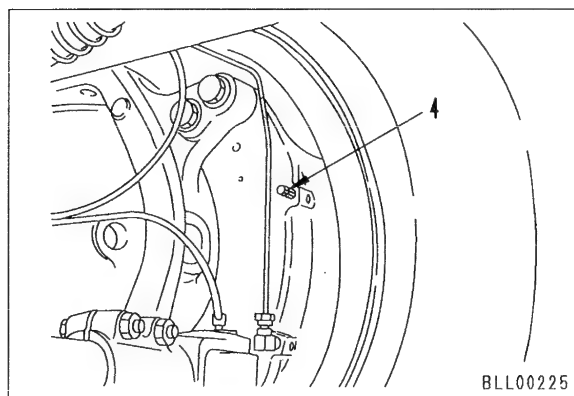
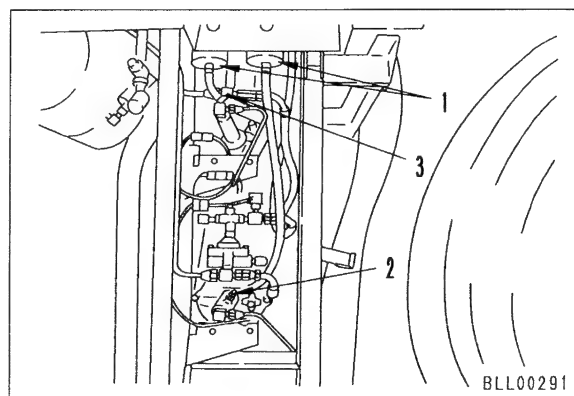
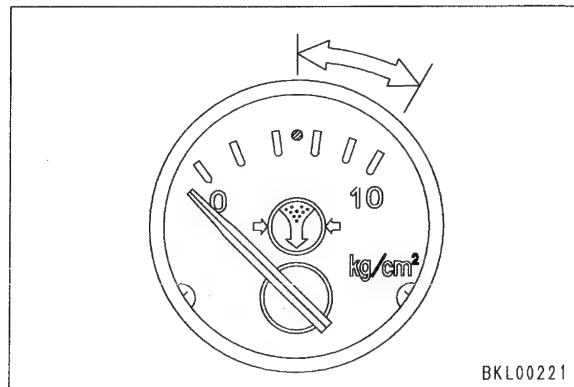
★ Run the engine while bleeding the air, and check that the air pressure gauge is in the range marked by the arrow.

8) Add brake oil to the oil reservoir to the specified level, then install the cap.

9) After completing the air bleeding operation, check that brake stroke sensor (5) of the brake booster is at the reset position, then assemble retainer (6).





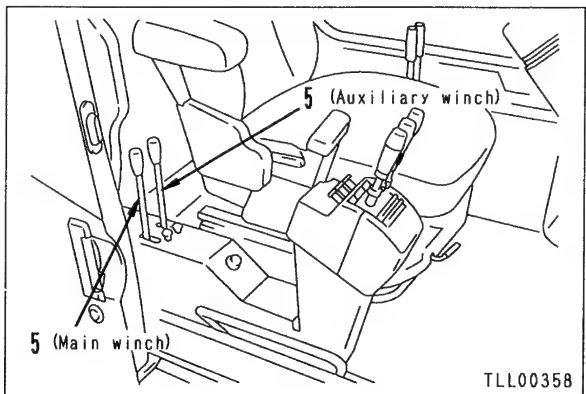
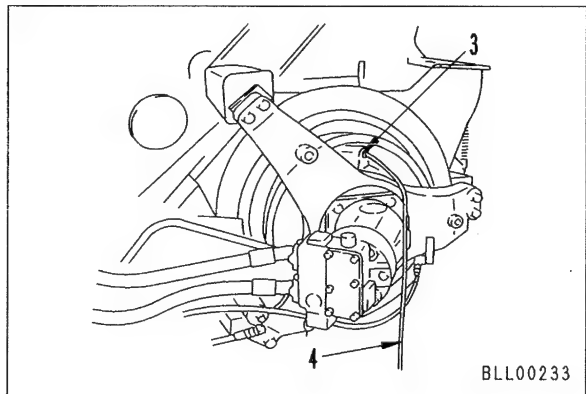
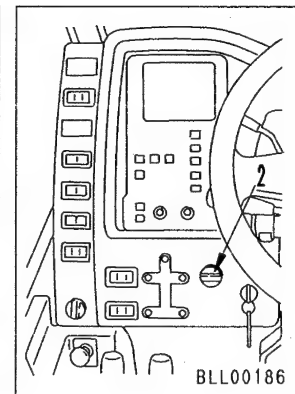
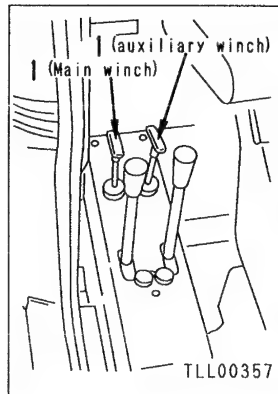
Retainer : **9.8 ± 2 Nm (1.0 ± 0.2 kgm)**



023S02

2. Bleeding air from main, auxiliary winch clutch cylinders

-  Extend the outriggers and set securely so that the machine cannot move, then set the boom horizontal.
-  Set main and auxiliary winch drum locks (1) in the operator's compartment to the LOCK position.
- 1) Start the engine and run at low idling.
- 2) Set PTO switch (2) securely to the "OPERATION 2" position.
- 3) Remove the cap of air bleed plug (3) of the main winch clutch cylinder, insert vinyl hose (4), then insert the other end of the hose in an oil container.
- ★ Use a cloth to prevent oil from getting on the lining.
- 4) Set main winch clutch lever (5) to the ON position, then loosen air bleed plug (3) slowly 1/2 of a turn.
- 5) Tighten the plug and set clutch lever (5) to the OFF position.
- 6) Repeat Steps 4) and 5) until no more bubbles come out from the air bleed plug.
 - Carry out the air bleeding operation for the top and bottom cylinders (2 places).
- 7) Repeat the procedure in Steps 1) – 6) to bleed the air from the auxiliary winch clutch cylinder.



023S02

3. Bleeding air from main, auxiliary winch brake master cylinders

! Extend the outriggers and set securely so that the machine cannot move, then set the boom horizontal.

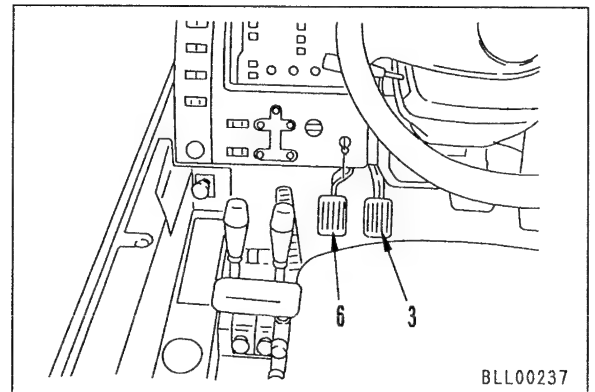
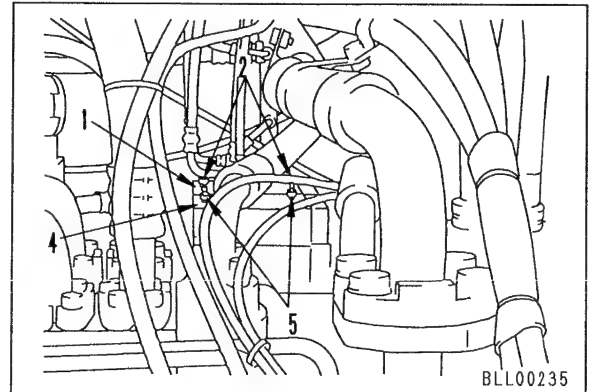
! Swing the revolving frame 90°.

! Set the main and auxiliary winch drum locks in the operator's compartment to the LOCK position.

- 1) Start the engine and run at low idling.
- 2) Set the PTO switch securely to the "OPERATION 2" position.
- 3) Remove the cap of air bleed plug (1) of the main winch clutch cylinder, insert vinyl hose (2), then insert the other end of the hose in an oil container.
- 4) Depress main winch brake pedal (3), then loosen air bleed plug (3) slowly 1/2 of a turn.
- 5) Tighten air bleed plug (2) and release brake pedal (3).
- 6) Repeat Steps 4) and 5) until no more bubbles come out from air bleed plug (2).

★ Bleed the air from the auxiliary winch brake master cylinder in the same way as for the main winch brake master cylinder.
 (4): Auxiliary winch brake master cylinder
 (5): Auxiliary winch air bleed plug
 (6): Auxiliary winch brake pedal

★ If it is difficult to bleed the air, bleed the air from the winch brake cylinder first, then bleed the air from the master cylinder again.

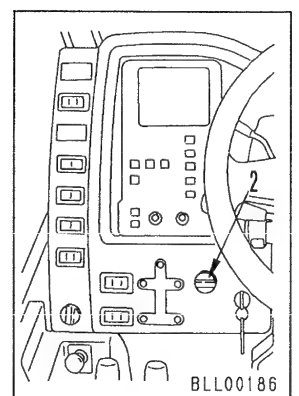
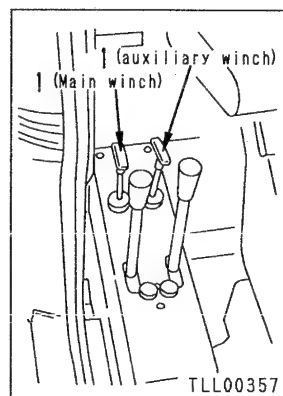


4. Bleeding air from main, auxiliary winch brake cylinders

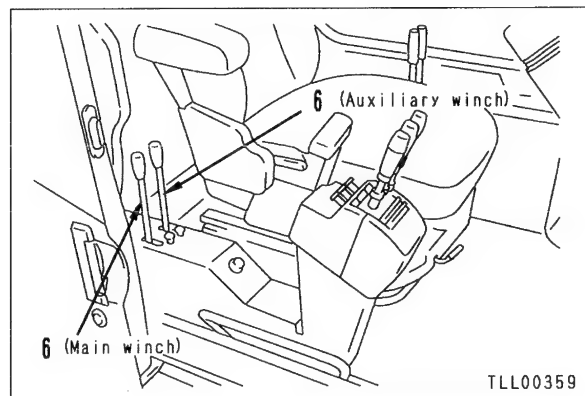
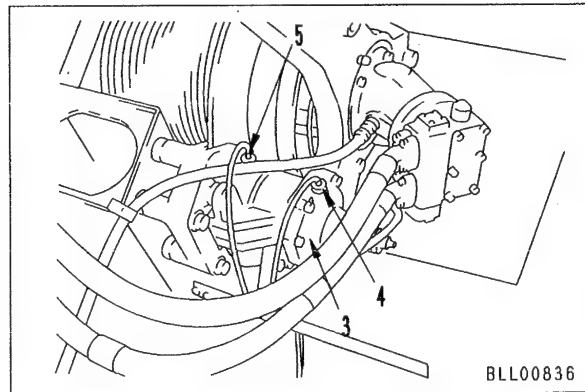
! Extend the outriggers and set securely so that the machine cannot move, then set the boom horizontal.

! Set main and auxiliary winch drum locks (1) in the operator's compartment to the LOCK position.

- 1) Bleeding air from main, auxiliary winch pedal brake cylinders
 - i) Start the engine and run at low idling.
 - ii) Set the PTO switch securely to the "OPERATION 1" position.



- iii) Insert a vinyl hose in air bleed plug (4) of main winch brake cylinder (3), then insert the other end of the hose in an oil container.
 - iv) Depress the main winch brake pedal, then loosen air bleed plug (4) slowly 1/2 of a turn.
 - v) Tighten air bleed plug (4), then release the brake pedal.
 - vi) Repeat Steps iv) and v) until no more bubbles come out from air bleed plug (4).
 - ★ Bleed the air from the auxiliary winch brake cylinder in the same way as for the main winch brake cylinder.
- 2) Bleeding air from main, auxiliary winch automatic brake cancel cylinders
- i) Start the engine and run at low idling.
 - ii) Set the PTO switch securely to the "OPERATION 1" position.
 - iii) Insert a vinyl hose in air bleed plug (5) of main winch brake cylinder (3), then insert the other end of the hose in an oil container.
 - iv) Operate main winch clutch lever (6) to the OFF position to set to the free-fall condition.
 - v) Loosen air bleed plug (5) slowly 1/2 of a turn and let the oil in the cylinder circuit flow out.
 - vi) Tighten air bleed plug (5), then operate clutch lever (6) to the ON position.
 - vii) Repeat Steps iv) and vi) until no more bubbles come out from air bleed plug (5).
 - ★ Bleed the air from the auxiliary winch automatic brake cylinder in the same way as for the main winch automatic brake cylinder.



023S02

5. Bleeding air from boom telescope cylinder

⚠ Extend the outriggers fully and set securely so that the machine cannot move, then swing the revolving frame to face the front and raise the boom 50 – 80°.

⚠ Set swing lock pin (1) to the LOCK position.

★ Carry out the warming-up operation.

1) Start the engine and run at idling for approx. 5 minutes.

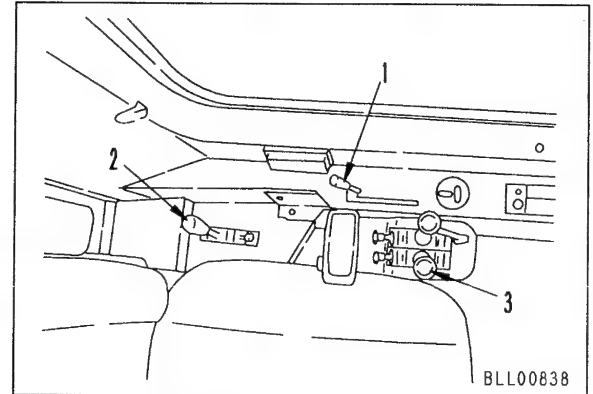
2) Run the engine at low idling and operate boom telescope lever (2) to extend and retract the boom approx. 10 times.

★ Set the boom horizontal, then raise it to 50 – 80°.

★ Move the piston rod to approx. 100 mm before the end of the stroke. Do not relieve the circuit.

3) Run the engine at high idling and repeat the operation in Step 2), then run the engine at low idling and operate the piston rod to the end of the stroke to relieve the circuit.

★ When bleeding the air after replacing the relief valve, measure the relief pressure first.

**6. Bleeding air from boom hoist cylinder**

⚠ Extend the outriggers fully and set securely so that the machine cannot move, then swing the revolving frame to face the front.

⚠ Set the swing lock pin to the LOCK position.

★ Carry out the warming-up operation.

★ For the first time, set the boom horizontal to circulate the oil.

1) Start the engine and run at idling for approx. 5 minutes.

2) Run the engine at low idling and operate boom hoist lever (3) to raise and lower the boom approx. 10 times.

★ Move the piston rod to approx. 100 mm before the end of the stroke. Do not relieve the circuit.

3) Run the engine at high idling and repeat the operation in Step 2), then run the engine at low idling and operate the piston rod to the end of the stroke to relieve the circuit.

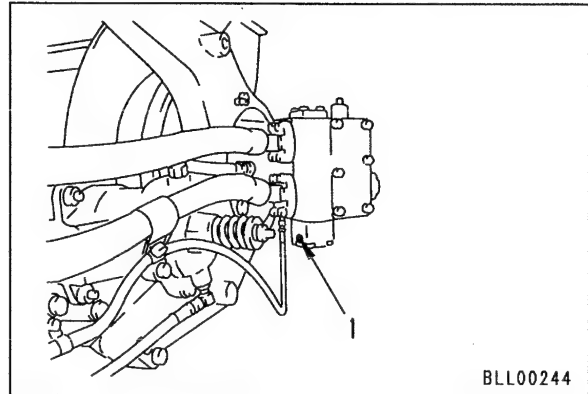
★ When bleeding the air after replacing the relief valve, measure the relief pressure first.

7. Bleeding air from cylinders

Repeat the procedure in Steps 5 and 6 to bleed the air from the cylinders.

8. Bleeding air from winch motor (main, auxiliary motor)

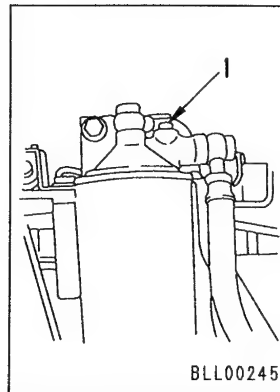
- ⚠ Extend the outriggers and set securely so that the machine cannot move, then swing the revolving frame to face the front.
- ⚠ Set the swing lock pin to the LOCK position.
 - 1) Remove the side cover from the winch motor where the air is to be bled.
 - 2) Set the PTO switch to the "OPERATION 1" or "OPERATION 2" position.
 - 3) Run the engine at low idling, wind in and wind out the hook with no load, then loosen air bleed plug (1) of the winch motor, and bleed the air until no more bubbles come out with the oil.
 - 4) After completely bleeding the air, tighten plug (1).
 - ★ If the piping has been disconnected, always bleed the air.
 - ★ When replacing the winch motor, fill the drain case with hydraulic oil before installing.



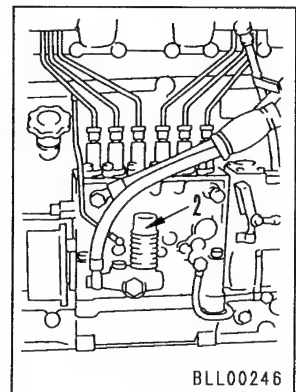
BLL00244

9. Bleeding air from fuel system

- 1) Loosen air bleed plug (1) on the fuel filter, operate priming pump (2), and when no more bubbles come out with the fuel, tighten the plug.
 - 2) Operate the priming pump a further 10 – 15 times to bleed the air from the fuel injection pump.
- ★ There is no air bleed plug installed to the pump. When the priming pump is operated, the check ball inside the joint bolt in the return circuit opens and releases the air to the tank.



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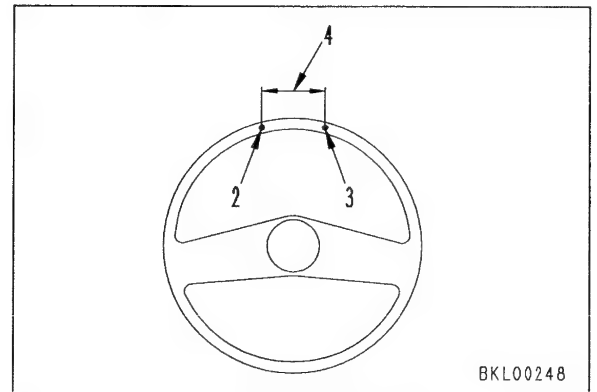
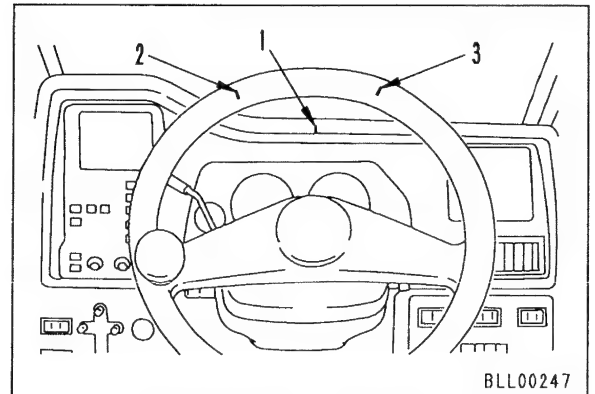
MEASURING STEERING WHEEL PLAY

★ Measurement conditions

- Engine speed: Low idling
- Machine posture: Straight travel

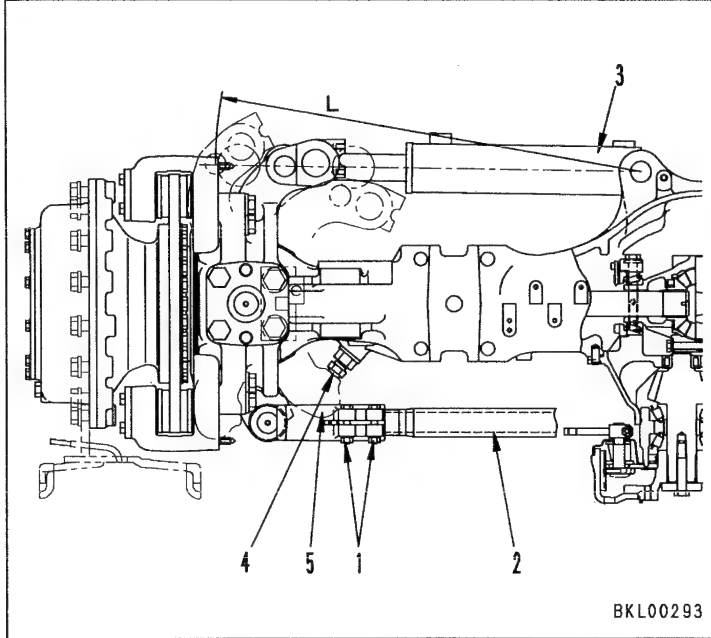
Method of measuring

1. Turn the steering wheel 2 or 3 times lightly to the left and right, confirm the neutral position for the steering mechanism, then make mark (1) on the outside frame of the machine monitor.
2. Turn the steering wheel to the right, and at the point where the wheels start to turn, make mark (2) on the steering wheel in line with mark (1) on the monitor.
3. Turn the steering wheel to the left, and at the point where the steering wheel becomes heavy, make mark (3) on the steering wheel in line with mark (1) on the monitor. Then measure distance (4) between mark (2) and mark (3).



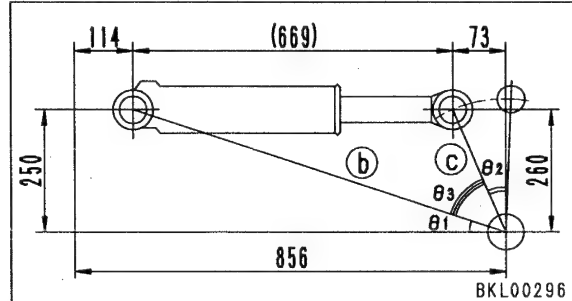
ADJUSTING MINIMUM TURNING RADIUS OF STEERING

- ⚠ Extend the outriggers and set securely so that the machine cannot move.



1. Set the steering mode switch to "4-WHEEL STEERING".
2. Turn the steering to the maximum steering angle.
3. Loosen adjustment bolt (1) and adjust dimension L of cylinder (3) with tie rod (2).
★ Dimension L: 799.0 ± 0.5 mm
⚙️ Adjustment bolt: 113 ± 15 Nm (11.5 ± 1.5 kgm)
4. Tighten stopper bolt (4) so that it is in contact with knuckle (5).
⚙️ Locknut: 927 ± 103 Nm (94.5 ± 10.5 kgm)
5. Repeat the procedure in Steps 3 and 4 to adjust the steering cylinders at the remaining 3 places in the same way.

- ★ Dimension L of steering cylinder
• When traveling straight



$$b = \sqrt{742^2 + 250^2} = 783.0$$

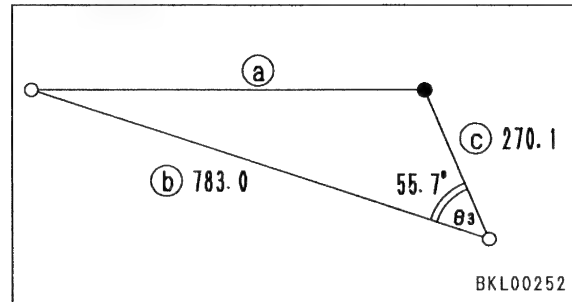
$$c = \sqrt{73^2 + 260^2} = 270.1$$

$$\theta_1 = \tan^{-1} \frac{250}{742} = 18.62^\circ$$

$$\theta_2 = \tan^{-1} \frac{73}{260} = 15.68^\circ$$

$$\theta_3 = 90^\circ - (\theta_1 + \theta_2) = 90^\circ - 34.3^\circ = 55.7^\circ$$

- In case of 0°

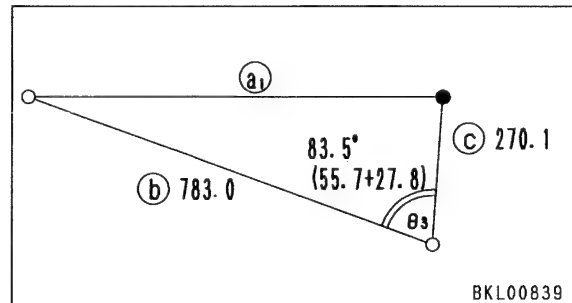


$$a = \sqrt{b^2 + c^2 - 2bc \times \cos \theta_3}$$

$$= \sqrt{783^2 + 270.1^2 - 2 \times 783 \times 270.1 \times \cos 55.7}$$

$$= 669.1$$

- In case of 27.8°



$$a_1 = \sqrt{b^2 + c^2 - 2bc \times \cos \theta_3}$$

$$= \sqrt{783^2 + 270.1^2 - 2 \times 783 \times 270.1 \times \cos 83.5}$$

$$= 789.8$$

TESTING AND ADJUSTING TOE-IN

TESTING TOE-IN

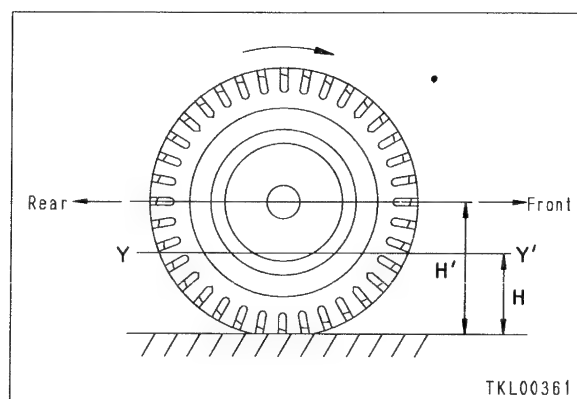
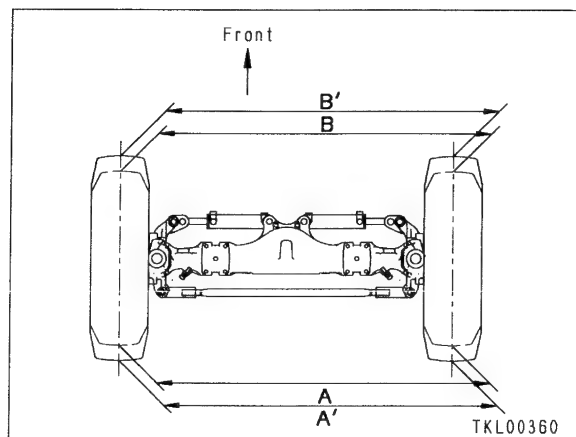
1. Set the wheels facing straight. (When the wheels are facing straight, the fender can be used as a bench mark when carrying out checks.)
2. Use a steel tape to measure distance **A** between the center of the left and right tires at position **Y** (height **H** from the road surface) as close as possible to the axial center of the circumference of the tire.
3. Using the outriggers, raise the wheels from the ground, and rotate in the direction of the arrow. Lower the wheels to the ground and use a steel tape to measure distance **B** between the center of the left and right tires at position **Y'** (height **H** from the road surface).
4. Convert the value (**A - B**) at the center of the axle (height **H'** from the road surface = 628) to (**A' - B'**).

Reference: Method of conversion

$$A' - B' = \frac{R}{\sqrt{R^2 - (H' - H)^2}} \times (A - B)$$


R: Tire radius (= 681)

- ★ Standard toe-in (**A' - B'**): 0 – 8 mm
- ★ If the result of the inspection shows that the toe-in is not within the standard range, adjust as follows.



ADJUSTING TOE-IN

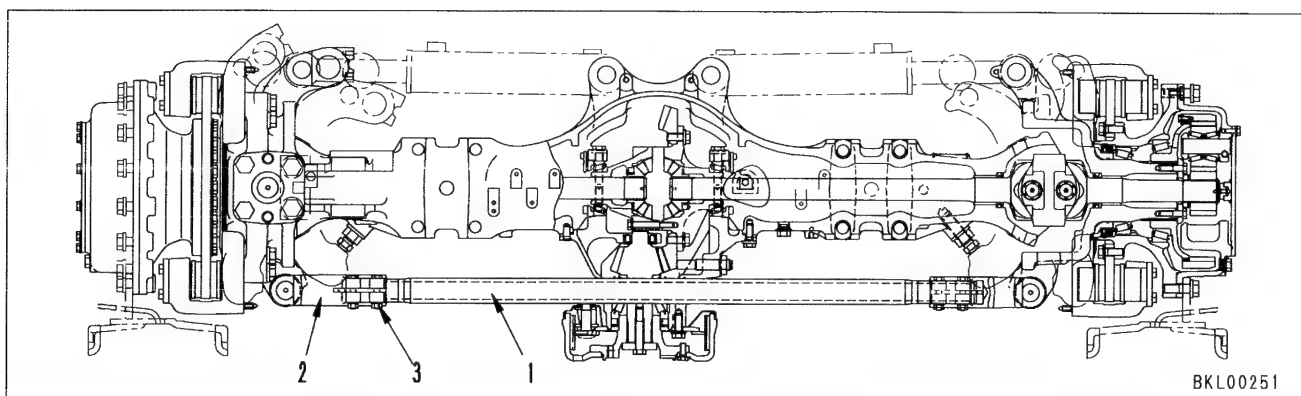
1. Loosen lock bolt (3) of yoke (2) at both ends of tie rod (1).
2. Rotate tie rod (1) to adjust so that the toe-in is within the standard value.

 **kgm** Yoke lock bolt :

113 ± 15 Nm {11.5 ± 1.5 kgm}

- ★ After adjusting the toe-in, check the toe-in again.

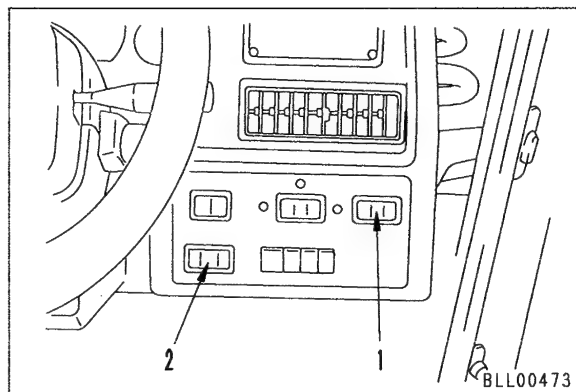
For details, see TESTING TOE-IN.



TESTING AND ADJUSTING PARKING BRAKE EFFECT

TESTING PARKING BRAKE EFFECT

1. Stop the machine on level ground.
2. Set parking brake switch (1) to the ON position, set travel mode selector switch (2) to the high range, and place the gear shift lever at the **D** position.
3. Depress the accelerator pedal, raise the engine speed to 1500 rpm, and check that the machine does not start to move.
 - ★ The test for the parking brake effect places a big load on the drive system, and this causes overload of the transmission and axle, so do not carry out this test more than necessary.
 - ★ If the braking effect is poor, adjust as follows.



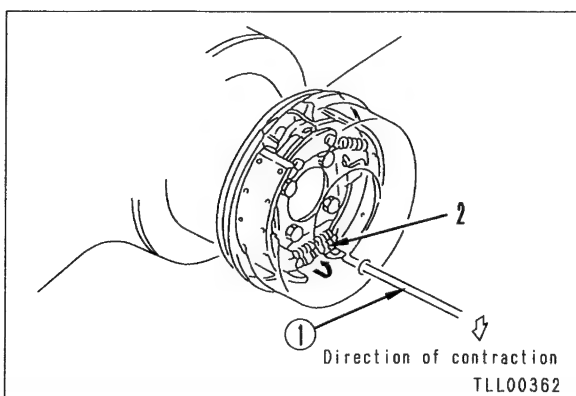
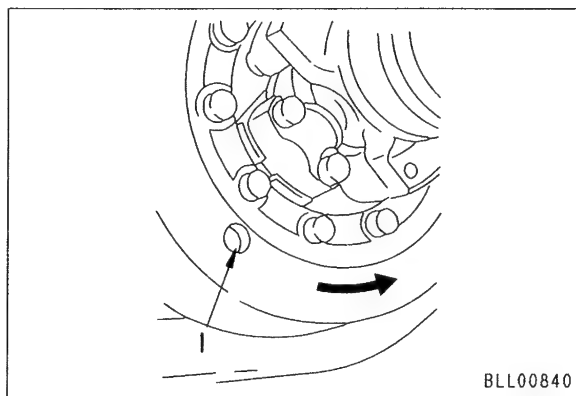
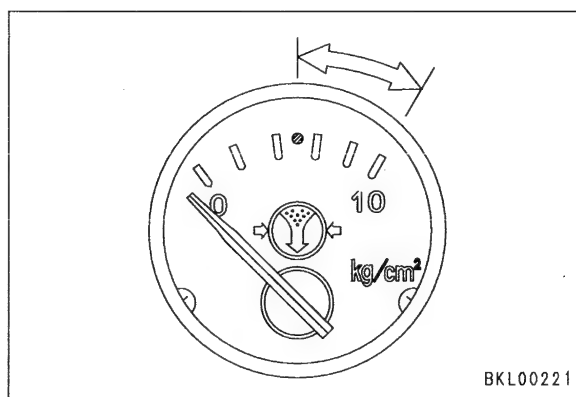
ADJUSTING PARKING BRAKE CLEARANCE

⚠ Extend the outriggers and set securely so that the machine cannot move.

1. Start the engine and raise the air pressure until the air pressure gauge is in the range marked by the arrow.
2. Set the parking brake switch to the OFF position, then rotate the wheel and set so that adjustment hole (1) in the brake drum is approx. 15 mm to the right from a point directly below the center.
3. Insert screwdriver ① into adjustment hole (1) in the brake drum, and turn adjustment screw (2) to expand the shoe and bring the shoe into tight contact with the drum.

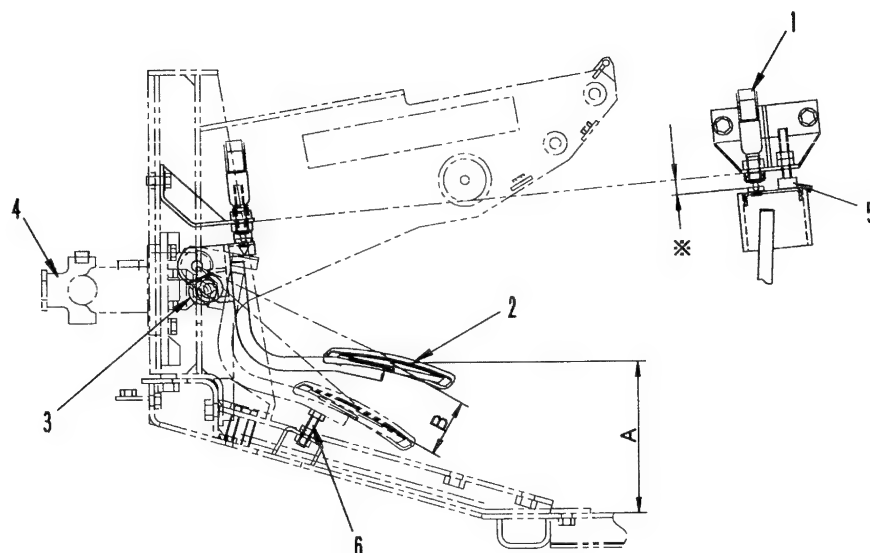
From this condition, turn the adjustment screw back 8 clicks in the direction of contraction.

 - ★ Shoe clearance when this is done: **0.23 mm**
4. After adjusting, rotate the wheel and check that the brakes do not drag.
 - ★ When replacing the parking brake or lining with a new part, the new lining will not fit the drum, and this will cause an extreme drop in the effect of the parking brake. To make the lining fit the drum, always run in the brakes without fail.
 - ★ For details of the procedure for running in the brakes, see the DISASSEMBLY AND ASSEMBLY section of the shop manual (DISASSEMBLY AND ASSEMBLY OF PARKING BRAKE).



023S02

ADJUSTING ENGINE CONTROL (CONTROL IN OPERATOR'S COMPARTMENT)



BKL00841


1. Measuring

- 1) Stop the engine.
- 2) Set accelerator pedal (2) at the low idling position, and measure dimension **A** from the floor.
- 3) Next, depress accelerator pedal (2) to the high idling position and measure amount of movement **B**.

2. Adjusting

- 1) Adjusting low idling
 - i) Tighten low idling detection switch (1) fully.
 - ii) Set so that roller (3) of accelerator pedal (2) is in contact with the plunger of air valve (4). (The point where the pedal becomes heavy when pushed in by hand.)
 - iii) Bring stopper bolt (5) into contact with the plate of pedal (2), then turn back four turns.

Dimension A (Standard mounting dimension): 148 mm


 Locknut:
 $34 \pm 4 \text{ Nm } \{3.2 \pm 0.4 \text{ kgm}\}$

- ★ If the dimension (14 mm) marked * is too large, adjust the plate of pedal (2).
- ★ Check that switch (1) is ON at low idling.

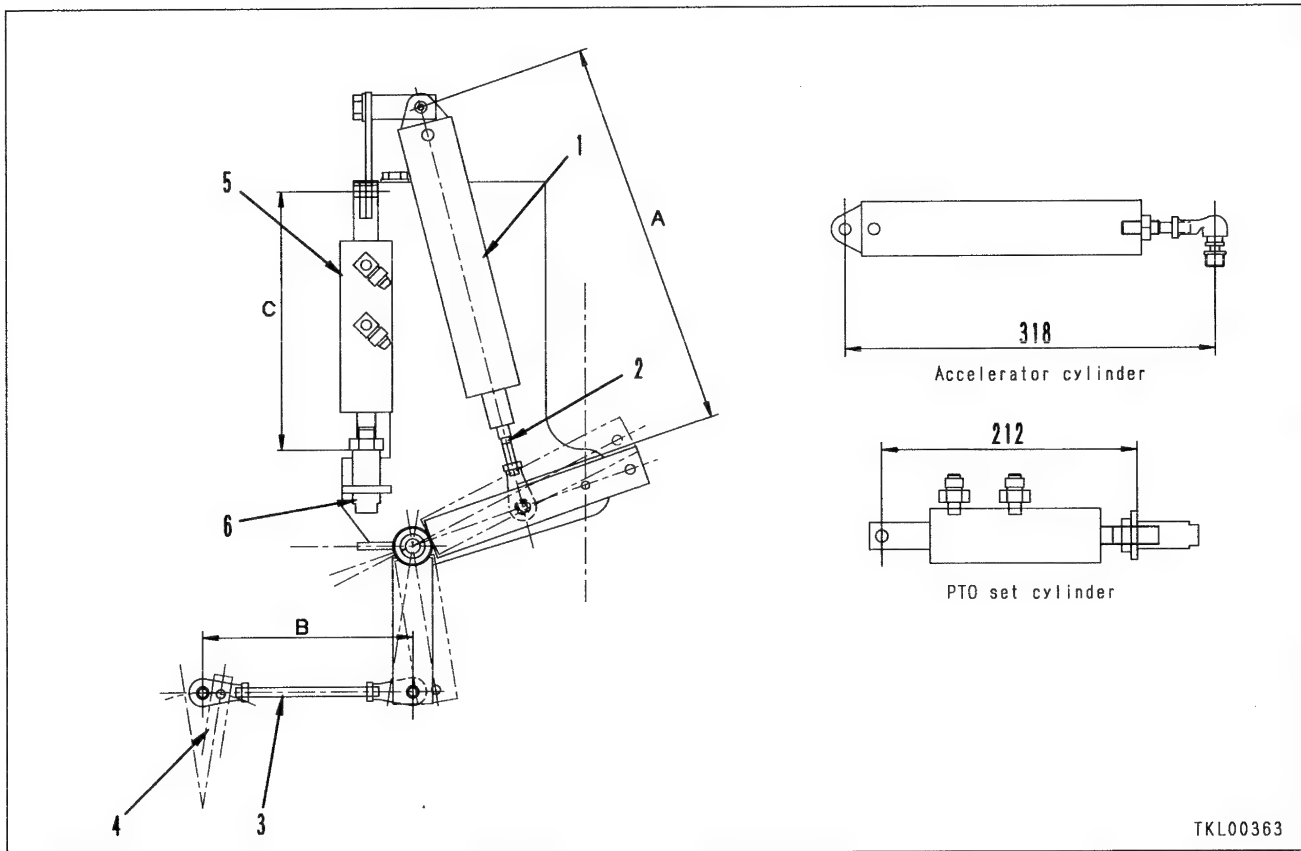
2) Adjusting high idling

- i) Depress accelerator pedal (2) until air valve (4) travels the full stroke (8 mm) to bring stopper bolt (6) into contact.
- ii) Turn stopper bolt (6) back one turn.

Dimension B (Standard movement): 65 mm

 Locknut:
 $34 \pm 4 \text{ Nm } \{3.2 \pm 0.4 \text{ kgm}\}$

ADJUSTING ENGINE CONTROL (CONTROL AT CHASSIS END)



1. Adjusting low idling

- 1) Adjust with rod (2) so that dimension **A** is 318 mm when accelerator cylinder (1) is fully retracted.
- 2) Adjust dimension **B** for the installed length of rod (3) to 170 mm (standard length).
 - ★ Check that engine throttle lever (4) is in contact with the idling stopper. If there is any gap, adjust rod (3).

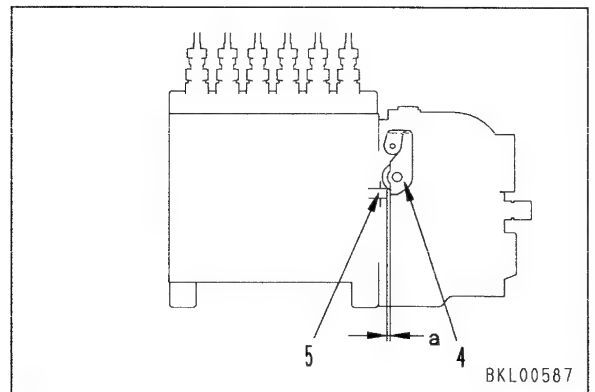
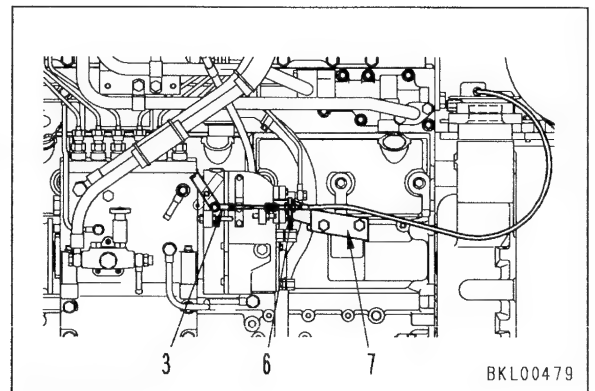
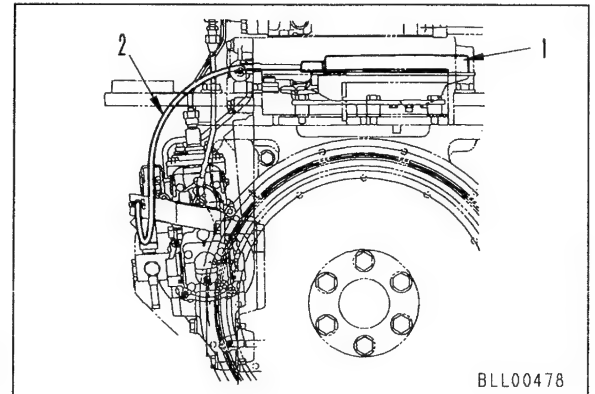
2. Adjusting PTO set cylinder

- 1) Adjust with rod (6) so that dimension **C** is 212 mm when PTO set cylinder (5) is fully retracted.
- 2) Set the engine tachometer in position, then start the engine and turn the PTO switch to "OPERATION 1".
- 3) Adjust rod (6) of PTO set cylinder (5) so that the engine speed is 1790_{-50}^{0} rpm when the engine is running at high idling.

023S02

METHOD FOR ADJUSTING ENGINE STOP MOTOR CABLE

1. Temporarily install ball joint (3) to cable (2) of engine stop motor (1) (screw in fully, then turn back approx. 1/2 turn), then install the ball joint to the stop lever of the injection pump.
2. Pull stop lever (4) of the injection pump by hand to the engine STOP position (no injection of fuel) and temporarily assemble the cable to the bracket. When this is done, temporarily assemble the cable to bracket (7) with locknut (6) at a point where stop lever (4) contacts engine STOP stopper (5).
 - ★ Engine stop motor (1) is at the engine STOP position when cable (2) is pulled.
 - ★ Stop lever (4) of the fuel injection pump is at the RUN position when the lever is free (it is pulled by a spring to the RUN position).
3. Adjust stop lever (4) of the fuel injection pump and STOP stopper (5) at the stop end so that clearance **a** is 1 – 2 mm. Adjust with nut (6) which secures the cable to the bracket or carry out fine adjustment by changing the depth that ball joint (3) is screwed in.



023S02

4. Tighten all nuts and bolts.
5. Turn the engine starting switch repeatedly to the ON and OFF positions, and check that the engine stop motor and cable work smoothly, then carry out the following checks again.

1) Check visually that there is slack in the engine stop motor cable when the engine is running, and that the stop lever of the fuel injection pump has returned fully to the RUN position.

2) Check again that the clearance between the stop lever and stopper at the STOP end is 1 – 2 mm when the engine is stopped.

★ With the engine stop motor, there are built-in limit switches at both ends of the cable stroke.

★ Engine stop motor stroke: 35 mm
Fuel injection pump stop lever stroke: 30 mm

★ When the engine is running, there is slack in the engine stop motor cable, and the RUN position is maintained by the action of a spring (this is frequently built into the fuel injection pump).

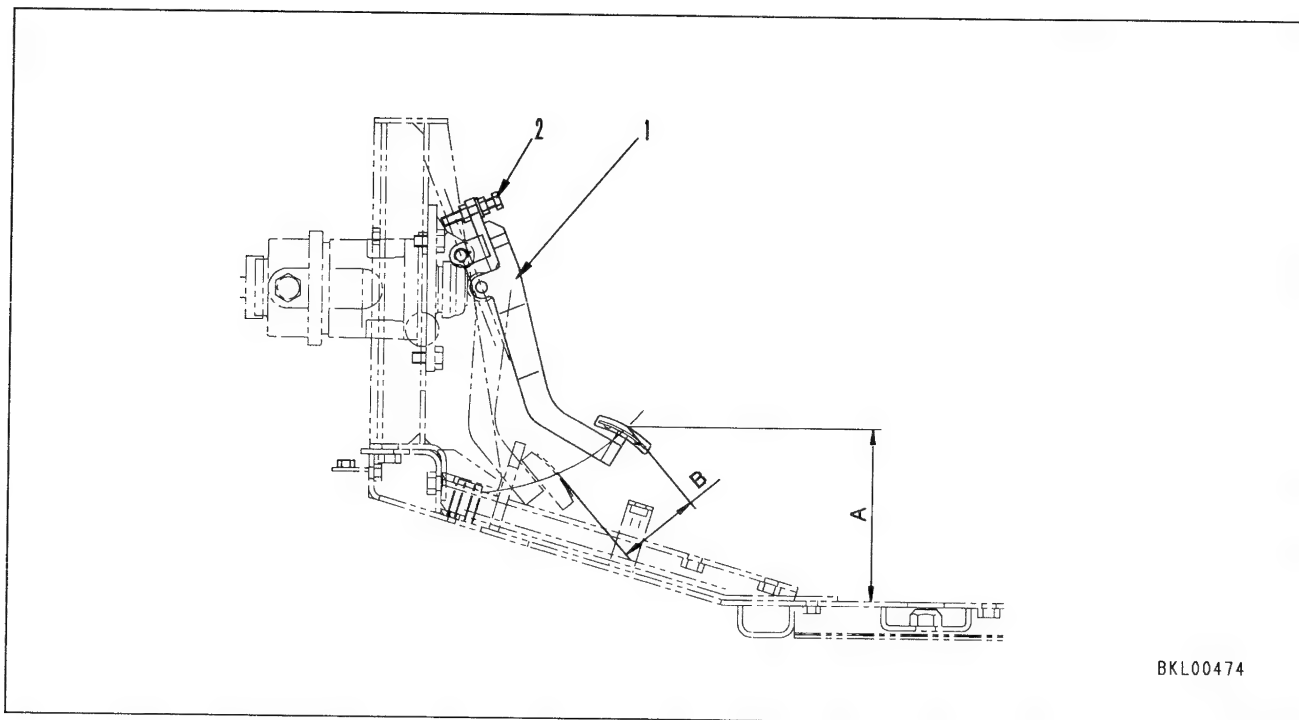
★ There is a loose spring inside the engine stop motor, and this absorbs the error in the stop motor when the engine is stopped.
However, if this is absorbed by the loose spring in the engine stop motor, force is brought to bear on the injection pump, so depending on the machine model, it may not be permissible to use this system.
With such models, there is a danger of problems arising with the injection pump if the clearance between the stop lever and the stopper at the STOP end is set to 0 when the engine is stopped.

★ Problems caused by improper adjustment of engine stop motor cable

• When engine stop motor cable is pulled and clearance between stop lever and STOP stopper is too large	• Engine does not stop
• When cable is free and clearance between stop lever and RUN stopper is too large	• Engine does not give full output because of drop in amount of fuel injected

023S02

ADJUSTING BRAKE PEDAL



1. Measuring

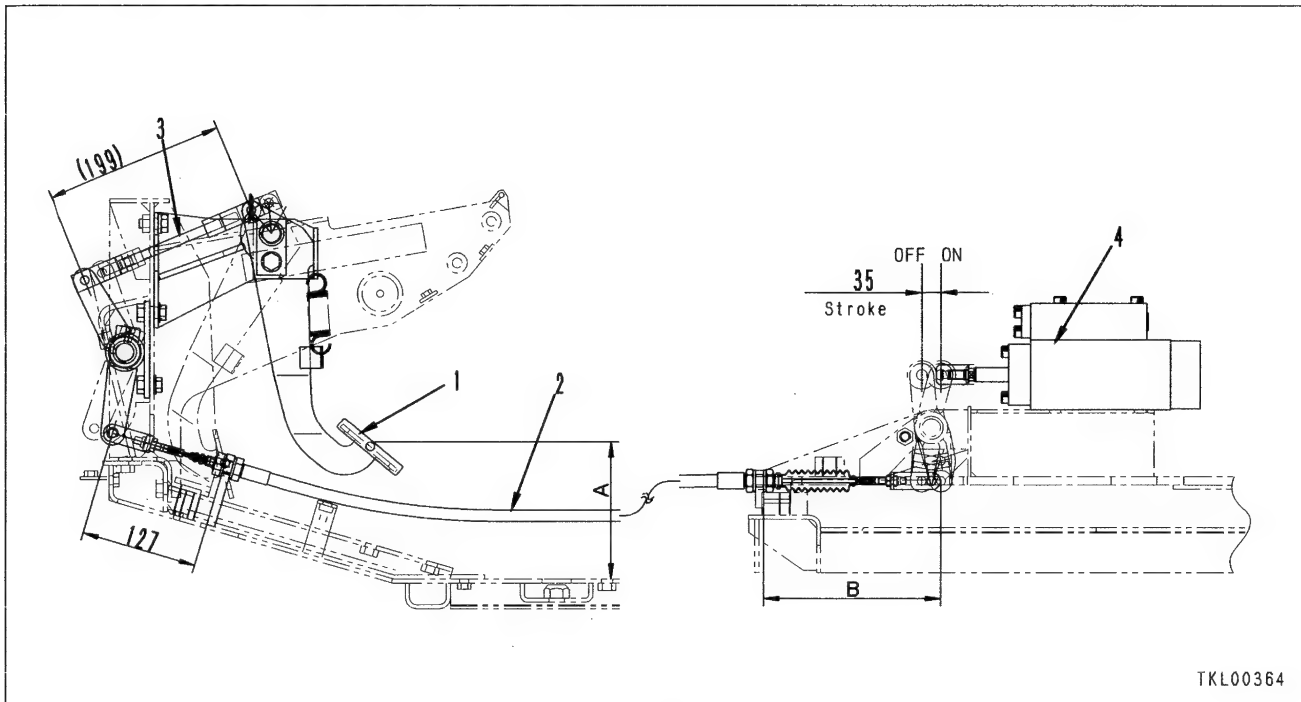
Measure dimension **A** of brake pedal (1) from the floor and dimension **B** for the amount of movement when the brake pedal is depressed fully.

2. Adjusting

Adjust with stopper bolt (2) so that dimension from the floor **A** is 153 mm when brake pedal (1) is under no load. (Maximum travel **B**: 66 mm)

023S02

ADJUSTING WINCH BRAKE



1. Adjusting main, auxiliary winch brake pedal

⚠ Set the main and auxiliary winch drum locks in the operator's compartment to the LOCK position.

1) Measuring

- i) Stop the engine.
- ii) Measure dimension **A** of the brake pedal from the floor and the maximum amount of movement when the brake pedal is depressed.

2) Adjusting

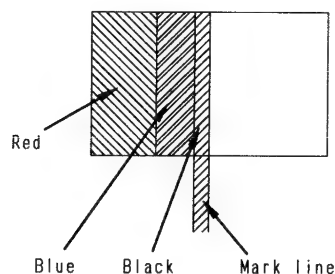
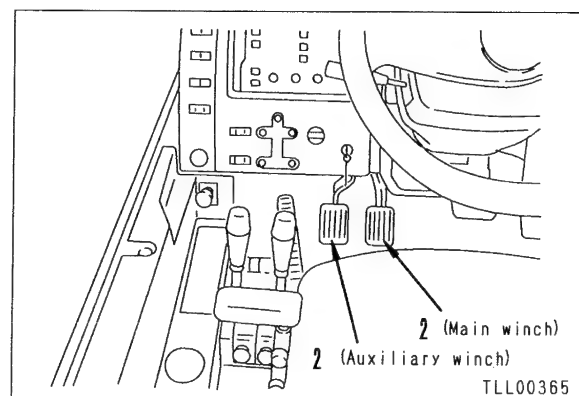
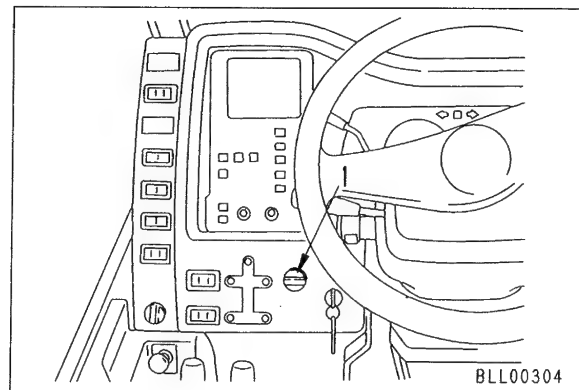
- i) Set the installed length at the pedal end of control cable (2) to 127 mm.
- ii) Adjust rod (3) so that dimension **A** of brake pedal (1) from the floor is 147 mm when there is no load.
- iii) Adjust installed length **B** of control cable (2) so that the maximum travel when master cylinder (4) is used is 35 mm.

023S02

2. Adjusting main, auxiliary winch brake

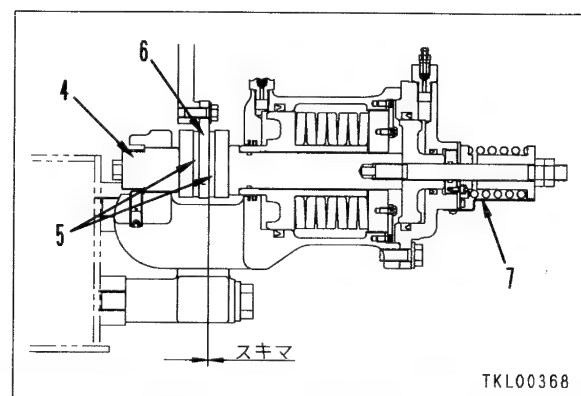
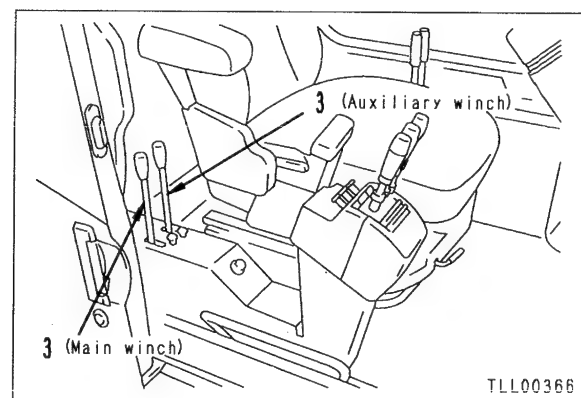
(adjusting brake pad clearance)

- ⚠ Extend the outriggers and set securely so that the machine cannot move, then set the boom horizontal.
- ⚠ Swing the revolving frame 90°.
- ⚠ Set the main and auxiliary winch drum locks in the operator's compartment to the LOCK position.
 - 1) Start the engine and run at low idling.
 - 2) Set PTO switch (1) to the "OPERATION 2" position.
 - 3) Depress winch brake pedal (2), then cancel the brake interlock and set clutch lever (3) to the OFF position.
 - 4) Screw in adjustment screw (4) (turn clockwise) and make the clearance 0 between pad (5) and disc (6).
 - 5) From the condition in Step 4) above, turn adjustment screw (4) back four turns (counter-clockwise) to make a clearance of 0.45 – 0.6 mm between pad (5) and disc (6). (The clearance changes 1.5 mm for one turn (10 clicks) of the adjustment screw.)
 - 6) Set clutch lever (3) to the ON position, then adjust the position of mark plate (7) so that the mark line is within the black range.



TKL00367

- 7) Release the drum lock and check that the winch brake works properly for both the main winch and hydraulic winch.
- 8) Carry out the free-fall operation and check that the hook goes down smoothly.



3. Testing main, auxiliary winch brake effect, procedure for running in

When replacing the brake assembly or pad with a new part, the new pad will not fit the disc, and this will make it impossible to obtain the proper effect from the brake. To make the pad fit the disc, check the braking effect and run in the brake as follows.



Extend the outriggers fully and set securely so that the machine cannot move.

[Procedure for testing braking effect]

- 1) Raise the boom $50^{\circ} - 70^{\circ}$, set the boom to the 1st stage length, then swing 90° .
- 2) Depress the winch brake pedal hard. (Operating effort: Approx. 30 kg)
- 3) In this condition, keep the engine speed at approx. 1000 rpm, slowly wind the winch in, and relieve the winch motor.
Continue this condition for approx. 5 seconds and check that the brake does not slip.
- 4) If the brake slips, run in the brake as follows.

[Procedure for running in brake]

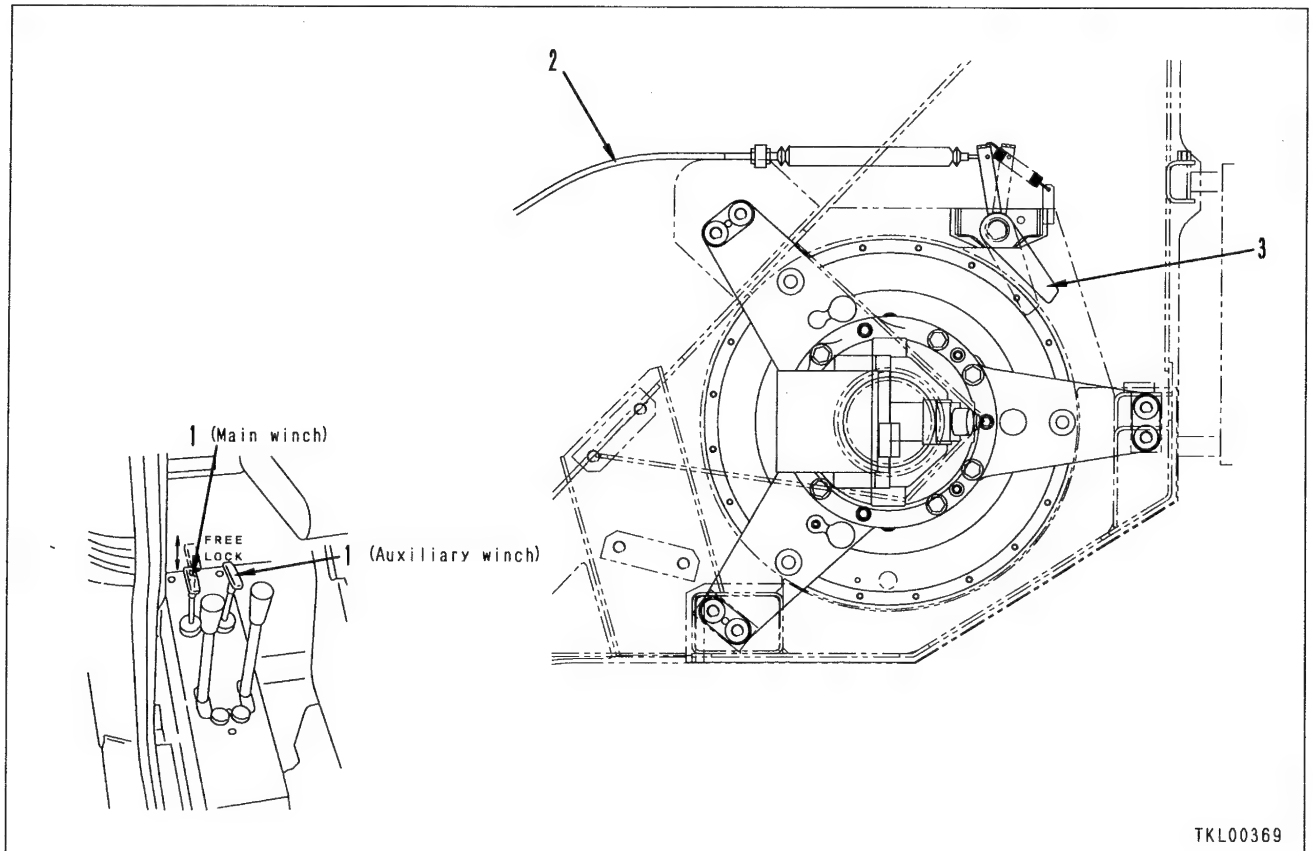
- 1) Raise the boom $70^{\circ} - 80^{\circ}$, extend the boom fully, then swing 90° .
- 2) Depress the accelerator pedal and run the engine at high idling (1790 rpm).
- 3) Keeping the winch brake pedal depressed (operating effort: approx. 10 – 20 kg), wind in the winch to raise the hook from near the ground level to the maximum height.

Take 1 or 2 minutes to carry out this operation.

★ When this operation is carried out, white smoke is given off by the pad, so watch the condition of the white smoke and carry out the operation so that large amounts of white smoke are not generated.

- 4) Let the brake disc cool (leave for approx. 20 minutes), then repeat the procedure to test the braking effect.
- 5) If the braking effect is still not correct, carry out the running-in operation again.

ADJUSTING WINCH DRUM LOCK

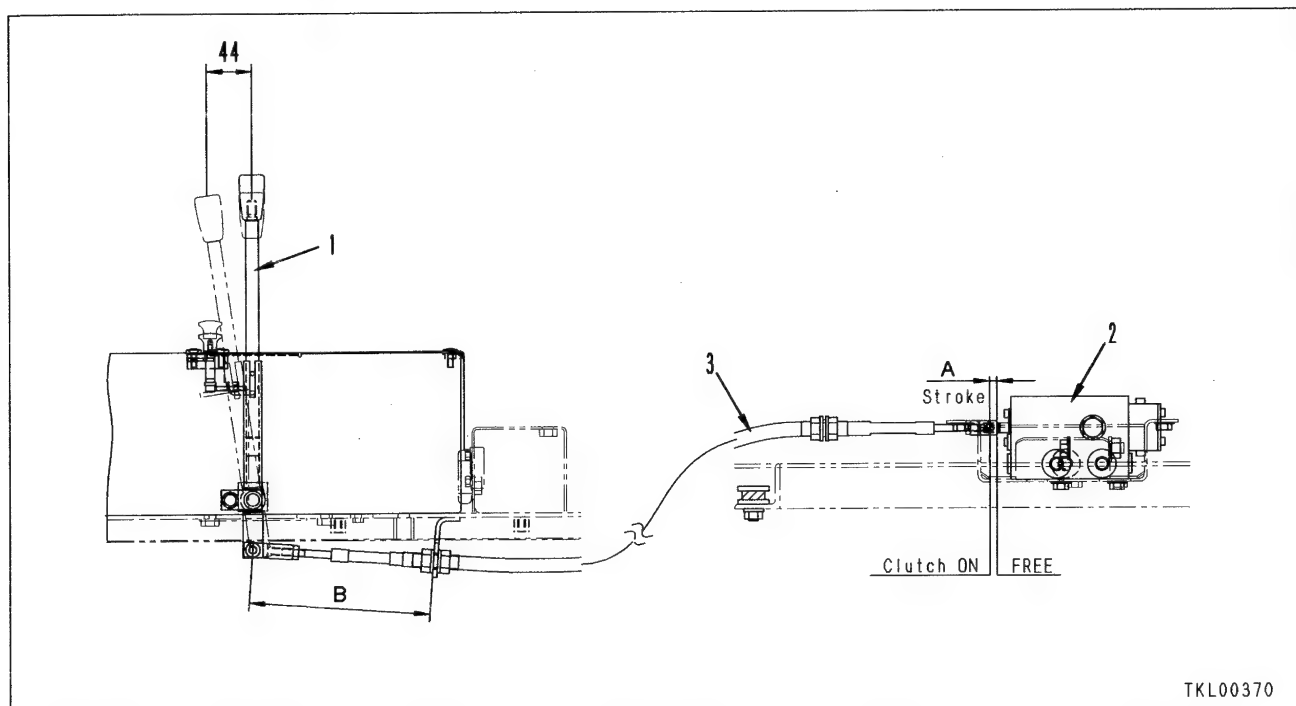


023S02

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- !** Set the winch clutch lever to the ON position.
1. Set drum lock knob (1) to the FREE position.
 2. Push in drum lock control cable (2) fully, then adjust so that the teeth of the drum and lever (3) are meshed securely.
 3. Pull the control cable up 50 mm and check that there is a clearance of at least 25 mm between the teeth of the drum and lever (3).
 4. Pull the control cable up at least 40 mm, and check that the knob is held and that it is canceled when there is 70° rotation to the left.

ADJUSTING MAIN, AUXILIARY WINCH CLUTCH



1. Adjusting main, auxiliary winch clutch lever

! Set the main and auxiliary winch drum locks in the operator's compartment to the LOCK position.

1) Measuring

- i) Turn the starting switch to the ON position.
- ii) With clutch lever (1) at the ON position, measure dimension **A** for the stroke of clutch valve (2) when the travel at the tip of the lever is 45 mm.

★ Keep the winch brake pedal depressed when operating the clutch lever.

2) Adjusting

Adjust installed length **B** of control cable (3) so that the maximum travel **A** when clutch valve (2) is used is 8 mm.

023S02

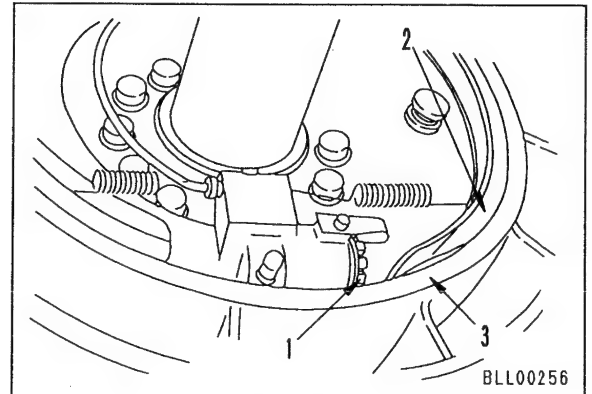
2. Adjusting main, auxiliary winch clutch

⚠ Set the winch drum lock knob to the LOCK position and the clutch lever to the OFF position, and check that the drum is locked securely.

- 1) Turn adjusting wheel (1) of the clutch wheel cylinder so that lining (2) is lightly in contact with drum (3).


★ The clutch shoe expands if it is turned clockwise, as seen from the adjusting wheel end.

- 2) Turn the adjusting wheel back 20 clicks (1 turn) to set the clearance between the drum and the lining to 0.75 mm.
- 3) Use the same procedure to adjust the wheel cylinders at both places.
- 4) After adjusting, operate the clutch and move the lever between ON and OFF 3 or 4 times.
- 5) Remove the drum lock, carry out the free-fall operation, and check that the hook goes down smoothly.



3. Testing main, auxiliary winch clutch effect, procedure for running in

When replacing the clutch assembly or lining with a new part, the new lining will not fit the drum, and this will make it impossible to obtain the proper effect from the clutch. To make the lining fit the drum, check the clutch effect and run in the clutch as follows.

-  Extend the outriggers fully and set securely so that the machine cannot move.

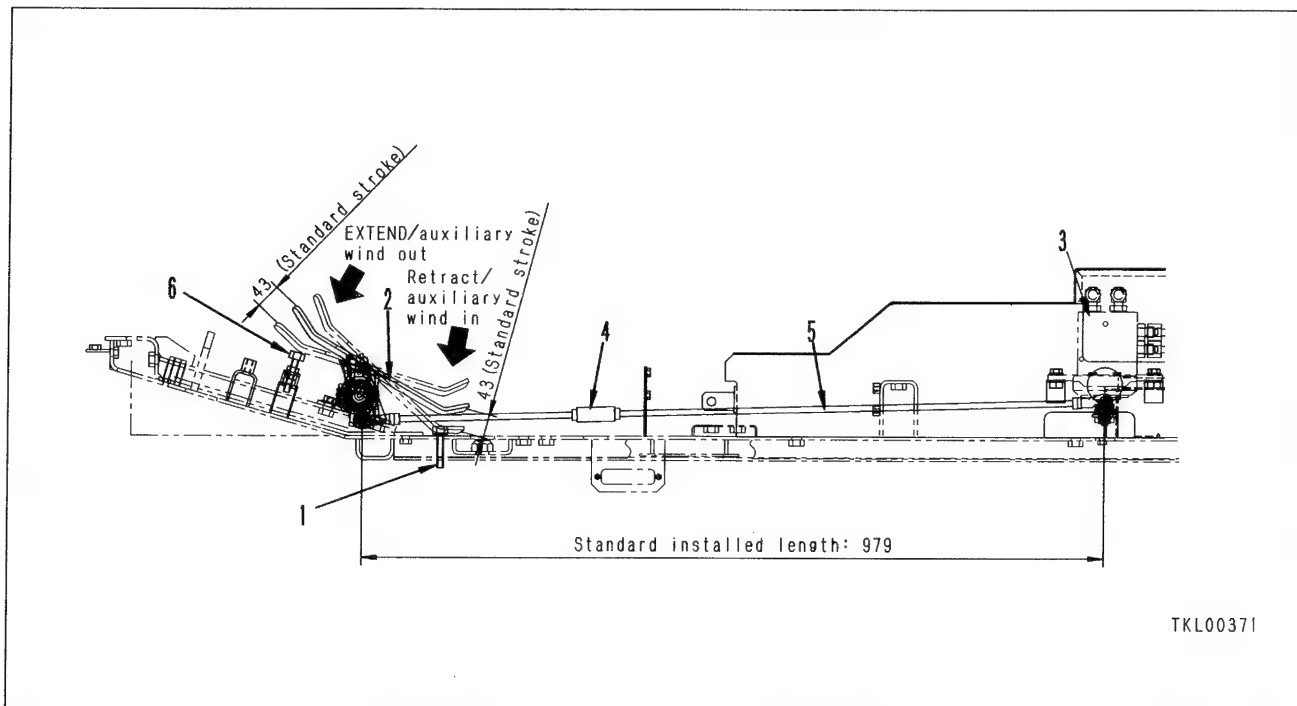
[Procedure for testing clutch effect]

- 1) Raise the boom $50^{\circ} - 70^{\circ}$, set the boom to the 1st stage length, then swing 90° .
- 2) Depress the winch brake pedal hard. (Operating effort: Approx. 30 kg)
- 3) In this condition, keep the engine speed at approx. 1000 rpm, slowly wind the winch in, and relieve the winch motor.
Continue this condition for approx. 5 seconds and check that the clutch does not slip.
- 4) If the clutch slips, run in the clutch as follows.

[Procedure for running in clutch]

- 1) Raise the boom $70^{\circ} - 80^{\circ}$, extend the boom fully, then swing 90° .
- 2) With the hook unloaded, wind in the winch and raise the hook to the maximum height.
- 3) Depress the accelerator pedal and run the engine at high idling (1,790 rpm).
- 4) Keeping the winch brake pedal depressed strongly (operating effort: approx. 20 kg), wind out the winch to lower the hook.
Take 1 or 2 minutes to carry out this operation.
★ When this operation is carried out, white smoke is given off by the lining, so watch the condition of the white smoke and carry out the operation so that large amounts of white smoke are not generated.
- 5) Let the clutch drum cool (leave for approx. 20 minutes), then repeat the procedure to test the clutch effect.
- 6) If the clutch effect is still not correct, carry out the running-in operation again.

ADJUSTING TELESCOPE/AUXILIARY WINCH PEDAL

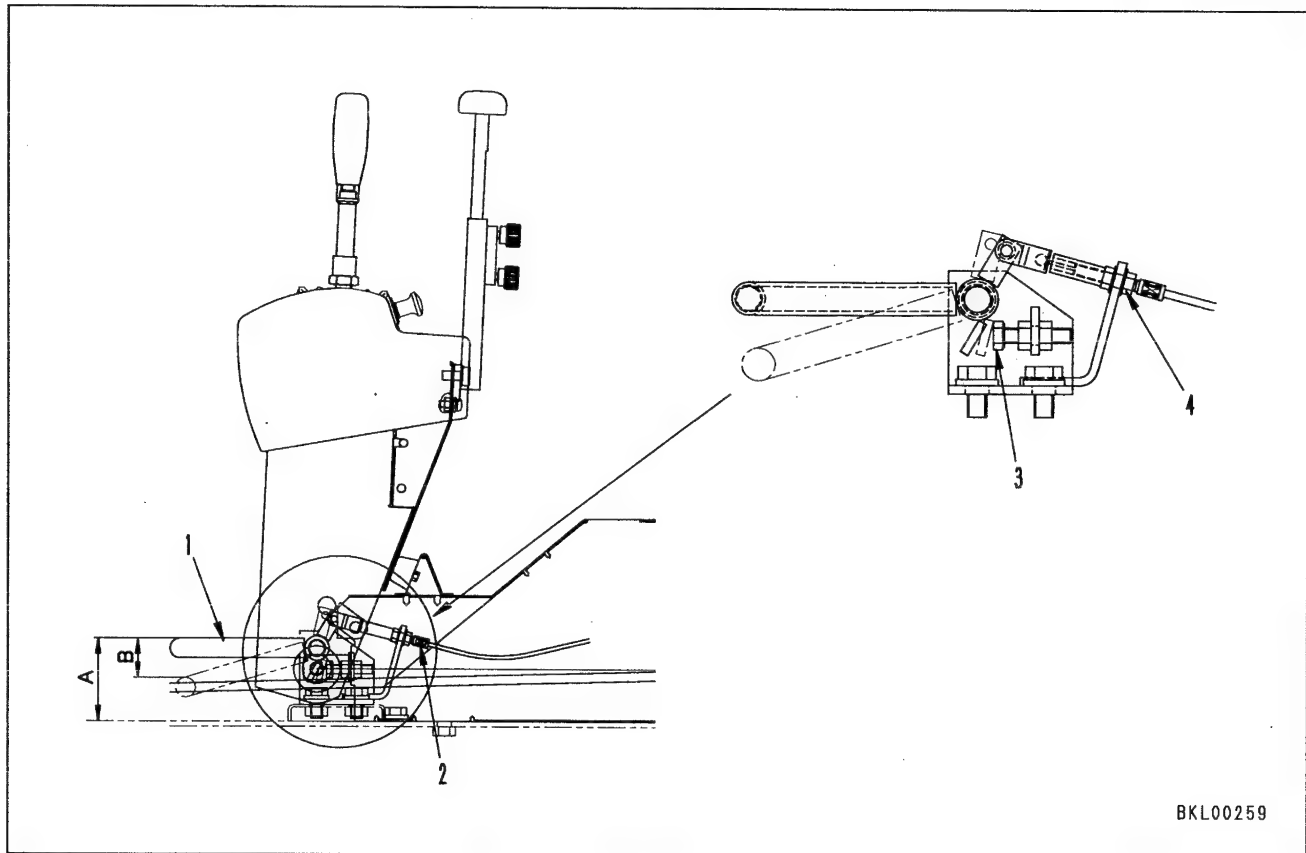


Start the engine and carry out adjustment.

1. Screw in stopper bolt (1) fully to the floor level.
 Bolt: $31 \pm 4 \text{ Nm}$ $\{3.2 \pm 0.4 \text{ kgm}\}$
2. Depress telescope/auxiliary winch pedal (2) until the RETRACT/auxiliary WIND IN end (rear end) contacts lightly at the end of the stroke of PPC valve (3).
3. Rotate turnbuckle (1) to bring the rear surface of pedal (2) into contact with stopper bolt (1), then turn rod (5) one turn in the direction of extension. (Rod mounting length: 979 mm)
 Locknut: $31 \pm 4 \text{ Nm}$ $\{3.2 \pm 0.4 \text{ kgm}\}$
4. Depress pedal (2) until the EXTEND/auxiliary WIND OUT end (front end) contacts lightly at the end of the stroke of PPC valve (3).
5. Put stopper bolt (6) in contact with the rear surface of pedal (2), then turn one turn further in the counterclockwise direction, and tighten with the locknut.
 Locknut: $31 \pm 4 \text{ Nm}$ $\{3.2 \pm 0.4 \text{ kgm}\}$
6. After adjusting stopper bolts (1) and (6), check that pedal (2) cannot be depressed to the end of the stroke valve (3).
 ★ The pedal must be stopped by the stopper bolt, not by the mechanical strength of the valve.

023S02


ADJUSTING LEVER STAND, LOCK LEVER



1. Measuring

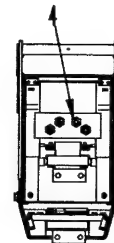
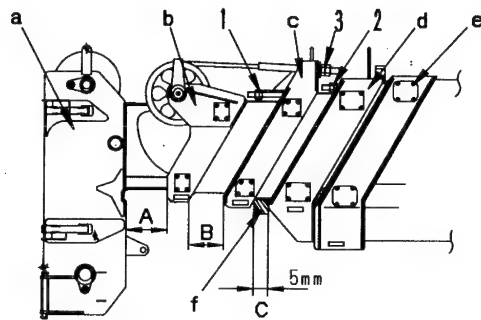
- 1) Stop the engine.
- 2) Measure dimension **A** at the bottom of the stand lock lever and amount of movement **B** when the lever is depressed.

2. Adjusting

- 1) Adjust with adjustment nut (4) of cable (2) so that the height of lock lever (1) is 73 mm from the top surface of the floor frame.
- 2) Adjust so that stopper bolt (3) is in contact at the position where amount of movement **B** of lock lever (1) is 35 mm.
 **kgm** Locknut: $31 \pm 4 \text{ Nm}$ $\{3.2 \pm 0.4 \text{ kgm}\}$
- 3) After carrying out the above adjustment, check that the lever stand moves smoothly when lock lever (1) is depressed.

023S02

ADJUSTING TELESCOPE WIRE ROPE



BKL00309

a : Top boom
 b : 4th boom
 c : 3rd boom
 d : 2nd boom
 e : Base boom

! Extend the outriggers and set securely so that the machine cannot move, then swing the revolving frame to face the front, and set the boom horizontal.

- Start the engine, set the PTO switch to the "OPERATION 1" or "OPERATION 2" position
- Set the boom select switch to the TOP position, then extend the boom to make dimension **A** approx. 300 mm.

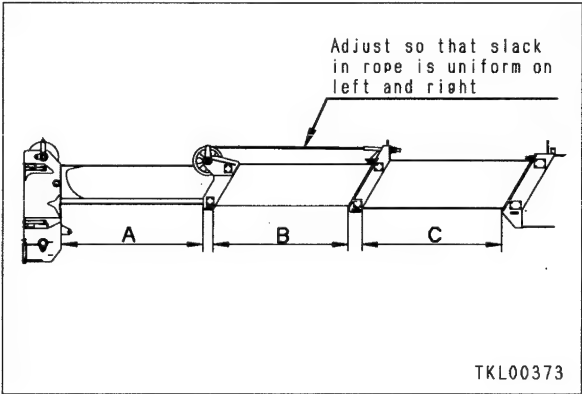
1. Adjusting retraction wire rope

- 1) Insert 5-mm stopper (**f**) between 2nd boom (**d**) and 3rd boom (**c**), then retract the boom. When doing this, make sure that dimensions **A** and **B** are at least 10 mm.
 - ★ Retract the boom slowly.
 - ★ If the clearance at **A** and **B** cannot be maintained, loosen adjustment nuts (1) and (2), then extend the boom and carry out the retraction operation again.
- 2) Tighten top boom retraction adjustment nut (1) and 4th boom retraction adjustment nut (2) so that dimensions **A** and **B** are 0 mm.
- 3) Extend the boom again approx. 300 mm, then retract it slowly, and check that dimension **C** is 5 mm when dimensions **A** and **B** are 0 mm.
 - ★ Repeat this operation 5 – 6 times to check, then tighten the locknut.

023S02

- Check the mounting dimensions of the wire rope before starting adjustment.

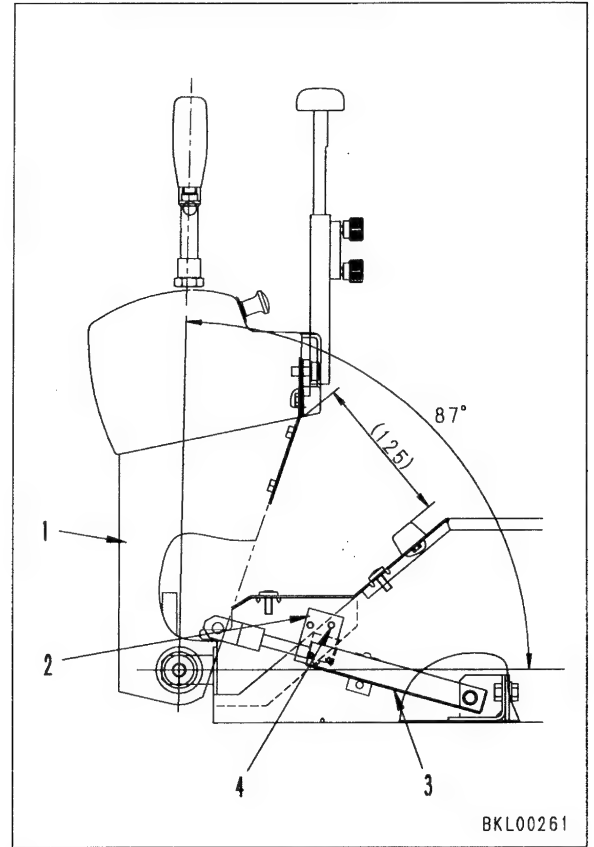
- 1) Retract the boom fully.
- 2) Tighten top boom extension adjustment nut (2) and 4th boom extension adjustment nut (4), and stop just before each boom starts to extend.
 - ★ Always adjust to the same setting on the left and right.
- 3) Fully extend the top, 4th, and 3rd booms, then retract the 3rd boom approx. 50 mm.
 - ★ By retracting the 3rd boom approx. 50 mm, the slack of the extension wire is at its maximum.
- 4) Tighten adjustment nut (3), and adjust the slack of the extension wire rope to 100 - 130 mm at the mid point of the 4th boom.
 - ★ Always adjust to the same setting on the left and right.
- 5) Tighten the locknut, then extend and retract the boom several times.
- 6) Adjust uniformly on the left and right using boom extension adjustment nuts (3) and (4) so that the difference in the extension of each boom when the boom is fully extended is $(B - A) = 0 - 5 \text{ mm}$, and $(C - B) = 0 - 5 \text{ mm}$.
 - ★ When adjusting, loosen the locknut before tightening the adjustment nut.
- 7) If the clearance is not $0 - 5 \text{ mm}$, adjust again with the slack in the extension cable within 100 - 130 mm.
 - ★ $B < A$: Loosen the wire rope.
 $C < B$: Loosen the wire rope.
 $B - A = \text{more than } 5 \text{ mm}$:
 Tighten the wire rope.
 $C - B = \text{more than } 5 \text{ mm}$:
 Tighten the wire rope.
- 8) Extend and retract the boom several times and check that the dimensions are the specified value.



ADJUSTING LIMIT SWITCH

1. Lever stand PTO switch (installed on right side)

- 1) Set lever stand (1) to 87°.
- 2) Move switch assembly (2) to the position where the switch contacts plate (3) and is turned ON, then tighten screw (4).
- 3) Move lever stand (1) and check that the PTO switch is turned OFF securely when the installed angle is less than 87°.



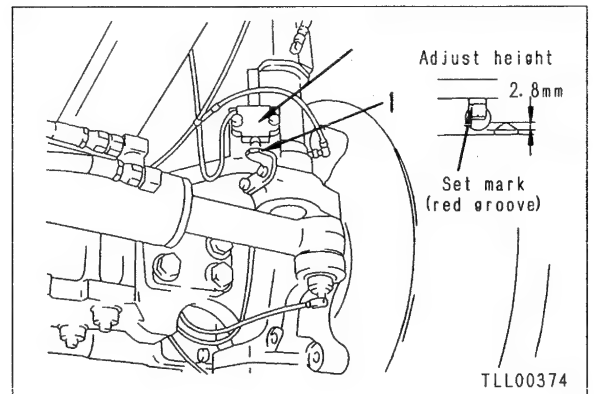
2. Rear steering CENTER detection switch



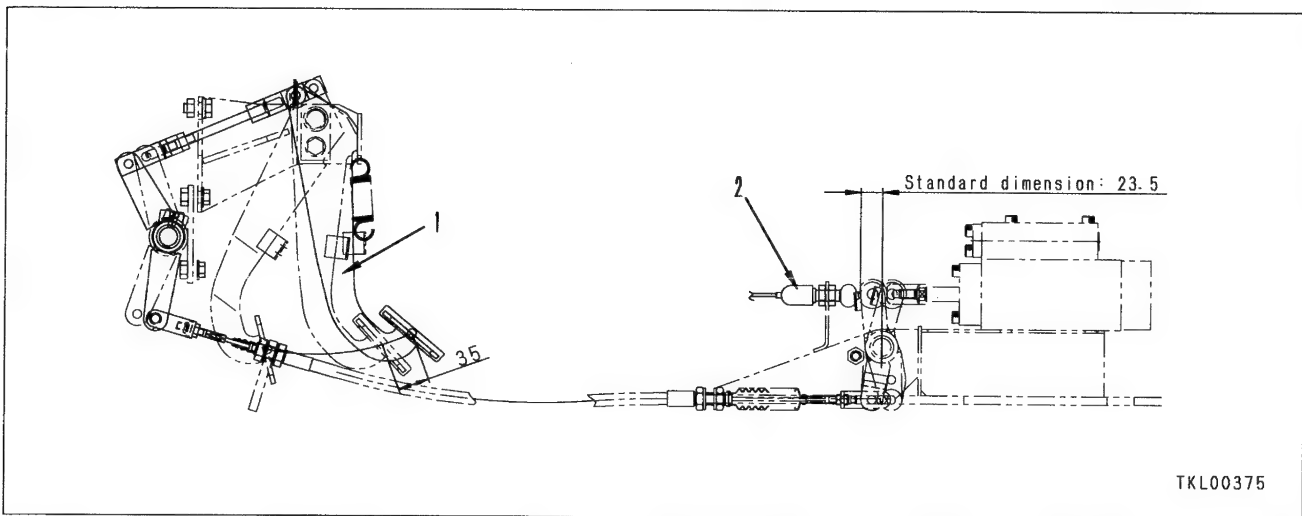
Extend the outriggers and set securely so that the machine cannot move.

- 1) Set the steering to the neutral position and apply the steering lock.
- 2) Install limit switch (2) temporarily so that the roller of the limit switch is pushed in by the top end of CENTER detection cam (1).
- 3) Release the steering lock, operate the steering, and fix in position so that the amount of movement of the roller of limit switch (2) is 2.8 ± 0.2 mm.

- ★ Move up and down to adjust so that the set mark (red groove) of the limit switch is at the same position as the end face of the switch holder when the switch is ON.




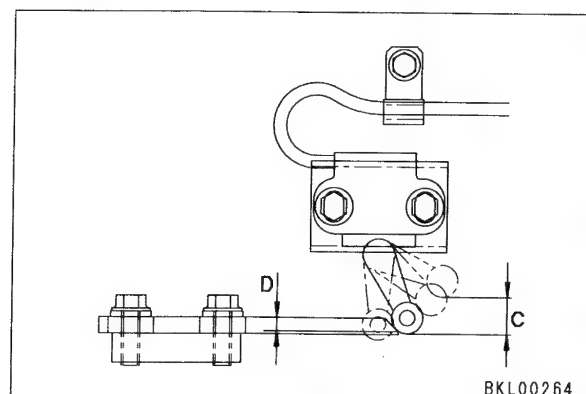
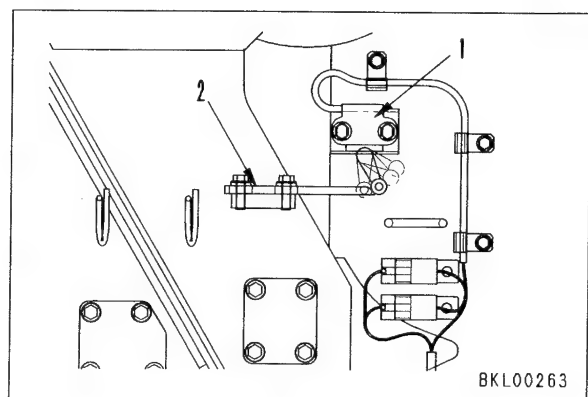
3. Free-fall interlock switch (main, auxiliary)



- 1) Depress winch brake pedal (1) 35 mm.
 - Set the PTO switch to "OPERATION 2".
- 2) In the above condition, adjust so that interlock cancel switch (2) is switched ON.
(Standard installed dimension of switch (2): 23.5 mm)
 - ★ Check that the clutch lever does not enter the OFF position if the winch brake pedal is not depressed.

4. Top boom STOW detection limit switch

- 1) Insert a spacer at the top boom stow stopper surface and retract the boom until it contacts the stopper.
Spacer thickness: **5 mm**
 - 2) Slide plate (1) to the front and fix the plate in position at the point where switch (2) is actuated.
 - ★ Check the point of actuation of the switch with an electrical tester.
 - 3) Check free stroke dimension **C** at this position.
 - ★ Dimension **C**: Min. 10 mm
 - 4) Extend the top boom 50 mm from this position and check dimension **D**.
 - ★ Dimension **D**: 5 – 9 mm
-  Roller contact surface:
Coat with grease (G2-LI)



023S02

5. Over-front position detector limit switch



Extend the outriggers and set securely so that the machine cannot move.

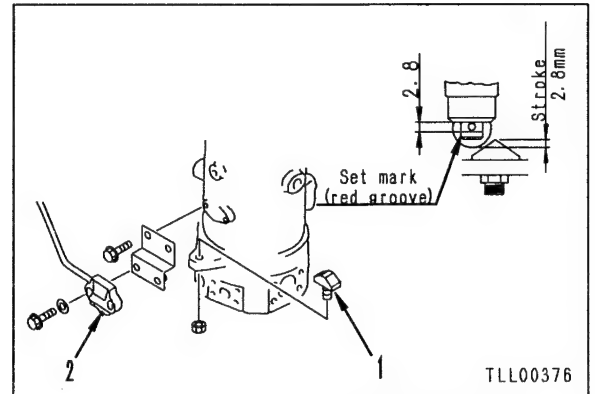
- 1) Swing the revolving frame to face the front, then insert the swing lock pin.
- 2) Install limit switch (2) temporarily so that the roller of the limit switch is pushed in by the top end of CENTER detection cam (1).
- 3) Remove the swing lock pin, operate the swing, and fix in position so that the amount of movement of the roller of limit switch (2) is 2.8 ± 0.2 mm.

- ★ Move up and down to adjust so that the set mark (red groove) of the limit switch is at the same position as the end face of the switch holder when the switch is ON.



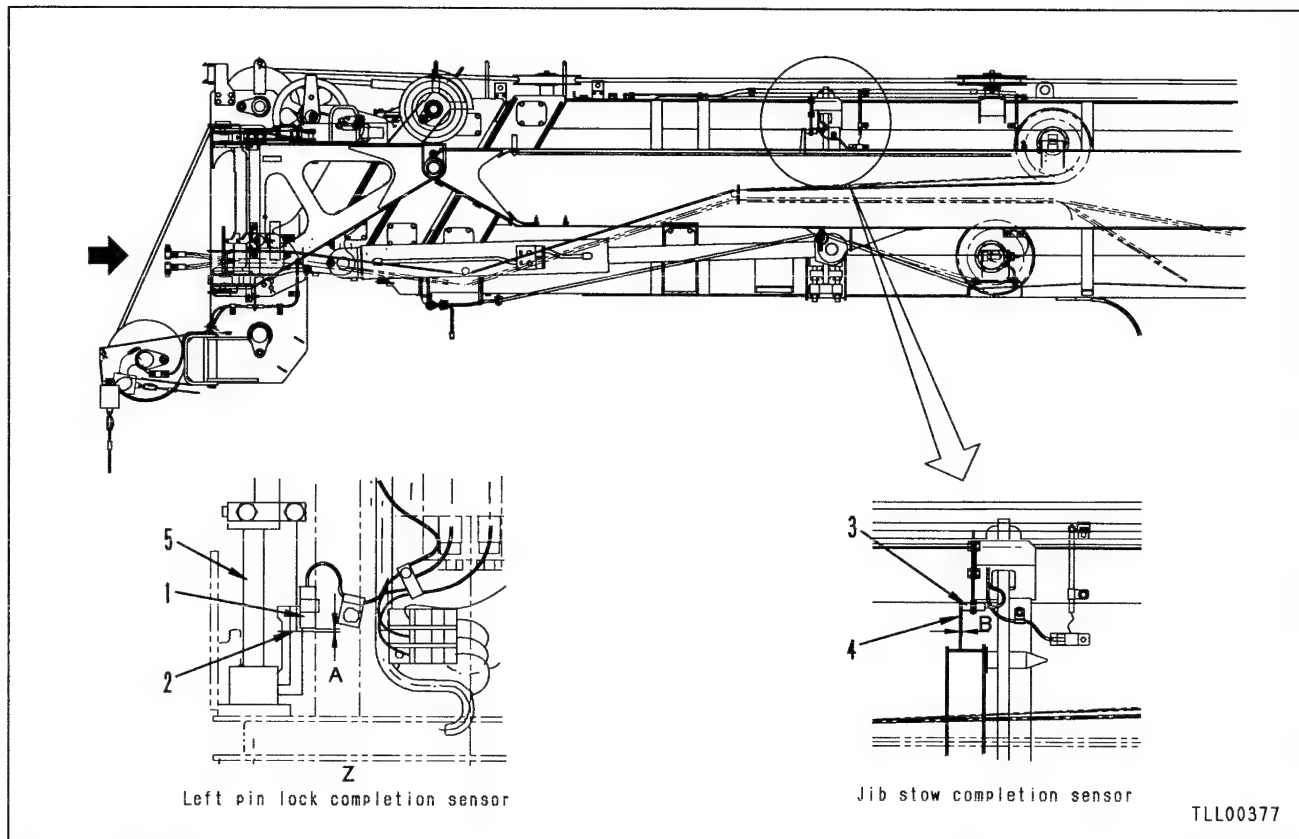
Roller contact surface:

Coat with grease (G2-LI)



TESTING AND ADJUSTING PROXIMITY SWITCH

1. Jib proximity switch



- ⚠ Extend the outriggers and set securely so that the machine cannot move, then set the chassis horizontal.
- ★ Set the PTO switch to "OPERATION 1".
 - ★ Set the moment limiter working mode switch (top) to jib operation.

Left pin lock completion sensor

Testing

The LED of sensor (1) must light up when lock cylinder (5) is set to the LOCK position.

Adjusting

Install sensor (1) so that clearance **A** between sensor (1) and plate (2) is 2 mm in the LOCK condition.

kgm Sensor locknut:

$19.5 \pm 9.5 \text{ Nm } \{2 \pm 1 \text{ kgm}\}$

Jib stow completion sensor

Testing

The LED of sensor (3) must light up when the boom is fully retracted.

Adjusting

Install sensor (3) so that clearance **B** between sensor (3) and plate (4) is 2 mm when the boom is fully retracted and the jib is stowed.

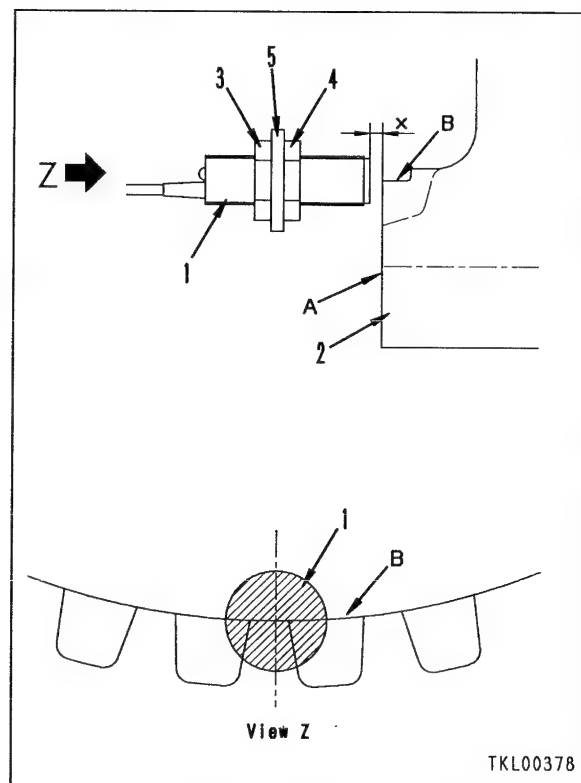
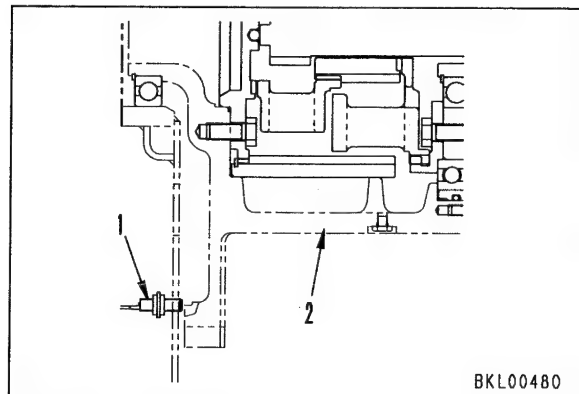
kgm Sensor locknut:

$19.5 \pm 9.5 \text{ Nm } \{2 \pm 1 \text{ kgm}\}$

023S02

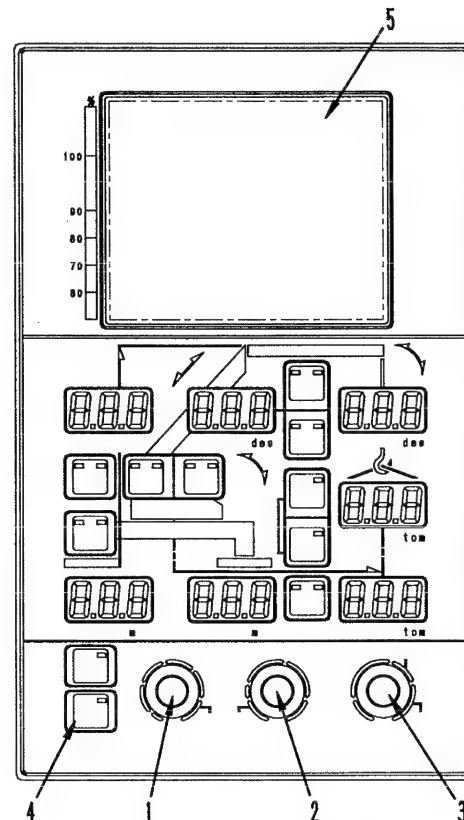
2. Drum rotation proximity switch

- 1) Put switch (1) in contact with surface **A** of drum (2).
 - ★ Check that surface **A** (detection value surface) of the drum is at the protruding position.
- 2) Screw in nut (3) until it contacts bracket (5), then tighten it a further 2.5 turns.
(Clearance $X = 2.5^{+0.5}_0$ mm)
- 3) Fix nut (3) in position, then tighten nut (4).
- ⚙️ Locknut : **1 Nm {0.1 kgm}**
- 4) Adjust the position of plate (5) so that the center of switch (1) is in line with surface **B** (machined surface on inside diameter) of the drum.



CHECKS BEFORE STARTING FOR OVERLOAD PREVENTION SYSTEM

- The checks before starting are carried out to check that the automatic stop function of the overload prevention system works properly, and that the displayed boom length, boom angle, and load are within the specified range.
 - Carry out the checks before starting as follows.
1. Turn the starting switch to the ON position and set the PTO switch to the "OPERATION 1" or "OPERATION 2" position.
 2. Start the engine and raise the boom to a position above the horizontal.
 3. Set top working mode switch (2) to BOOM and bottom working mode switch (3) to OUTRIGGER.
 4. Slide the outrigger to the desired length, then insert the lock pin.
 5. To check the outrigger extension width setting function, check that the position of the lock pin matches the panel display.
 6. To check the outrigger setting, press set switch (4).
 7. To check the setting for the number of loops of wire rope, press set switch (4).
 8. To check the automatic stop function, set display mode switch (1) to the CHECK position, then check the following items.
 - 1) Check that when the switch is turned to the CHECK position, all the lamps on the control panel light up and the buzzer sounds, then all the panel lamps goes out and the buzzer stops, and the display returns to normal.
 - 2) Check the model name, outrigger type, and jib specification of the display of control panel (5).
 9. Operate the work equipment control lever to confirm the following.
 - 1) When the boom hoist lever is operated, the boom does not go down.
 - 2) When the boom telescope lever is operated, the boom does not extend.
 - 3) When the winch lever is operated, the winch does not wind in.
 - 4) When the jib hoist lever is operated, the jib does not go down.
(For power tilt jib machines only, install the jib before operations using the jib, then carry out this check.)
 - 5) Check that when each lever is operated, the display on control panel (5) is inverted at the same time as the lever is operated.
 - 6) Check that the overwind display is inverted when the winch is in the overwind condition.
 - Set the overload prevention cancel switch to CANCEL and wind the winch in.



WING250 X
 Main jib→RAISE, LOWER, EXTEND, STOW
 Auxiliary jib→RAISE, LOWER
 Main winch→WIND IN/OUT
 Auxiliary winch→WIND IN/OUT
 Swing→left/right
 Overwind TOP BOOM stow
 Automatic stop cancel

Check mode screen

TKL00379

023S02

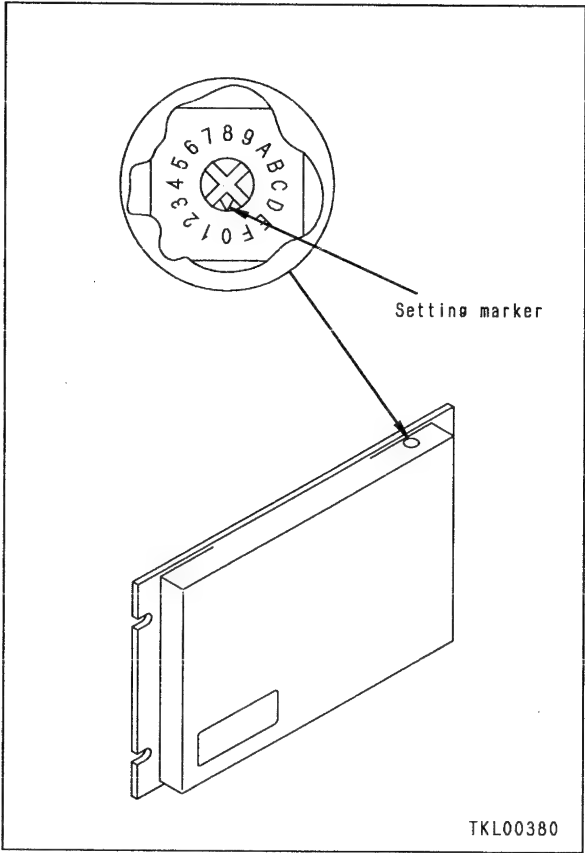
- 023S02
- 7) Check that top boom stow is normally displayed when the boom is extended.
 - Set the overload prevention cancel switch to CANCEL and extend the boom.
 - 8) Check that the automatic stop cancel display is inverted when the automatic stop is canceled.
 10. To check that the display value for each sensor is normal, set display mode switch (1) to the SWING RANGE position and check the following items.
 - 1) When swinging the upper structure, check that the swing position display on control panel (5) matches the condition of the machine, and that the over-front position display is given when the work equipment is facing the front.
 - 2) Check that the boom length display is **7.6 m** when the boom length is the minimum.
 - 3) Check that the boom length display is **32.0 m** when the boom length is the maximum.
 - 4) Set the boom to the desired boom angle and boom length, move the boom down, then stop the operation. (When doing this, do not carry out automatic stop because of overload.)
 - 5) Wind in the auxiliary winch hook to a point immediately before the overwind position, then wind out the main winch hook to a point just before it touches the ground.
 - 6) In the condition in Items 4) and 5), check that the actual load display value on control panel (5) is **0.3 ± 0.1 ton** when there is no load.

SETTING MODEL SELECTOR
SWITCH FOR OVERLOAD
SAFETY SYSTEM

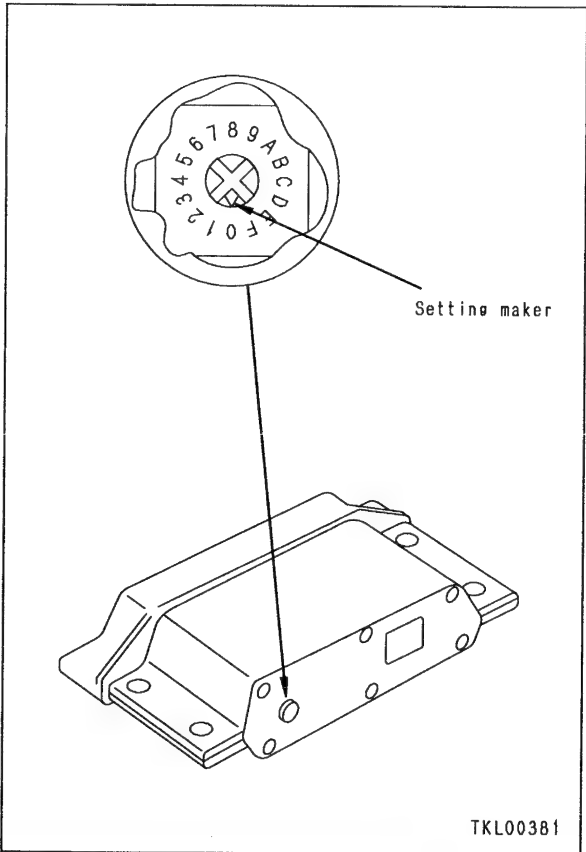
- When replacing the overload prevention controller, set 6 types to match the combination of the type of outrigger and the type of jib.
(Use a screwdriver to change the setting of the switches)

Switch	Outrigger type	Jib
0	X-shaped	Power tilt
1	H-shaped	Power tilt
2	X-shaped	3-stage fixed
3	H-shaped	3-stage fixed
4	X-shaped	No jib
5	H-shaped	No jib

Note: After setting the switches, always fit the rubber caps.



- When replacing the jib communication module, set the model selection switch to 0. (Use a screwdriver to change the setting of the switches)
Note: After setting the switches, always fit the rubber caps.



023S02

METHOD OF DISPLAYING SERVICE MODE FOR OVERLOAD PREVENTION SYSTEM

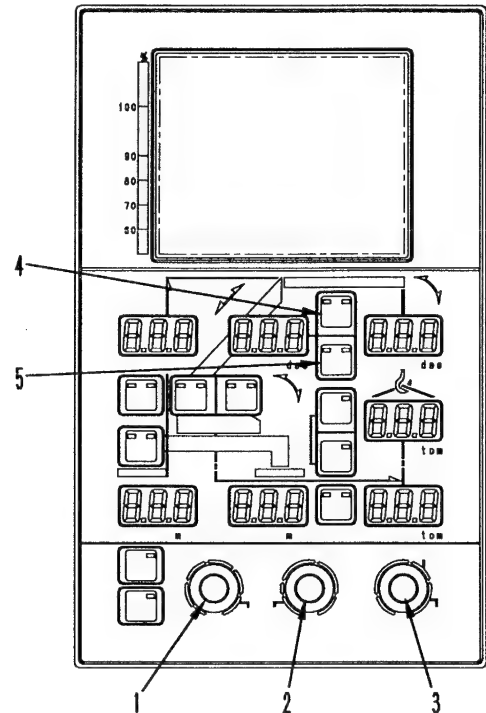
- The overload prevention system uses codes to display the calculations of the output of the sensors used for testing and adjusting, and troubleshooting. If any sensor is replaced, adjust only that sensor again; if the moment limiter is replaced, adjust all sensors again. The following procedure is used to display the service modes.

1. Method of displaying service mode

- Set the PTO switch to the "OPERATION 1" position.
- 1) Set display mode switch (1) to the CHECK position.
- 2) Turn working mode top switch (2) fully to the left.
- 3) Turn working mode top switch (3) fully to the left.
- 4) In this condition, press UPPER LIMIT angle switch (4) and LOWER LIMIT angle switch (5) at the same time for at least 1 second.

2. Content of service mode display

- After the service modes have been displayed using the procedure above, it is possible to use a combination of top mode switch (2) and bottom mode switch (3) of the working mode setting switch to give the display shown in the table below.



TKL00382

Top working mode switch		Bottom working mode switch	
Setting switch	Set position	Setting switch	Set position

TKL00383

Top operation set switch	Bottom operation set switch	Sensor No.	Content of display	Unit
1	1	S1	Boom angle	0.01 deg
	2	S2	Boom length	mm
	3	S3	Pressure (head)	0.01 kg/cm ²
	4	S4	Pressure (bottom)	0.01 kg/cm ²
	5	S5		
	6	S6		
	7	S7		
	8	S8		
	9	S9	Jib tilt angle	0.01 deg
	10	S10	Swing angle	0.01 deg
	11	---		

- Display only; do not adjust sensor.

Top operation set switch	Bottom operation set switch	Sensor No.	Content of display	Unit
2	1	S1	Boom angle MIN	0.01 deg
	2	S2	Boom length MIN	mm
	3	S3	Head pressure MIN	0.01 kg/cm ²
	4	S4	Bottom pressure MIN	0.01 kg/cm ²
	5	S5		
	6	S6		
	7	S7		
	8	S8		
	9	S9	Jib tilt angle MIN	0.01 deg
	10	S10	Swing angle offset	0.01 deg
	11	— — —		

Top operation set switch	Bottom operation set switch	Sensor No.	Content of display	Unit
3	1	S1	Boom angle MAX	0.01 deg
	2	S2	Boom length MAX	mm
	3	S3		
	4	S4		
	5	S5		
	6	S6		
	7	S7		
	8	S8		
	9	S9	Jib tilt angle MAX	0.01 deg
	10	S10	ROM part number	
	11	— — —		

Top operation set switch	Bottom operation set switch	Sensor No.	Content of display	Unit
4	1	S21	Outrigger length (front right)	mm
	2	S22	BOutrigger length (front left)	mm
	3	S23	Outrigger length (rear right)	mm
	4	S24	Outrigger length (rear left)	mm
	5	S25		
	6	S26		
	7	S27		
	8	S28		
	9	S29		
	10	S30		
	11	S31		

023S02

Top operation set switch	Bottom operation set switch	Sensor No.	Content of display	Unit
5	1	S21	Outrigger length (front right) MIN	mm
	2	S22	Outrigger length (front left) MIN	mm
	3	S23	Outrigger length (rear right) MIN	mm
	4	S24	Outrigger length (rear left) MIN	mm
	5	S25		
	6	S26		
	7	S27		
	8	S28		
	9	S29		
	10	S30		
	11	S31		

Top operation set switch	Bottom operation set switch	Sensor No.	Content of display	Unit
6	1	S21	Outrigger length (front right) MAX	mm
	2	S22	Outrigger length (front left) MAX	mm
	3	S23	Outrigger length (rear right) MAX	mm
	4	S24	Outrigger length (rear left) MAX	mm
	5	S25		
	6	S26		
	7	S27		
	8	S28		
	9	S29		
	10	S30		
	11	— — —	Error code mode	

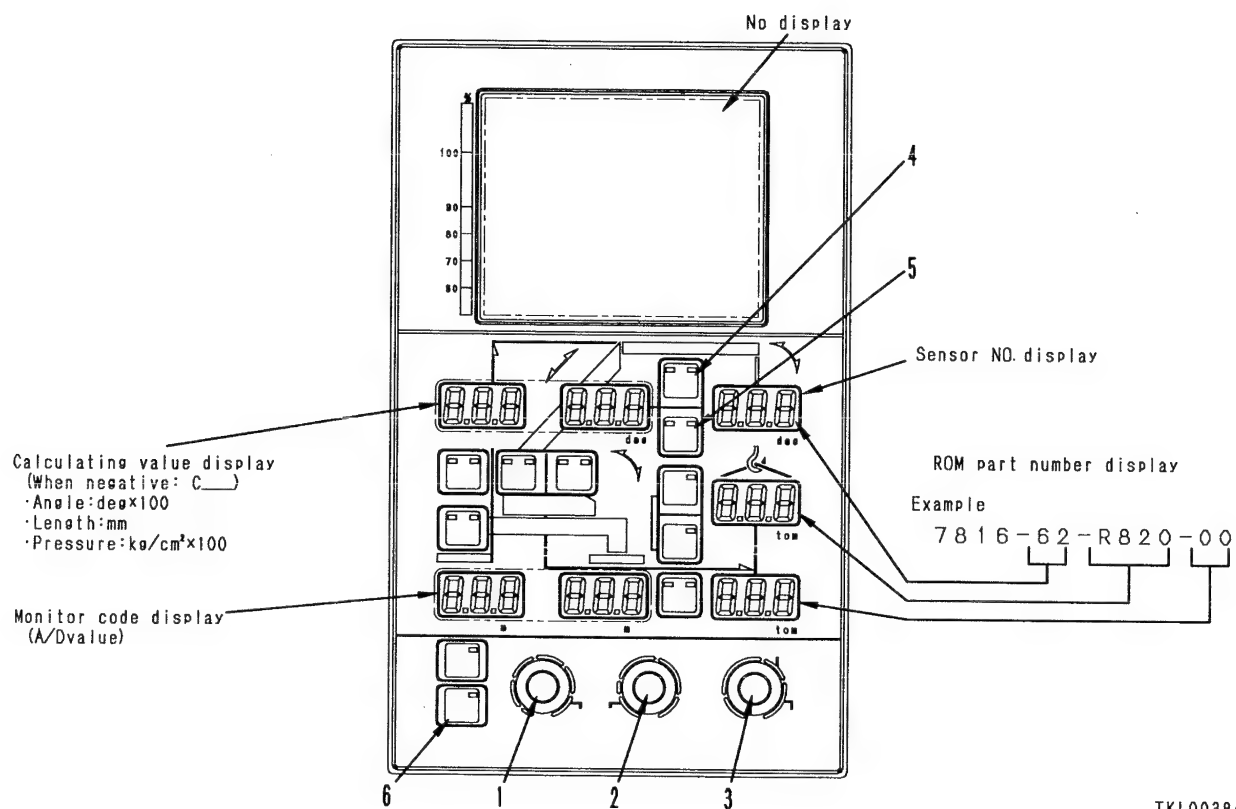
3. Overload prevention control using service mode

- 1) The overload prevention function works according to the value set for the work before the check mode is set.
- 2) The working range limit and target set value are held at the condition in operation before setting to the check mode; the set/cancel switches are also held in the same way.
- 3) The boom length/lifting height selector switch is also kept in the condition in operation before setting to the check mode.

4. Method of quitting service mode

Set display mode switch (1) to any position other than CHECK.

5. Monitor display condition



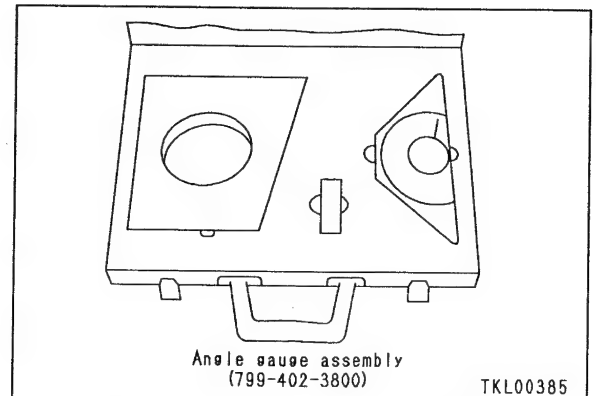
TKL003B4

023S02

Table of switches and function

No.	Switch operation	Function	Remarks
4	Top limit angle switch	Set value adjustment (+ side)	When switch is pressed, setting advances in units of 0.05 deg, 0.05 kg/cm ² , or 5 mm
5	Bottom limit angle switch	Set value adjustment (– side)	
6	Press set switch for at least 1 sec	Storing set value in memory	
4 • 5 • 6	Press set + top limit angle + bottom limit angle switches at same time for at least 1 sec	Memory cancel	Cancels memory setting of sensor adjusted value being displayed

- 1) Method of adjusting boom angle
- ★ Set the boom angle to 0° and 83° , and adjust the input value for the boom angle.
 - ★ When measuring, use an angle gauge (tool M).
 - ★ Before adjusting, check that the setting of the work equipment is completed.
- MIN setting
 - i) Set to the service mode, then set top switch (2) to position 2 and bottom switch (3) to position 1.
 - ii) Retract the boom fully, lower the boom to near 0° (horizontal), then measure the boom angle with the angle gauge.
 - iii) Align the calculated value display with the reading on the angle gauge.
The angle changes as follows.
Each time top limit angle switch (4) is pressed: $+0.05^\circ$
Each time bottom limit angle switch (5) is pressed: -0.05°
 - iv) Keep set switch (6) pressed for at least 1 sec.
 - v) When the setting is completed, the display lights up.
(When the memory is canceled, it flashes.)
 - MAX setting
 - i) Set to the service mode, then set top switch (2) to position 3 and bottom switch (3) to position 1.
 - ii) Retract the boom fully, raise the boom to near 83° , then measure the boom angle with the angle gauge.
 - iii) Align the calculated value display with the reading on the angle gauge.
(Operate the switches in the same way as for the MIN setting.)
 - iv) Keep set switch (6) pressed for at least 1 sec.
 - v) When the setting is completed, the display lights up.
(When the memory is canceled, it flashes.)
 - ★ Set the angle gauge parallel to the boom on a flat surface on top of the boom.
If there is even a slight unevenness on the top surface of the boom, there will be an error in the reading, so be extremely careful to check that the surface is flat.



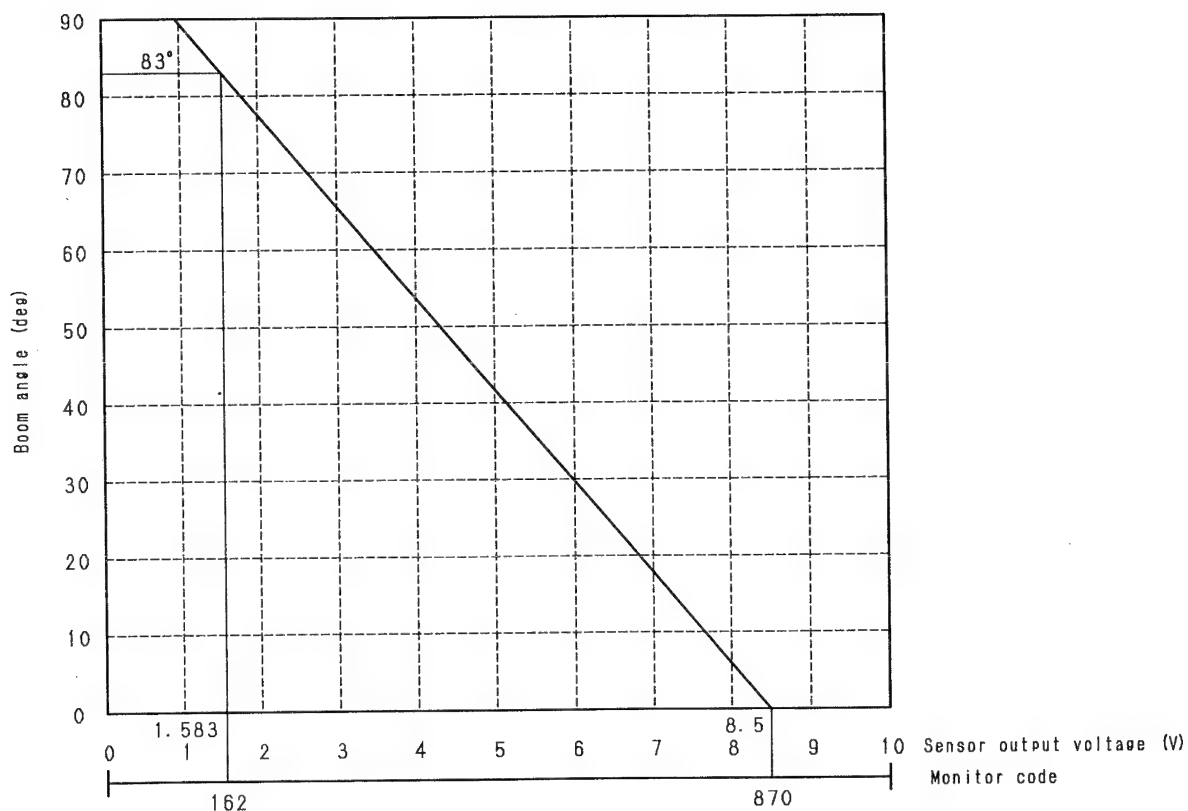
023S02

BOOM ANGLE MONITOR CODE CONVERSION TABLE

Conversion formula for monitoring code (A/D value) voltage

$$A/D \text{ value} = V/10 \times 1023$$

V : Sensor output voltage



TKL00386

023S02

2) Method of adjusting boom length

- ★ Adjust the input value for the boom length when the boom is fully retracted and when it is fully extended.
- ★ Before adjusting, check that the setting of the work equipment is completed.

- MIN setting

- i) Set to the service mode, then set top switch (2) to position 2 and bottom switch (3) to position 2.
- ii) Raise the boom to near the top limit, then retract the boom fully and measure the boom length.
- iii) Align the calculated value display with the actual measurement.
The length changes as follows.
Each time top limit angle switch (4) is pressed: + 5 mm
Each time bottom limit angle switch (5) is pressed: – 5 mm
- iv) Keep set switch (6) pressed for at least 1 sec.
- v) When the setting is completed, the display lights up.
(When the memory is canceled, it flashes.)

- MAX setting

- i) Set to the service mode, then set top switch (2) to position 3 and bottom switch (3) to position 2.
- ii) Raise the boom to near the top limit, then extend the boom fully and measure the boom length.
- iii) Align the calculated value display with the actual measurement.
(Operate the switches in the same way as for the MIN setting.)
- iv) Keep set switch (6) pressed for at least 1 sec.
- v) When the setting is completed, the display lights up.
(When the memory is canceled, it flashes.)



It is possible to change the calculated value display, but actually do not make any change; simply omit Step iii) when adjusting.

MIN value for boom length: 7,560 mm

MAX value for boom length: 73,960 mm

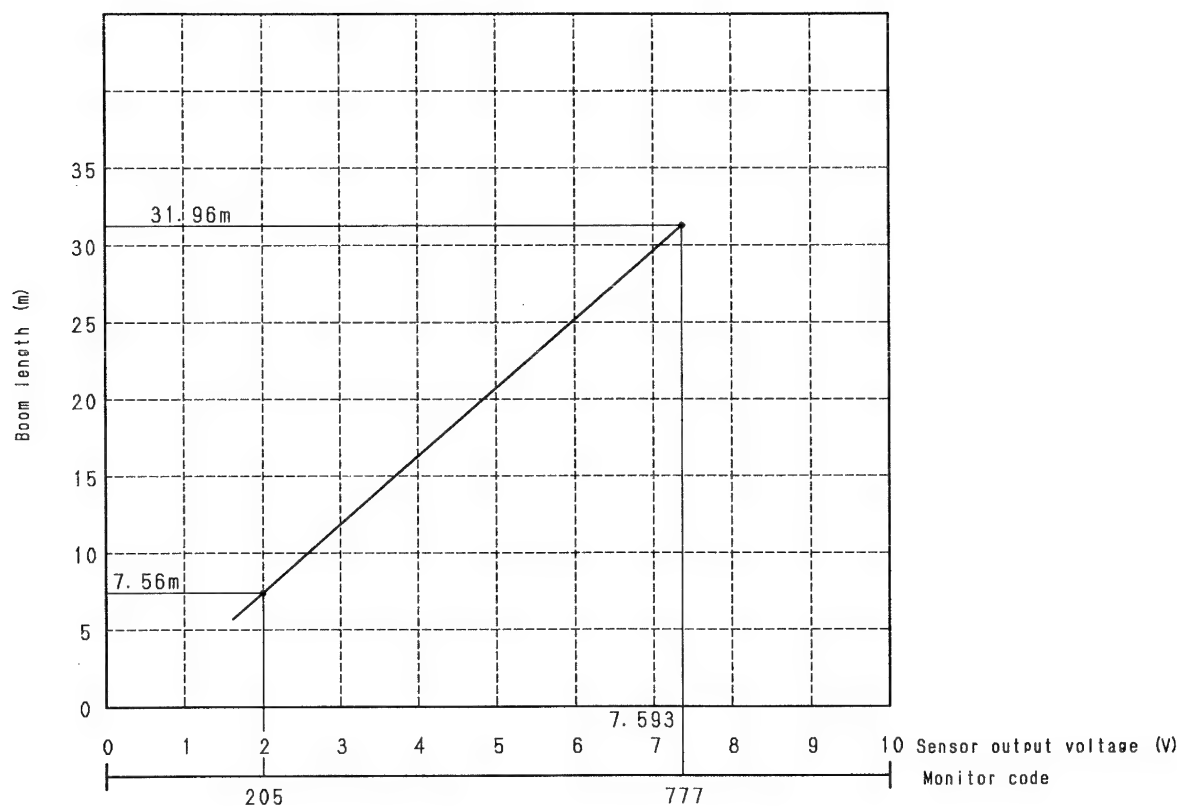
Reason:

The error in the boom length is extremely small (only a few centimeters); furthermore, it is difficult to measure the boom length accurately.

BOOM LENGTH MONITOR CODE CONVERSION TABLE

Conversion formula for monitoring code (A/D value) voltage

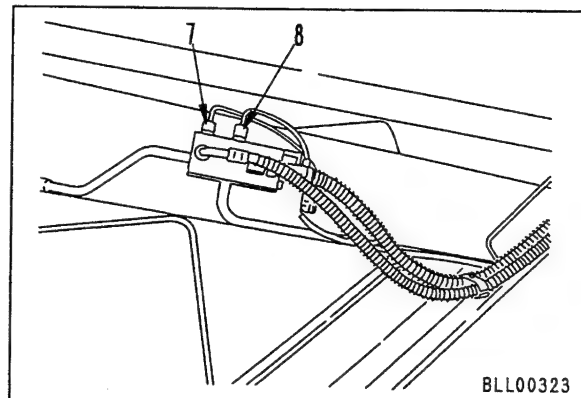
$A/D \text{ value} = V/10 \times 1023$
V : Sensor output voltage



TKL00387

023S02

- 3) Method of adjusting cylinder pressure
- ★ Adjust the 0 point for the bottom pressure and head pressure of the boom hoist cylinder.
 - MIN setting (Adjustment 0 point)
 - i) Remove head pressure sensor (7) and bottom pressure sensor (8) from the boom hoist cylinder, and set with the pressure released to the atmosphere.
 - ii) Set to the service mode, then set top switch (2) to position 2 and bottom switch (3) to position 3 (head pressure) and 4 (bottom pressure).
 - iii) Keep set switch (6) pressed for each sensor for at least 1 sec.
 - iv) When the setting is completed, the display lights up.
(When the memory is canceled, it flashes.)
 - ★ Confirm that monitor code is "205".

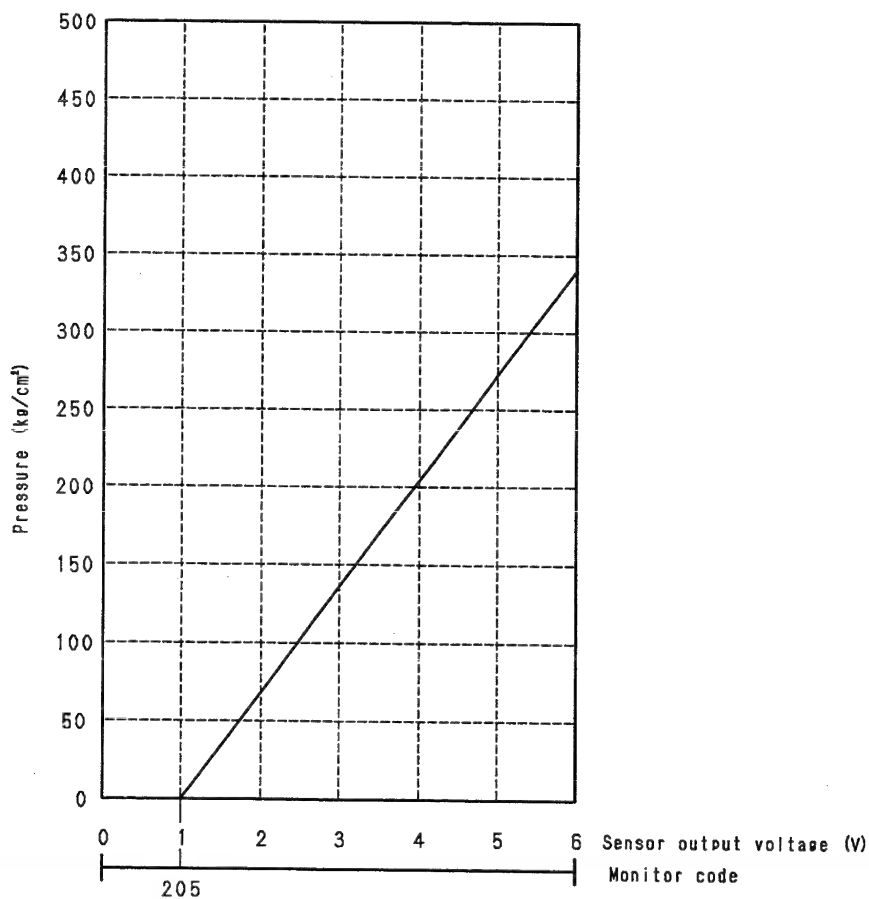


CYLINDER PRESSURE MONITOR CODE CONVERSION TABLE

Conversion formula for monitoring code (A/D value)
voltage

$$A/D \text{ value} = V/5 \times 1023$$

V : Sensor output voltage



TKL00388

4) Method of adjusting swing angle

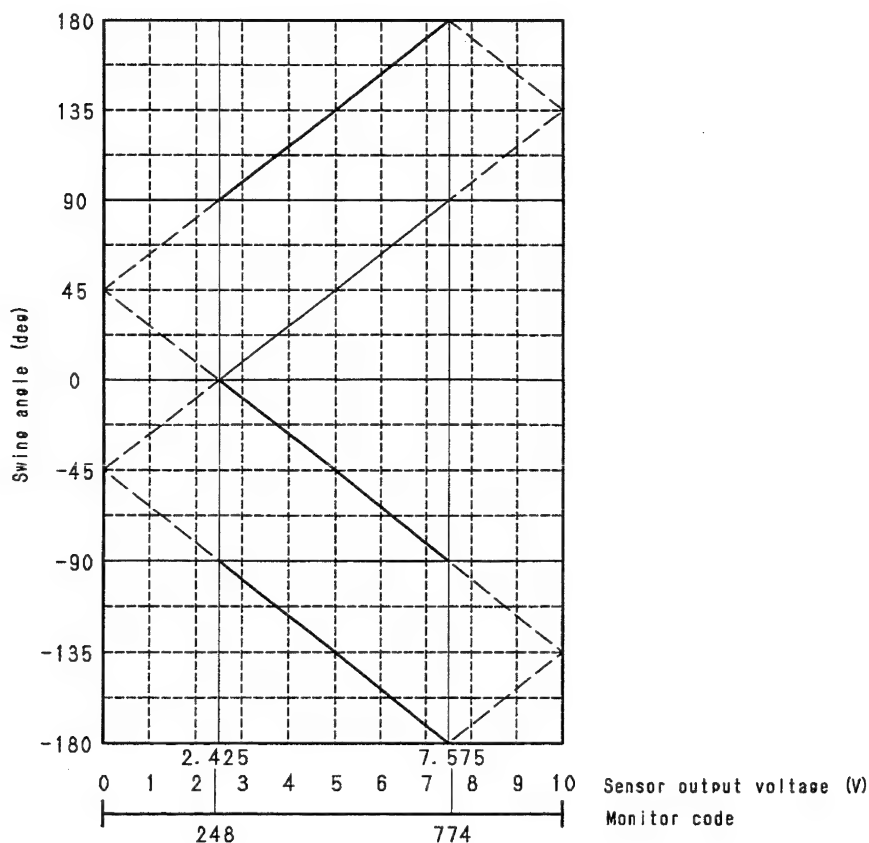
- ★ Adjust the 0 point so that the over-front position of the swing angle detection sensor matches the front of the machine.
- MIN setting
 - i) Set to the service mode, then set top switch (2) to position 2 and bottom switch (3) to position 10.
 - ii) Swing the upper structure to face the front, then insert the swing lock pin.
 - iii) Keep set switch (6) pressed for at least 1 sec.
 - iv) When the setting is completed, the calculated value display becomes 0 when top switch (2) is set to 1 and bottom switch (3) is set to 10.
- Adjust the swing lock position as swing angle 0°.

SWING ANGLE MONITOR CODE CONVERSION TABLE

Conversion formula for monitoring code (A/D value) voltage

$$A/D \text{ value} = V/5 \times 1023$$

V : Sensor output voltage



TKL00389

- 5) Method of adjusting outrigger extension length
- ★ Adjust the input value for the outrigger length when the outrigger is full retracted and when it is fully extended.
 - ★ Before adjusting, check that the setting of the outrigger is completed.
 - ★ Set the boom to the minimum length and swing the upper structure to face the front.
 - MIN setting
 - i) Retract all the outriggers fully.
 - ii) Set to the service mode, then adjust each outrigger individually.

Operation of top, bottom switch

	Top switch ②	Bottom switch ③
Outrigger front right	5	1
Outrigger front left	5	2
Outrigger rear right	5	3
Outrigger rear left	5	4

- iii) After setting each outrigger, keep each set switch (6) pressed for at least 1 sec.
- iv) When the setting is completed, the display lights up.
(When the memory is canceled, it flashes.)

- MAX setting
 - i) Extend all the outriggers fully.
 - ii) Set to the service mode, then adjust each outrigger individually.


Operation of top, bottom switch

	Top switch ②	Bottom switch ③
Outrigger front right	5	1
Outrigger front left	5	2
Outrigger rear right	5	3
Outrigger rear left	5	4

- iii) After setting each outrigger, keep each set switch (6) pressed for at least 1 sec.
- iv) When the setting is completed, the display lights up.
(When the memory is canceled, it flashes.)

- Outrigger cylinder stroke

	X-shaped	H-shaped
MIN value	35	0
MAX value	2,165	2,186

 It is possible to change the calculated value, but actually do not change it.

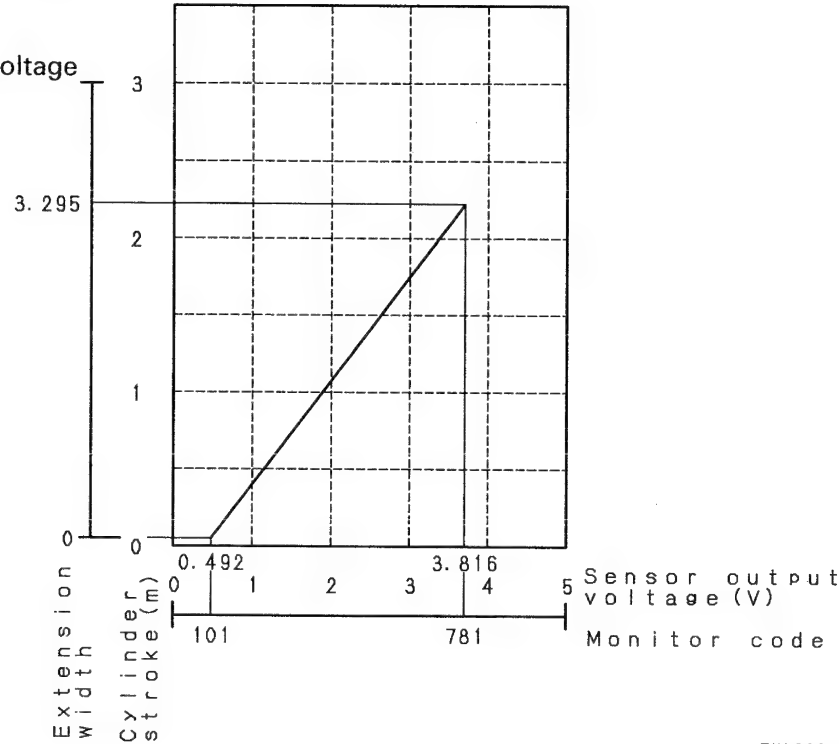
OUTRIGGER EXTENSION WIDTH
MONITOR CODE CONVERSION TABLE

Conversion formula for monitoring code
(A/D value) voltage

$A/D \text{ value} = V/5 \times 1023$

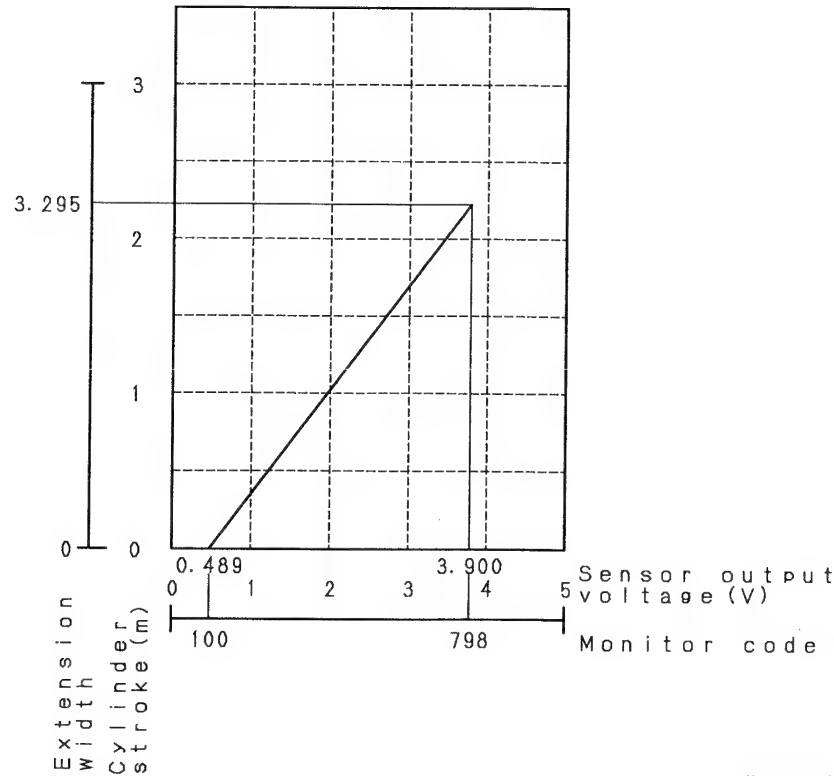
V : Sensor output voltage

X-shape outrigger



TKL00390

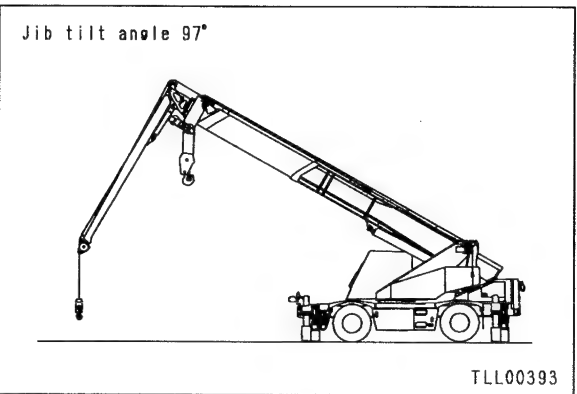
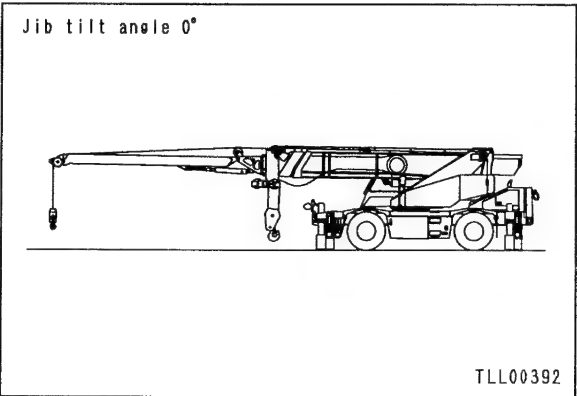
H-shape outrigger



TKL00391

023S02

- 6) Method of adjusting jib tilt angle (power tilt jib)
- ★ Adjust the minimum value and maximum value for the jib tilt angle.
 - ★ Before adjusting, check that the setting of the jib working mode is completed.
 - MIN setting
 - i) Set to the service mode, then set top switch (2) to position 2 and bottom switch (3) to position 9.
 - ii) Set to the minimum boom length, then extend the jib hoist cylinder fully. (Jib tilt angle 0°)
 - iii) Keep set switch (6) pressed for at least 1 sec.
 - iv) When the setting is completed, the display lights up. (When the memory is canceled, it flashes.)
 - MAX setting
 - i) Set to the service mode, then set top switch (2) to position 3 and bottom switch (3) to position 9.
 - ii) Set to the minimum boom length, then retract the jib hoist cylinder fully. (Jib tilt angle 97°)
 - iii) Keep set switch (6) pressed for at least 1 sec.
 - iv) When the setting is completed, the display lights up. (When the memory is canceled, it flashes.)

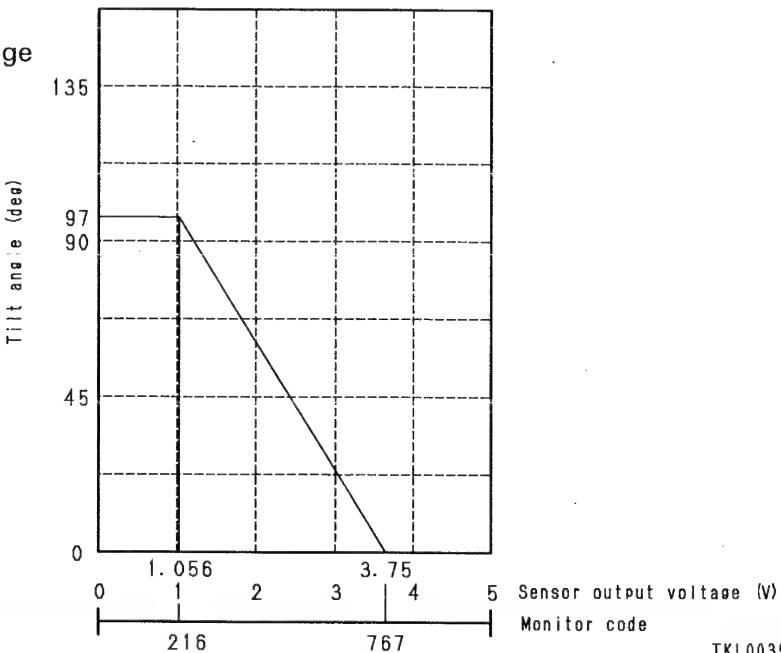


SWING ANGLE MONITOR CODE CONVERSION TABLE

Conversion formula for monitoring code (A/D value) voltage

$$A/D \text{ value} = V/5 \times 1023$$

V : Sensor output voltage



TKL00394

TROUBLESHOOTING

Points to remember when troubleshooting	20-202
Sequence of events in troubleshooting	20-203
Points to remember when carrying out maintenance	20-204
Checks before troubleshooting	20-212
Connector types and mounting locations.....	20-213
Connector arrangement diagram	20-221
Connection table for connector pin numbers.....	20-224
Explanation of functions of control mechanism of electrical system	20-234
Display method for self-diagnosis (error codes) and saving to memory	20-242
Table of error codes, re-enaction	20-245
Method of using judgement table	20-254
Method of using troubleshooting flow charts	20-255

POINTS TO REMEMBER WHEN TROUBLESHOOTING

- ⚠ Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.
- ⚠ When carrying out the operation with two or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.
- ⚠ If the radiator cap is removed when the engine is hot, hot water may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.
- ⚠ Be extremely careful not to touch any hot parts or to get caught in any rotating parts.
- ⚠ When disconnecting wiring, always disconnect the negative (-) terminal of the battery first.
- ⚠ When removing the plug or cap from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure.

When carrying out troubleshooting, and important point is of course to understand the structure and function. However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components.
If components are disassembled immediately any failure occurs:
 - Parts that have no connection with the failure or other unnecessary parts will be disassembled.
 - It will become impossible to find the cause of the failure.

It will also cause a waste of manhours, parts, or oil or grease, and at the same time, will also lose the confidence of the user or operator.
For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.
2. Points to ask user or operator
 - 1) Have any other problems occurred apart from the problem that had been reported?
 - 2) Was there anything strange about the machine before the failure occurred?
 - 3) Did the failure occur suddenly, or were there problems with the machine condition before this?
 - 4) Under what conditions did the failure occur?
 - 5) Had any repairs been carried out before the failure?
When were these repairs carried out?
 - 6) Has the same kind of failure occurred before?
3. Check before troubleshooting
 - 1) Check the oil level.
 - 2) Check for any external leakage of oil from the piping or hydraulic equipment.
 - 3) Check the travel of the control levers.
 - 4) Check the stroke of the control valve spool.
 - 5) Other maintenance items can be checked externally, so check any item that is considered to be necessary.
4. Confirming failure

Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.

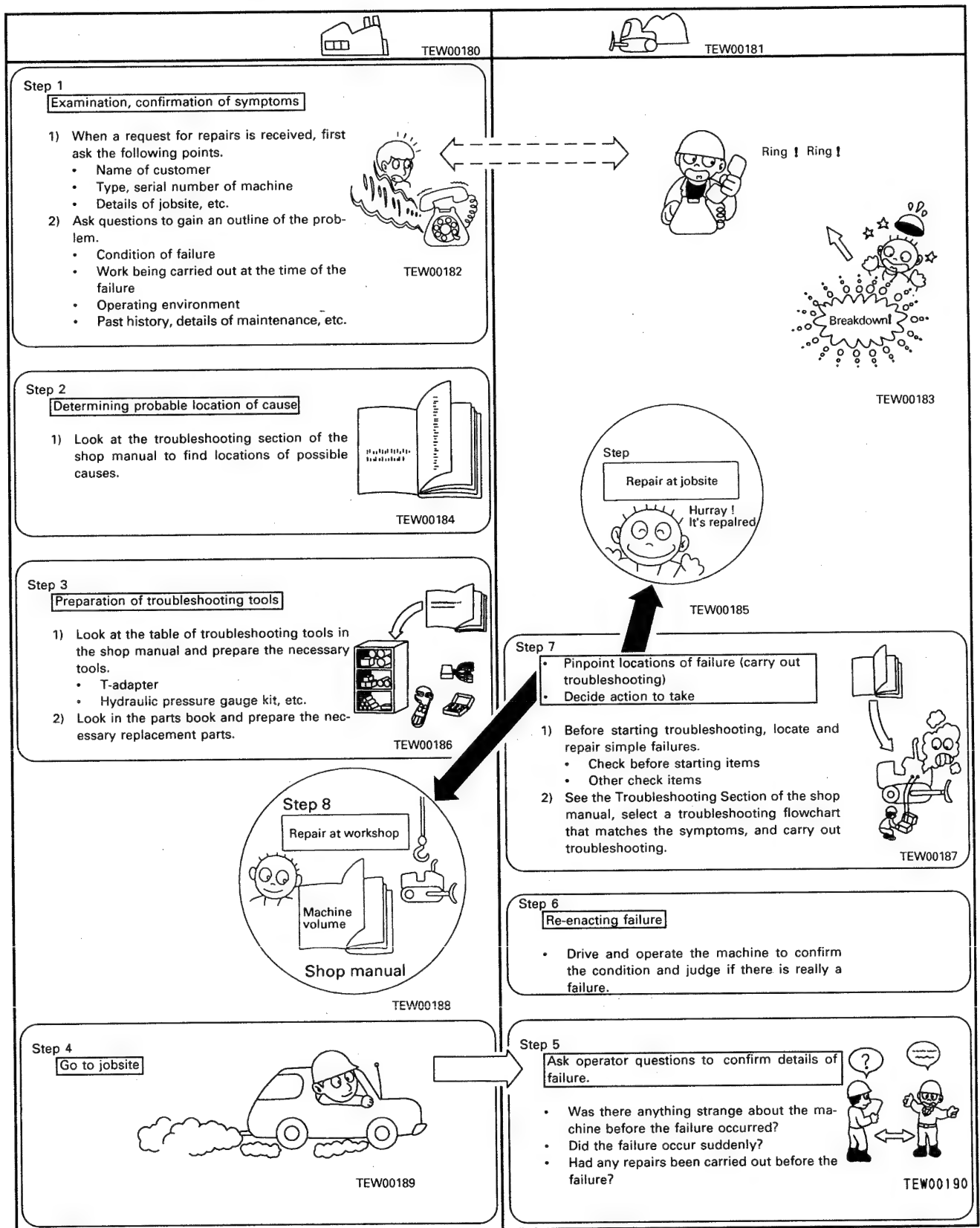
 - ★ When operating the machine to reenact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.
5. Troubleshooting

Use the results of the investigation and inspection in Items 2 - 4 to narrow down the causes of failure, then use the troubleshooting flowchart to locate the position of the failure exactly.

 - ★ The basic procedure for troubleshooting is as follows.
 - 1) Start from the simple points.
 - 2) Start from the most likely points.
 - 3) Investigate other related parts or information.
6. Measures to remove root cause of failure

Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again.
To prevent this, always investigate why the problem occurred. Then, remove the root cause.

SEQUENCE OF EVENTS IN TROUBLESHOOTING



023S02

POINTS TO REMEMBER WHEN CARRYING OUT MAINTENANCE

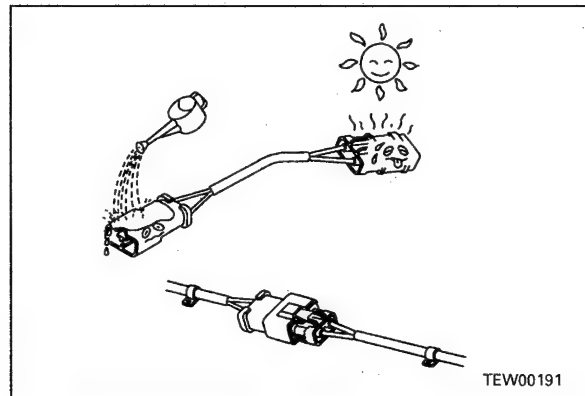
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on "Handling electric equipment" and "Handling hydraulic equipment" (particularly gear oil and hydraulic oil).

1. POINTS TO REMEMBER WHEN HANDLING ELECTRIC EQUIPMENT

1) Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

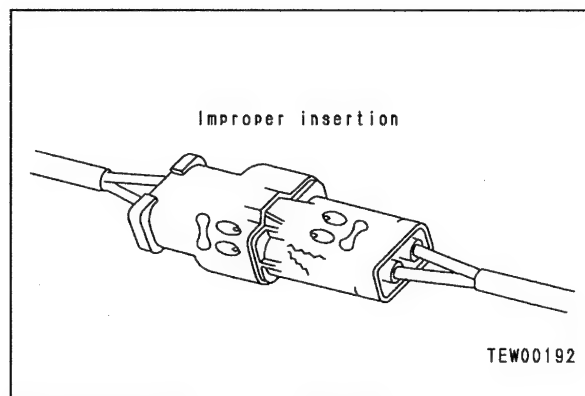
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.



Main failures occurring in wiring harness

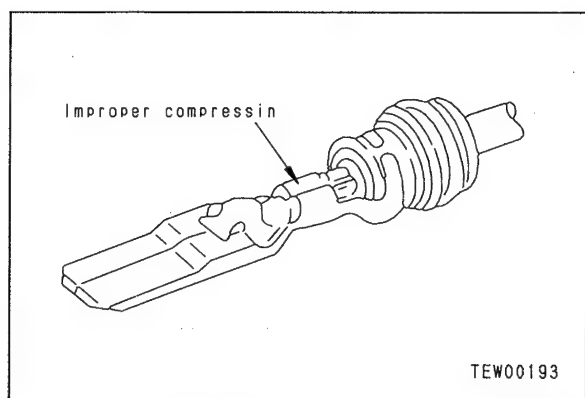
① Defective contact of connectors (defective contact between male and female)

Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces.



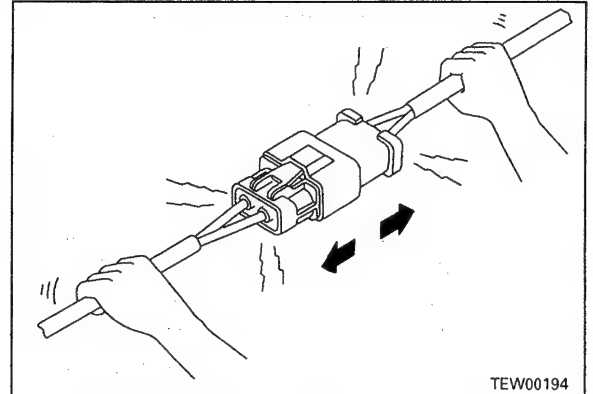
② Defective crimping or soldering of connectors

The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



③ Disconnections in wiring

If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.

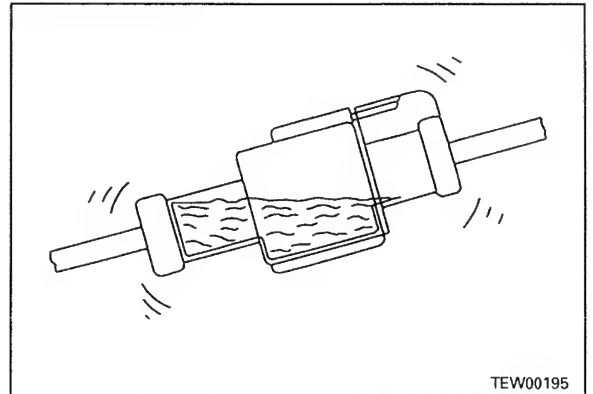


TEW00194

④ High-pressure water entering connector

The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector, depending on the direction of the water jet.

As already said, the connector is designed to prevent water from entering, but at the same time, if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.



TEW00195

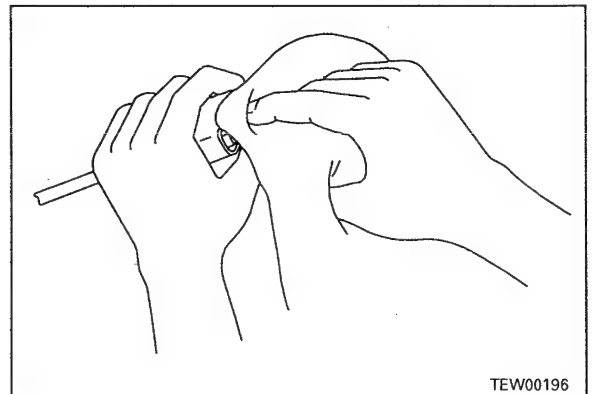
⑤ Oil or dirt stuck to connector

If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact.

If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed air and spray it with a contact restorer.

★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.

★ If there is oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.



TEW00196

2) Removing, installing, and drying connectors and wiring harnesses

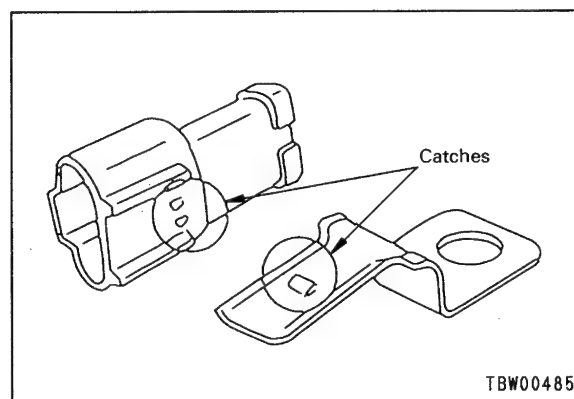
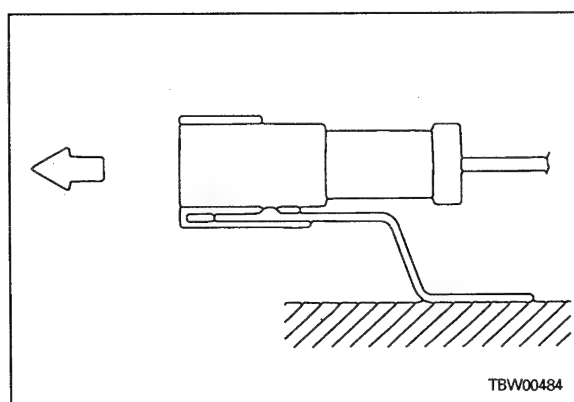
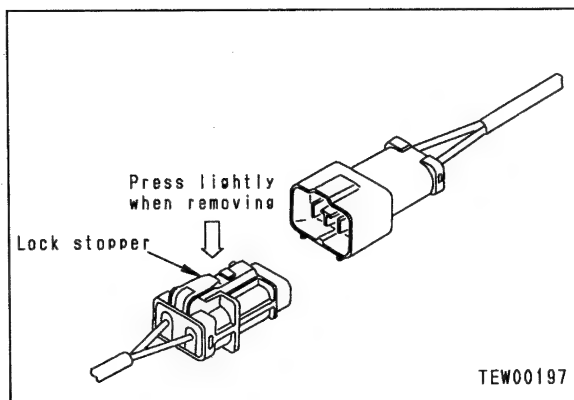
● Disconnecting connectors

- ① Hold the connectors when disconnecting.
When disconnecting the connectors, hold the connectors and not the wires. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.

★ Never pull with one hand.

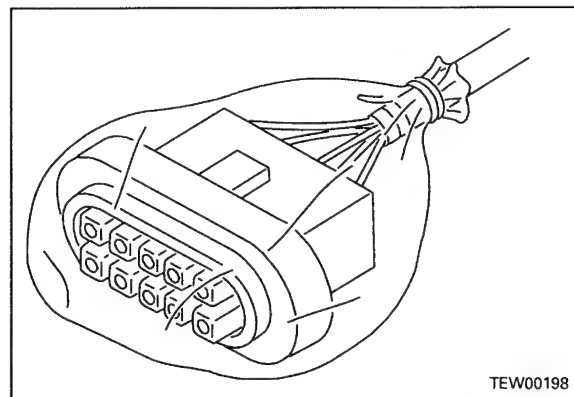
- ② When removing from clips
When removing a connector from a clip, pull the connector in a parallel direction to the clip.

★ If the connector is twisted up and down or to the left or right, the housing may break.



- ③ Action to take after removing connectors
After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.

★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.



● Connecting connectors

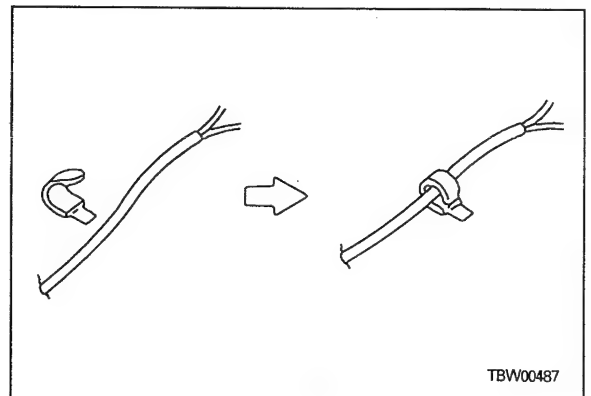
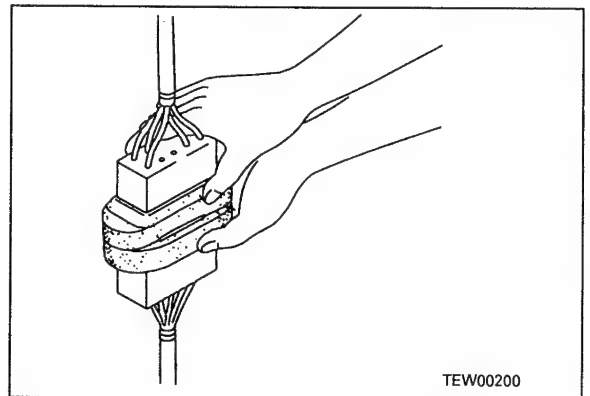
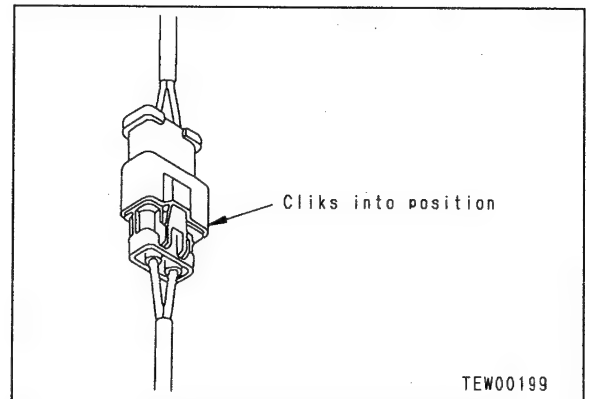
- ① Check the connector visually.
 - 1) Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
 - 2) Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
 - 3) Check that there is no damage or breakage to the outside of the connector.
 - ★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.
 - ★ If there is any damage or breakage, replace the connector.
- ② Fix the connector securely.

Align the position of the connector correctly, then insert it securely.

For connectors with lock stopper, push in the connector until the stopper clicks into position.
- ③ Correct any protrusion of the boot and any misalignment of the wiring harness

For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.

 - ★ If the connector cannot be corrected easily, remove the clamp and adjust the position.
- ④ If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.

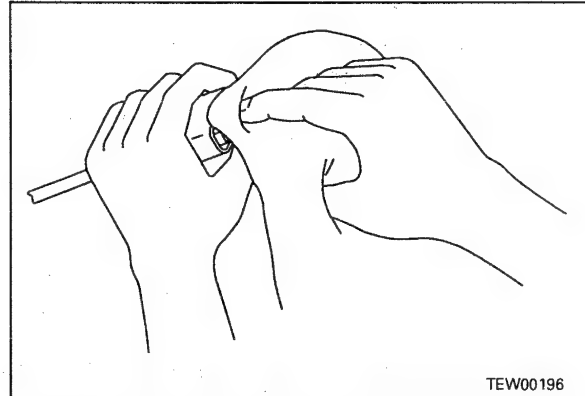


- **Drying wiring harness**

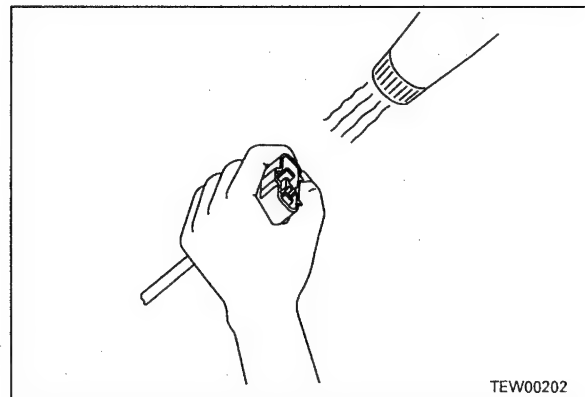
If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness.

If water gets directly on the connector, do as follows.

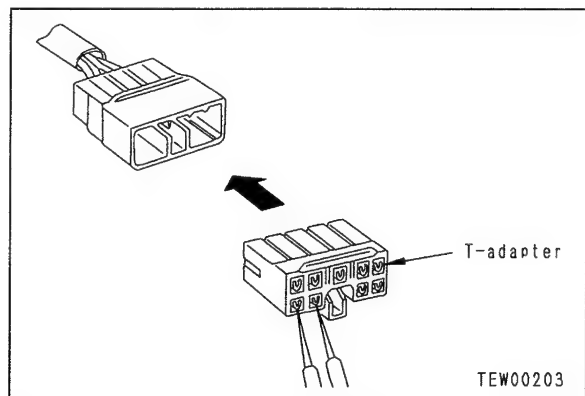
- ① Disconnect the connector and wipe off the water with a dry cloth.
 - ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.



- ② Dry the inside of the connector with a dryer. If water gets inside the connector, use a dryer to dry the connector.
 - ★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.

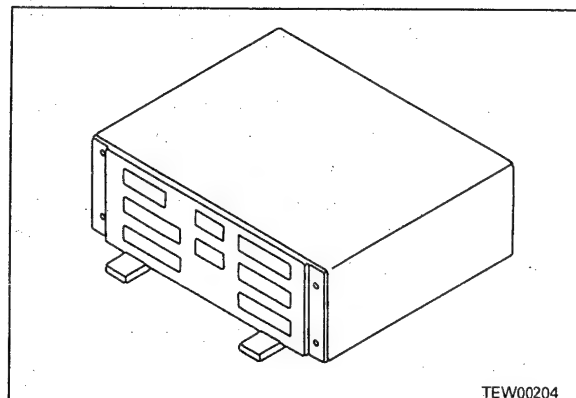


- ③ Carry out a continuity test on the connector. After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
 - ★ After completely drying the connector, blow it with contact restorer and reassemble.



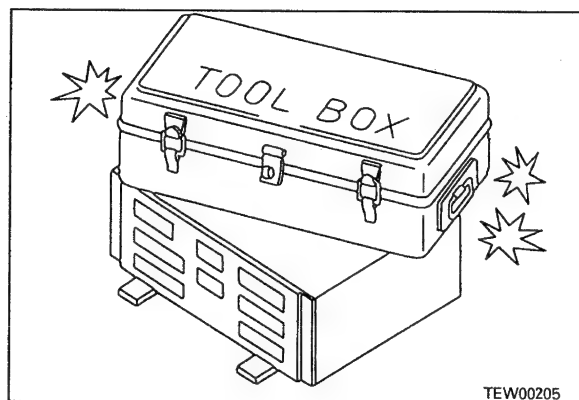
3) Handling control box

- ① The control box contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the control box.
- ② Do not open the cover of the control box unless necessary.



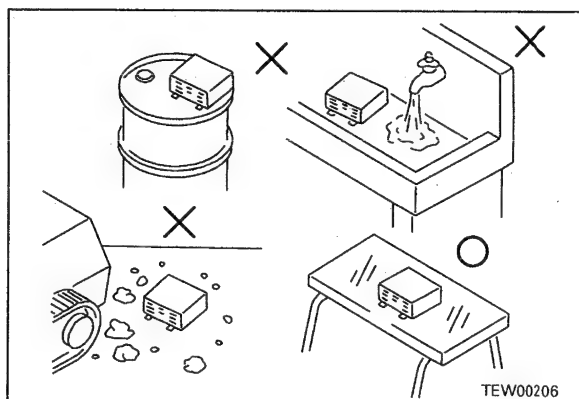
TEW00204

- ③ Do not place objects on top of the control box.
- ④ Cover the control connectors with tape or a vinyl bag. Never touch the connector contacts with your hand.
- ⑤ During rainy weather, do not leave the control box in a place where it is exposed to rain.



TEW00205

- ⑥ Do not place the control box on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand).
- ⑦ Precautions when carrying out arc welding. When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the control box. Fit an arc welding ground close to the welding point.



TEW00206

2. Points to remember when troubleshooting electric circuits

- 1) Always turn the power OFF before disconnecting or connect connectors.
- 2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Disconnect and connect the related connectors several times to check.
- 3) Always connect any disconnected connectors before going on to the next step.
 - ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
- 4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
 - ★ If there is any change, there is probably defective contact in that circuit.

3. POINTS TO REMEMBER WHEN HANDLING HYDRAULIC EQUIPMENT

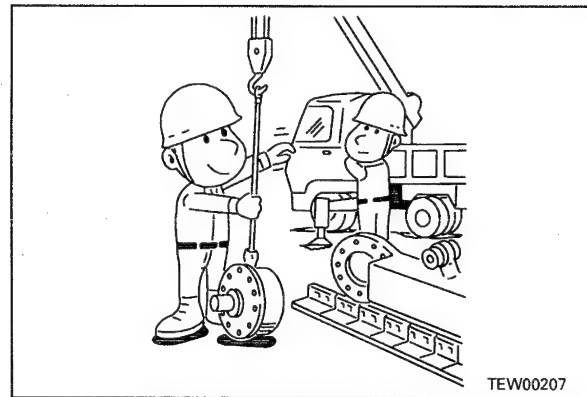
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1) Be careful of the operating environment.

Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

2) Disassembly and maintenance work in the field

If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be confirmed with special test equipment.

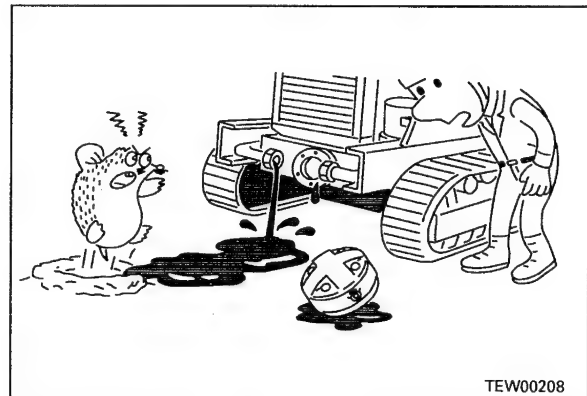


TEW00207

3) Sealing openings

After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this.

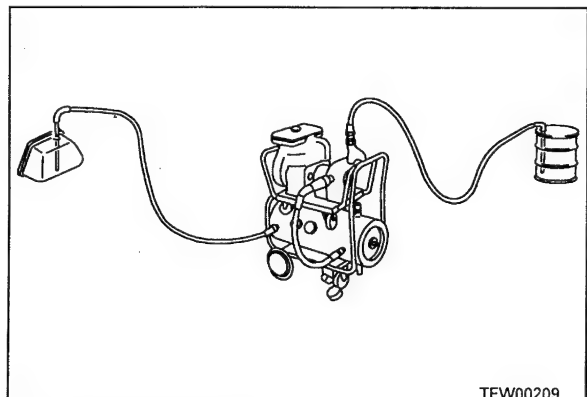
Do not simply drain oil out on to the ground, collect it and ask the customer to dispose of it, or take it back with you for disposal.



TEW00208

4) Do not let any dirt or dust get in during refilling operations.

Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.



TEW00209

023S02

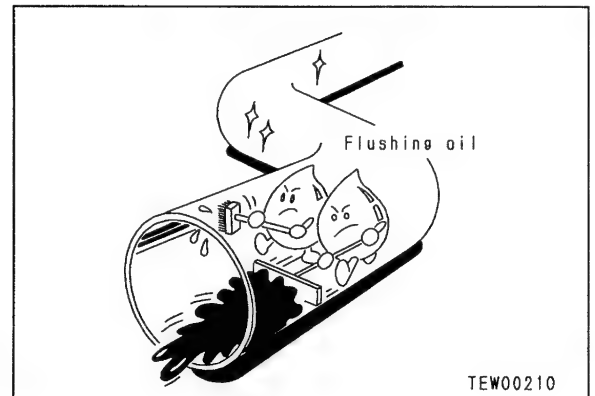
5) Change hydraulic oil when the temperature is high.

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Do not drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

6) Flushing operations

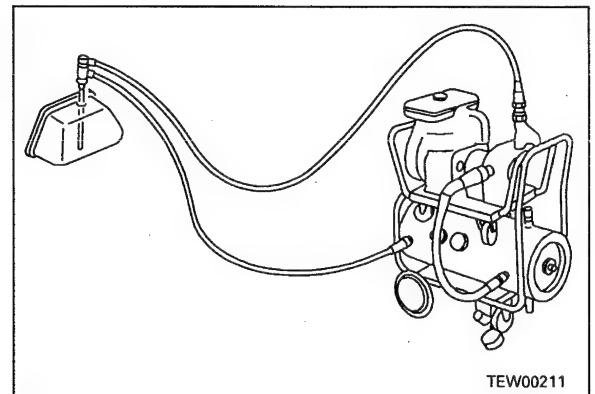
After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit.

Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.

**7) Cleaning operations**

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit.

The oil cleaning equipment is used to remove the ultrafine (about 3μ) particles that the filter built into the hydraulic equipment cannot remove, so it is an extremely effective device.



CHECKS BEFORE TROUBLESHOOTING

	Item	Judgement value	Action
Checks before starting	Lubricating oil, coolant	1. Check fuel level, type of fuel	— Add fuel
		2. Check for impurities in fuel	— Clean, drain
		3. Check hydraulic oil level	— Add oil
		4. Check hydraulic filter	— Replace
		5. Check brake fluid level	— Add oil
		6. Check engine oil level	— Add oil
		7. Check coolant level	— Add water
		8. Check dust indicator	— Clean or replace
		9. Drain water from air tank	— See Troubleshooting
	Electrical equipment	10. Check for looseness, corrosion of battery terminal, wiring	— Tighten or replace
		11. Check for looseness, corrosion of alternator terminal, wiring	— Tighten or replace
		12. Check for looseness, corrosion of starting motor terminal, wiring	— Tighten or replace
		13. Check actuation of gauges	— Repair or replace
		14. Check actuation of moment limiter	— See Troubleshooting
		15. Check actuation of overwind prevention system (safety device)	— See Troubleshooting
Other check items	Hydraulic, mechanical equipment	16. Check for abnormal noise, smell	— Repair
		17. Check for oil leakage	— Repair
		18. Carry out air bleeding	— Bleed air
		19. Check effect of winch brake	— Adjust or repair
		20. Check effect of winch clutch	— Adjust or repair
		21. Check effect of swing brake	— Adjust or repair
		22. Check effect of parking brake, service brake	— Adjust or repair
	Electrics, electrical equipment	23. Check battery voltage (engine stopped)	24 – 26V Repair or replace
		24. Check battery electrolyte level	— Add electrolyte or replace
		25. Check for discolored, burnt, exposed wiring	— Replace
		26. Check for missing wiring clamps, hanging wiring	— Repair
		27. Check for water leaking on wiring (be particularly careful attention to water leaking on connectors or terminals)	— Disconnect connector and dry
		28. Check for blown, corroded fuses	— Replace
		29. Check alternator voltage (engine running at 1/2 throttle or above)	28.5 – 29.5V Repair or replace
		30. Check operating sound of battery (when starting switch is turned ON/OFF)	— Replace
		31. Check air pressure	— Repair or adjust

023S02

CONNECTOR TYPES AND MOUNTING LOCATIONS

★ The Address column in the table above shows the address in the connector arrangement drawing (3-dimensional drawing).

Connector No.	Type	No. of pins	Mounting location	Address	Connector No.	Type	No. of pins	Mounting location	Address
B01	—	1	GND	—	C12	MIC	21	Moment limiter controller	U-8
B01	X	2	Intermediate connector	K-9	C13	AMP040	16	Moment limiter controller	U-8
B02	M	2	Boom working lamp	H-9	C14	AMP040	20	Moment limiter controller	U-8
B05	SWP	8	Intermediate connector	F-8	C15	AMP040	16	Moment limiter controller	V-8
B06	1-pin connector	1	Boom stop lamp	I-9	C16	AMP040	20	Moment limiter controller	V-7
B07	X	3	Top boom stow detection limit switch	K-8	C19	L	2	Intermediate connector	T-6
B08	X	3	Main winch overwind limit switch	J-7	C20	S (Blue)	16	Intermediate connector	S-2
B09-1	Hirose Denki	4	Intermediate connector	—	C21	S (Blue)	16	Intermediate connector	R-2
B09-2	Hirose Denki	4	Intermediate connector	—	C22	S (White)	16	Intermediate connector	P-4
B09-3	Hirose Denki	4	Intermediate connector	—	C23	S (White)	12	Intermediate connector	R-2
B10	X	3	S top	—	C24	M	6	Intermediate connector	P-5
B11	X	4	Jib cord reel	F-7	C25	S (White)	16	Intermediate connector	
B12	SWP	6	Proximity sensor	E-8	C28	—	5	Right turn relay	T-6
B13	X	2	Cord reel length sensor	G-8	C29	—	5	Left turn relay	T-6
B14	X	4	Cord reel length sensor	G-8	C30	—	5	Swing flasher relay	P-9
BJ1	X	4	Jib cord reel	C-5	C31	—	5	N safety relay	P-9
BJ2	SWP	8	Intermediate connector	C-5	C32	—	5	Horn relay	P-9
BR1	SWP	8	Intermediate connector	H-7	C33	—	5	Suspension free relay	P-9
BR2	SWP	12	Intermediate connector	G-7	C34	—	5	Work equipment lever host relay	P-9
BR3	SWP	12	Intermediate connector	H-7	C35	—	5	Jib auto extension relay	P-9
C01	MIC	21	Upper MDT	Q-9	C36	—	5	Jib EXTEND/STOW relay	P-9
C02	MIC	21	Upper MDT	Q-9	C37	—	5	Jib rotation permission relay	P-9
C03	AMP040	16	Upper MDT	Q-9	C38	KES 1	2	Diode	—
C04	AMP040	20	Upper MDT	Q-9	C39	KES 1	2	Diode	—
C05	AMP040	16	Upper MDT	R-9	C40	KES 1	2	Diode	—
C06	AMP040	20	Upper MDT	R-9	C41	—	5	Upper MDT	P-9
C07	1-pin connector	1	Spare output 2	—	C45	Relay	5	Working small lamp relay	P-9
C08	1-pin connector	1	Spare input 4	—	C46	Relay	5	Step lamp relay	O-9
C09	1-pin connector	1	Spare input 3	—	C48	Relay	6	Working lamp relay	P-9
C10	M	4	TV power box wiring harness	P-3	C49	KES 1	2	Diode	—
C11	MIC	21	Moment limiter controller	U-8	C50	Relay	5	Pedal/lever selector relay	P-9

023S02

Con- nector No.	Type	No. of pins	Mounting location	Ad- dress	Con- nector No.	Type	No. of pins	Mounting location	Ad- dress
C51	Relay	6	Jib extension relay	P-9	C94	M	6	Front wiper motor	C-2
C52	Relay	6	Jib stow relay	P-9	C95	S(White)	10	Front and roof wiper switch	W-5
C55	KES 1	2	Diode	—	C96	M	6	Starting switch	W-5
C56	M	4	Emergency gear shift selector switch	R-2	C97	1-pin connector	1	Horn switch (built into steering portion)	W-7
C57	M	4	Emergency gear shift switch	R-2	C98	SWP	14	Gear shift lever, exhaust brake switch	W-6
C58	KES 1	2	Diode	—	C99	SWP	6	Lighting combination switch	W-6
C59	KES 1	2	Diode	—	C100	SWP	6	Turn signal indicator switch, hazard switch, hazard pilot lamp	W-6
C60	KES 1	2	Diode	—	C101	KES 1	2	Diode	—
C61	KES 1	2	Diode	—	C102	1-pin connector	1	Spirit level lighting	Y-9
C62	KES 1	2	Diode	—	C103	1-pin connector	1	Spirit level lighting	Z-9
C63	KES 1	2	Diode	—	C104	1-pin connector	1	Panel lighting	Z-9
C64	KES 1	2	Diode	—	C105	1-pin connector	1	Panel lighting	Z-8
C66	PA	9	Radio	Z-6	C108	M	2	Winch buzzer	T-1
C67	CN	2	Speaker (left)	R-9	C109	M	2	Monitor alarm buzzer	T-1
C68	CN	2	Speaker (right)	P-8	C110	M	2	Emergency alarm buzzer	U-1
C69	1-pin connector	1	External speaker	T-9	C111	M	2	Moment limiter buzzer	T-1
C70	1-pin connector	1	External speaker	T-9	C112	X	2	Low pressure switch	W-1
C73	S	16	Intermediate connector	Q-3	C113	Eftch	2	Acceleration off switch	V-1
C74	M	8	Intermediate connector	Q-3	C114	X	2	Air pressure sensor	P-9
C75	S	8	Intermediate connector	P-3	C115	—	1	GND	—
C76	—	1	Cigar lighter	Q-5	C116	M	6	Intermediate connector	Q-3
C77	1-pin connector	1	Cigar lighter	Q-5	C117	M	2	Swing lever horn switch	Y-6
C78	—	1	Door switch	T-1	C119	SWP	6	Jib rotation permission relay	—
C79	Yazaki	14	Meter panel	X-3	C120	M	2	Free-fall interlock solenoid	Q-2
C80	Yazaki	14	Meter panel	X-2	C121	M	2	Free-fall interlock solenoid	R-2
C81	S(Blue)	16	Intermediate connector	X-2	C122	KES 1	2	Diode	—
C82	S(White)	16	Intermediate connector	X-2	C123	KES 1	2	Diode	—
C83	S	8	Intermediate connector	W-2	C126	1-pin connector	1	Work equipment lever (RAISE) detection switch	S-1
C90	Nihon Koku Denshi	14	Air conditioner panel (when standard)	—	C127	1-pin connector	1	Work equipment lever (RAISE) detection switch	S-1
C92	Nihon Koku Denshi	6	Motor actuator (selector box)	W-4	C130	1-pin connector	1	Step lamp	S-1
C93	AMP040	12	Moment limiter panel	W-4	C131	1-pin connector	1	Step lamp	S-1

023S02

Con- nector No.	Type	No. of pins	Mounting location	Ad- dress	Con- nector No.	Type	No. of pins	Mounting location	Ad- dress
C132	S	10	Roof wiring harness	S-9	CR10	SWP	14	Revolving frame RH wiring harness	G-7 P-6
C133	CN	4	Wiper motor	D-5	CR11	SWP	16	Revolving frame RH wiring harness	F-8 P-6
C134	M	2	Working lamp on top of cab	D-5	E01	X	2	Engine speed sensor	m-1
C135	KES 1	2	Diode	—	E02	X	3	Accelerator position meter	o-3
C136	KES 1	2	Diode	—	E03	Terminal	—	Engine oil pressure sensor	m-1
C137	KES 1	2	Diode	—	E04	X	2	Engine water temperature sensor	n-8
C138	CN	6	Wiper relay	—	E05	SWP	8	Engine stop motor	o-2
C139	CN	6	Roof wiper relay	—	E06			Alternator	m-9
C143	—	1	GND	—	E07	Terminal	—	Heater relay	o-3
C150	S(White)	16	Intermediate connector	P-3	E08	Terminal	—	Heater relay	o-1
C155	KES 1	2	Diode	—	E09	Terminal	—	Heater relay	o-2
C159		2	Diode	—	E10	—	2	Diode	—
C201	S	16	Intermediate connector	—	E11	X	2	Intermediate connector	m-9
CP1	S	8	Intermediate connector (front panel)	T-3	E12	KES 1	2	Diode	—
CP2	S	6	Intermediate connector (front panel)	W-4	E13	Terminal	—	Alternator	
CP3	S(Blue)	16	Intermediate connector (front panel)	W-3	E14	Terminal	—	Starting motor	ℓ-9
CP4	S	8	Intermediate connector (front panel)	T-3	E15	Terminal	1	Alternator	m-8
CP5	S	8	Intermediate connector (front panel)	T-2	E16	Terminal	—	GND	m-9
CP6	S(Blue)	12	Intermediate connector (front panel)	T-2	EL1	SWP	12	Intermediate connector	—
CP8	S(White)	12	Intermediate connector (top panel)	U-8	EL2	SWP	12	Intermediate connector	m-1
CP9	S(Blue)	16	Intermediate connector (top panel)	T-9	J01	AMP040	20	Jib communication module	D-8
CP10	S	12	Intermediate connector (front side panel)	W-5	J03	X	3	Tilt angle sensor	E-8
CP11	S	12	Intermediate connector (front side panel)	W-5	J06	X	2	Lock cylinder solenoid (left)	B-6
CR1	SWP	6	Slip ring wiring harness	E-5 P-7	J07	X	2	Lock cylinder solenoid (left)	D-5
CR2	L	2	Slip ring wiring harness	E-5 P-7	J08	X	2	Rotation cylinder solenoid	C-8
CR3	SWP	14	Slip ring wiring harness	G-7 P-5	J09	X	2	Rotation cylinder solenoid	D-6
CR4	SWP	16	Revolving frame RH wiring harness	E-5 P-7	J10	X	2	Lock cylinder solenoid (right)	D-8
CR5	SWP	16	Slip ring wiring harness	P-5	J11	X	2	Lock cylinder solenoid (right)	D-5
CR6	SWP	16	Revolving frame RH wiring harness	E-5 P-8	J12	X	2	Jib selector valve solenoid	B-7 D-8
CR7	SWP	12	Revolving frame RH wiring harness	E-6 P-8	J13	L (White)	16	Jib EXTEND/STOW selector relay	—
CR9	SWP	16	Revolving frame RH wiring harness	G-7 P-6	J14	KES 1	2	Diode	—

Connector No.	Type	No. of pins	Mounting location	Address	Connector No.	Type	No. of pins	Mounting location	Address
J16	SWP	6	Proximity sensor	–	L28	KES 1	2	Diode	–
J17-1	Hirose Denki	4	Intermediate connector	–	L29	X	2	Suspension lock rear solenoid	j-9
J17-2	Hirose Denki	4	Intermediate connector	K-6	L30	KES 1	2	Diode	–
J17-3	Hirose Denki	4	Intermediate connector	H-7	L31	X	2	Suspension lift solenoid	d-4
J18	X	2	Intermediate connector	K-7	L32	KES 1	2	Diode	–
J19	X	3	Signal top overwind switch	K-6	L33	X	4	Outrigger RL	k-9
L01	L	2	Intermediate connector (slip ring)	o-1	L34	X	2	Outrigger individual solenoid	k-9
L02	X	2	Intermediate connector (slip ring)	i-1	L36	X	4	Outrigger RR	o-7
L03	SWP	8	Intermediate connector (slip ring)	i-1	L37	X	2	Outrigger individual solenoid	o-7
L04	SWP	14	Intermediate connector (slip ring)	i-1	L39	X	4	Outrigger FR	g-1
L05	SWP	14	Intermediate connector	o-6	L40	X	2	Outrigger individual solenoid	f-2
L06	X	2	Intermediate connector	o-6	L42	X	4	Outrigger FL	d-3
L08	X	2	Swing pump merge selector solenoid	g-7	L43	X	2	Outrigger individual solenoid	e-3
L09	KES 1	2	Diode	–	L45	S(White)	12	Intermediate connector	–
L10	X	3	Rear suspension sensor detection limit switch	j-9	L46	CN	4	Front combination lamp assembly	d-4
L11	X	4	Rear steering lock cylinder	j-9	L48	M	3	Passing beam, travel beam	d-3
L12	X	2	Rear steering solenoid	i-8	L49	M	3	Passing beam, travel beam	f-2
L13	X	2	Rear steering solenoid	h-8	L51	CN	4	Front combination lamp assembly (left)	g-2
L14	KES 1	2	Diode	–	L52	M	6	Rear combination lamp (left)	o-7
L15	KES 1	2	Diode	–	L53	1-pin connector	1	License lamp	n-8
L16	X	2	Outrigger selector valve assembly	g-1	L54	1-pin connector	1	Back-up buzzer	n-8
L18	X	2	Parking brake air pressure switch	d-5	L55	M	6	Rear combination lamp (right)	m-9
L19	X	2	Steering mode selector solenoid	d-5	L57	X	2	Exhaust brake air solenoid	–
L20	X	2	Steering mode selector solenoid	d-4	L58	KES 1	2	Diode	–
L21	KES 1	2	Diode	–	L59	X	2	Sub engine control solenoid	i-8
L22	KES 1	2	Diode	–	L60	KES 1	2	Diode	–
L23	X	2	Rear wheel steering solenoid	d-4	L61	Terminal	–	GND	–
L24	KES 1	2	Diode	–	L62	KES 1	2	Diode	–
L25	X	2	Reverse steering compensation solenoid	d-5	L63	Terminal		Battery relay	o-5
L26	KES 1	2	Diode	–	L64	Terminal		Battery relay	o-5
L27	X	2	Suspension lock front solenoid	j-9	L65	Terminal		Emergency relay	d-3

023S02

Con- nector No.	Type	No. of pins	Mounting location	Ad- dress	Con- nector No.	Type	No. of pins	Mounting location	Ad- dress
L66	Terminal		Slow blow fuse	o-4	L99	X	2	Hi-Lo solenoid	k-2
L67	Terminal		Slow blow fuse	o-4	L100	KES 1	2	Diode	-
L68	Terminal		Slow blow fuse	n-4	L101	X	2	4WD solenoid	k-2
L69	Terminal		Slow blow fuse	o-4	L102	KES 1	2	Diode	-
L70	SWP	14	Intermediate connector	e-6	L103	X	2	Speed sensor (electro- magnetic pickup)	k-1
L71	X	2	Service brake solenoid	f-7	L104	X	2	Speed sensor (electro- magnetic pickup)	k-1
L72	KES 1	2	Diode	-	L105	X	2	Torque converter oil temperature sensor	i-8
L73	X	2	Parking brake solenoid	f-7	L106	X	2	Stop lamp switch	e-6
L74	KES 1	2	Diode	-	L107	X	2	Tachograph	o-5
L75	X	2	Front brake stroke switch	e-6	L108	X	2	Hydraulic oil temperature sensor	-
L76	X	2	Rear brake stroke switch	e-6	L109	SWP	8	Intermediate connector	-
L77	X	2	Brake oil reservoir tank	f-6	L110	Terminal	-	GND	n-4
L78	X	2	Brake oil reservoir tank	f-6	L111	X	2	Intermediate connector	-
L79	X	3	Auto grease switch	h-8	L112	X	3	Intermediate connector	-
L80	1-pin connector	1	Auxiliary side clearance lamp	-	L130	Terminal		Slow blow fuse	
L81	1-pin connector	1	Auxiliary side clearance lamp	-	L131	Terminal		Slow blow fuse	-
L82	KES 1	2	Diode	-	L132	Terminal		Battery relay	-
L83	1-pin connector	1	Auto grease	h-7	L133	Terminal		Battery relay	-
L84	1-pin connector	1	Auto grease	g-7	L134	Terminal		Emergency relay	-
L85	-	1	Fuel level sensor	g-7	L140	X	2	Outrigger selector valve assembly	h-1
L86	-	1	Fuel level sensor	g-7	L146	KES 1	2	Diode	-
L88	1-pin connector	1	Grease pressure switch	g-1	L151	X	2	Outrigger individual solenoid	f-2
L90	X	2	PTO solenoid	i-9	L152	X	2	Outrigger individual solenoid	e-2 e-3
L91	KES 1	2	Diode	-	L153	X	2	Outrigger individual solenoid	o-7
L92	X	2	Lock-up solenoid	o-8	L154	X	2	Outrigger individual solenoid	l-9
L93	X	2	F1 solenoid	k-2	L155	1-pin connector	1	Spirit level lighting	-
L94	X	2	F3 solenoid	o-8	L156	1-pin connector	1	Spirit level lighting	-
L95	X	2	F2 solenoid	l-2	LM01	L	2	Intermediate connector	l-2
L96	KES 1	2	Diode	-	LM02	SWP	6	Intermediate connector	m-3
L97	X	2	R solenoid	n-3	LM03	SWP	14	Intermediate connector	m-3
L98	KES 1	2	Diode	-	LM04	SWP	14	Intermediate connector	m-3

023S02

Con- nector No.	Type	No. of pins	Mounting location	Ad- dress	Con- nector No.	Type	No. of pins	Mounting location	Ad- dress
LM05	SWP	14	Intermediate connector	n-3	M32	Relay	5	Reverse steering mode relay	c-6
LM06	SWP	14	Intermediate connector	ℓ-2	M33	Relay	5	Special steering mode relay	d-6
LM07	SWP	16	Intermediate connector	ℓ-2	M34	Relay	5	Transmission solenoid power source relay	c-7
LM08	SWP	16	Intermediate connector	ℓ-3	M35	Relay	6	Emergency gear shift relay	c-7
LM09	SWP	16	Intermediate connector	m-3	M36	Relay	5	Back-up lamp relay	c-7
LM10	SWP	16	Intermediate connector	m-3	M37	Relay	6	Outrigger selector relay	d-7
M01	MIC	21	MDT	o-7	M38	Relay	5	Outrigger power source relay	d-6
M02	MIC	21	MDT	o-7	M39	Relay	5	F2/R solenoid (ECMV) cut relay	c-7
M03	AMP040	20	MDT	o-6	M40	Relay	5	F1/F3 solenoid (ECMV) cut relay	c-7
M04	AMP040	16	MDT	o-6	M44	–	4	Flasher unit	D-9
M05	AMP040	20	MDT	o-6	M45	–	2	Resistor	F-2
M06	AMP040	16	MDT	o-6	M46	–	2	Resistor	F-7
M13	MIC	21	Transmission controller	o-5	M47	KES 1	2	Diode	–
M14	AMP040	20	Transmission controller	o-5	M48	KES 1	2	Diode	–
M15	AMP040	16	Transmission controller	o-5	M49	KES 1	2	Diode	–
M16	KES 1	2	Diode	–	M50	KES 1	2	Diode	–
M17	KES 1	2	Diode	–	M51	KES 1	2	Diode	–
M18	L	2	Intermediate connector	d-7 o-18	M53	Relay	5	Stop lamp relay	–
M19	S(White)	16	Intermediate connector	d-8	M60	M	6	Intermediate connector	–
M20	S(Blue)	16	Intermediate connector	d-8	M61	S(White)	10	Intermediate connector	E-9
M21	S(White)	12	Intermediate connector	d-8	M62	1-pin connector	1	Intermediate connector	f-9
M22	S(Blue)	16	Intermediate connector	d-9	M63	KES 1	2	Diode	–
M23	S(Blue)	12	Intermediate connector	d-9	M64	KES 1	2	Diode	–
M24	Relay	5	Engine stop motor relay	c-7	M65	KES 1	2	Diode	–
M25	Relay	5	Head lamp Lo relay	c-7	M66	KES 1	2	Diode	–
M26	Relay	5	Head lamp Hi relay	c-6	M67	KES 1	2	Diode	–
M27	Relay	5	Side lamp relay	c-6	M68	KES 1	2	Diode	–
M28	Relay	5	Bottom turn signal indicator relay (right)	c-6	M68	1-pin connector	1	Retarder control wiring harness (opt)	–
M29	Relay	5	Bottom turn signal indicator relay (right)	c-7	M69	M	3	Retarder control wiring harness (opt)	–
M30	Relay	5	Anti-nosedive relay	c-7	M69	KES 1	2	Diode	–
M31	Relay	5	Swing pump merge solenoid	c-7	M70	Yazaki	2	Retarder control wiring harness (opt)	–

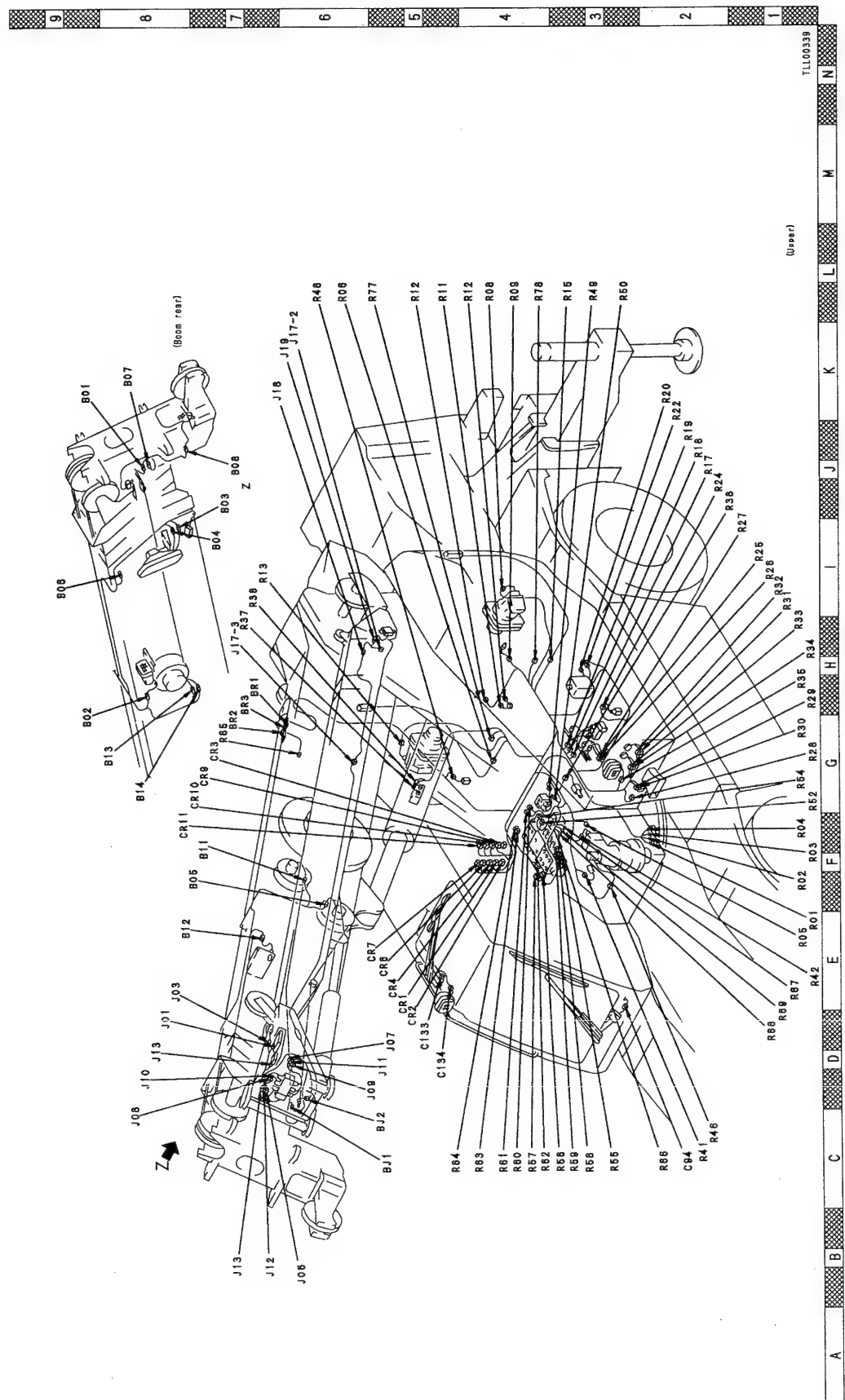
023S02

Connector No.	Type	No. of pins	Mounting location	Address	Connector No.	Type	No. of pins	Mounting location	Address
M71	Yazaki	2	Retarder control wiring harness (opt)	—	P36	1-pin connector	1	Lock display lamp (front panel)	—
M72	AMP070	10	Retarder control wiring harness (opt)	f-8	P37	1-pin connector	1	Lock display lamp (front panel)	—
M73	AMP070	14	Retarder control wiring harness (opt)	f-8	P38	—	1	Mount completion indicator (front panel)	—
M74	1-pin connector	1	Retarder control wiring harness (opt)	—	P39	—	1	Mount completion indicator (front panel)	—
M84	KES 1	1	Diode	—	P40	—	1	Left lock completion indicator (front panel)	—
M85	KES 1	2	Diode	—	P41	—	1	Left lock completion indicator (front panel)	—
M86	KES 1	2	Diode	—	P43	M	6	Jib auto extension switch (front panel)	—
M87	KES 1	2	Diode	—	P46	—	1	Jib auto extension switch (front side panel)	—
P01	—	1	PTO switch (front panel)	—	P47	—	1	Jib auto extension switch (front side panel)	—
P02	—	1	PTO switch (front panel)	—	P48	—	1	Jib auto extension switch (front side panel)	—
P03	—	1	PTO switch (front panel)	—	P49	—	1	Jib auto extension switch (front side panel)	—
P04	—	1	PTO switch (front panel)	—	P50	—	1	Jib auto extension switch (front side panel)	—
P05	—	1	PTO switch (front panel)	—	P51	—	1	Jib auto extension switch (front side panel)	—
P06	—	1	PTO switch (front panel)	—	P53	S	8	Boom select switch	—
P07	—	1	PTO switch (front panel)	—	P55	M	6	Pedal selector, telescope, hoist	—
P08	—	1	PTO switch (front panel)	—	P56	M	6	Swing LOCK/FREE	—
P09	M	6	Outrigger EXTEND/RETRACT switch (front panel)	—	P57	M	6	Swing brake switch	—
P10	M	6	Outrigger JACK/SLIDE switch (front panel)	—	P65	M	6	Swing buzzer	—
P17	1-pin connector	1	Automatic stop cancel switch (front panel)	—	P66	M	6	Step lamp	—
P18	1-pin connector	1	Automatic stop cancel switch (front panel)	—	P67	M	6	Working lamp	—
P19	1-pin connector	1	Indicator (front panel)	—	P68	Yazaki	7	Reverse steering switch	—
P20	1-pin connector	1	Indicator (front panel)	—	P69	M	6	Suspension lock	—
P21	M	6	Parking brake switch (front panel)	—	P70	Yazaki	6	Suspension lift switch	—
P25	M	6	Travel mode switch (front panel)	—	P72	CN	2	Room lamp assembly	—
P29	MIC	13	Steering mode switch (front panel)	—	P79	—	1	Outrigger individual switch (FR)	—
P30	S	8	Rear steering lock switch (front panel)	—	P80	—	1	Outrigger individual switch (FR)	—
P31	Yazaki	7	Emergency steering switch (front panel)	—	P81	—	1	Outrigger individual switch (RR)	—
P32	1-pin connector	1	Free display lamp (front panel)	—	P82	—	1	Outrigger individual switch (RR)	—
P33	1-pin connector	1	Free display lamp (front panel)	—	P83	—	1	Outrigger individual switch (FL)	—
P34	1-pin connector	1	Center display lamp (front panel)	—	P84	—	1	Outrigger individual switch (FL)	—
P35	1-pin connector	1	Center display lamp (front panel)	—	P85	—	1	Outrigger individual switch (RL)	—

Con- nector No.	Type	No. of pins	Mounting location	Ad- dress	Con- nector No.	Type	No. of pins	Mounting location	Ad- dress
P86	—	1	Outrigger individual switch (RL)	—	R42	X	2	Swing FREE/LOCK solenoid	E-1
P87	—	1	Outrigger ALL control switch	—	R43	KES 1	2	Diode	—
P88	—	1	Outrigger ALL control switch	—	R47	Terminal		GND	—
R01	L	2	Intermediate connector	E-1 h-1	R48	X	2	Boom telescope selector valve	L-6
R02	X	2	Slip ring assembly	F-1 J-1	R49	X	2	Pedal/lever selector sole- noid	L-3
R03	SWP	8	Intermediate connector	F-1 J-1	R50	X	2	Pedal/lever selector sole- noid	L-3
R04	SWP	14	Intermediate connector	F-1 J-1	R51	KES 1	2	Diode	—
R05	X	4	Swing angle sensor	E-1	R52	X	2	Jib tilt unload solenoid	G-1
R06	M	2	Swing flasher lamp (right)	L-6	R53	X	2	Diode	—
R09	SWP	6	Proximity switch	L-4	R54	X	2	Boom winch unload solenoid	G-1
R10	—	1	Swing buzzer	—	R54	X	2	PPC pressure switch	C-3
R11	1-pin connector	1	Swing buzzer	L-5	R56	X	2	PPC pressure switch	C-3
R12	SWP	6	Proximity switch	L-4 L-5	R57	X	2	PPC pressure switch	C-4
R15	M	2	Swing flasher lamp (left)	L-3	R58	X	2	PPC pressure switch	C-3
R16	X	3	Air conditioner compressor unit	—	R59	X	2	PPC pressure switch	C-3
R20	CN	2	Washer tank (front)	K-2	R60	X	2	PPC pressure switch	C-4
R21	KES 1	2	Diode	—	R61	X	2	PPC pressure switch	C-4
R22	CN	2	Washer tank (upper)	K-2	R62	X	2	PPC pressure switch	C-4
R23	KES 1	2	Diode	—	R63	X	2	PPC pressure switch	C-4
R24	X	2	Accumulator pressure switch	J-2	R64	X	2	PPC pressure switch	C-5
R25	X	2	Swing left PPC pressure switch	I-1	R65	X	4	Boom angle sensor	G-7
R26	X	2	Swing right PPC pressure switch	I-1	R66	—	1	Winch brake switch (main) limit	C-2
R33	—	1	Electric horn	H-1	R67	—	1	Winch brake switch (auxiliary) limit	E-1
R34	—	1	Electric horn	H-1	R68	—	1	Winch brake switch (main) limit	D-1
R35	M	2	Work lamp	H-1	R69	—	1	Winch brake switch (auxiliary) limit	E-1
R36	X	3	Boom bottom pressure sensor	I-7	R74	—	1	GND	—
R37	X	3	Boom head pressure sensor	H-7					
R38	X	2	Swing brake solenoid	J-2					
R39	KES 1	2	Diode	—					
R40	X	3	Over-front detection limit	—					
R41	X	2	Low pressure switch (rear)	C-2					

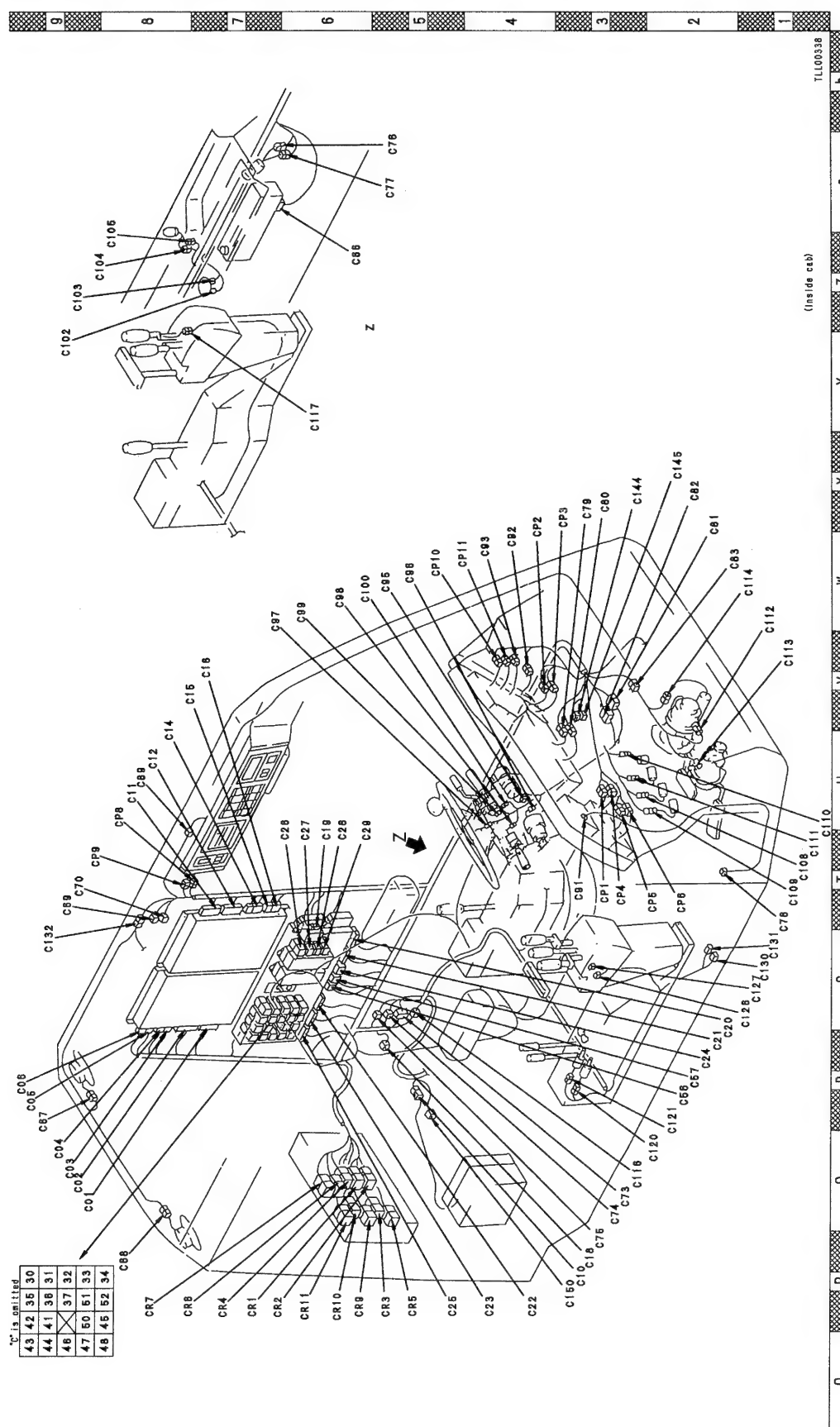
CONNECTOR ARRANGEMENT DIAGRAM

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023S02

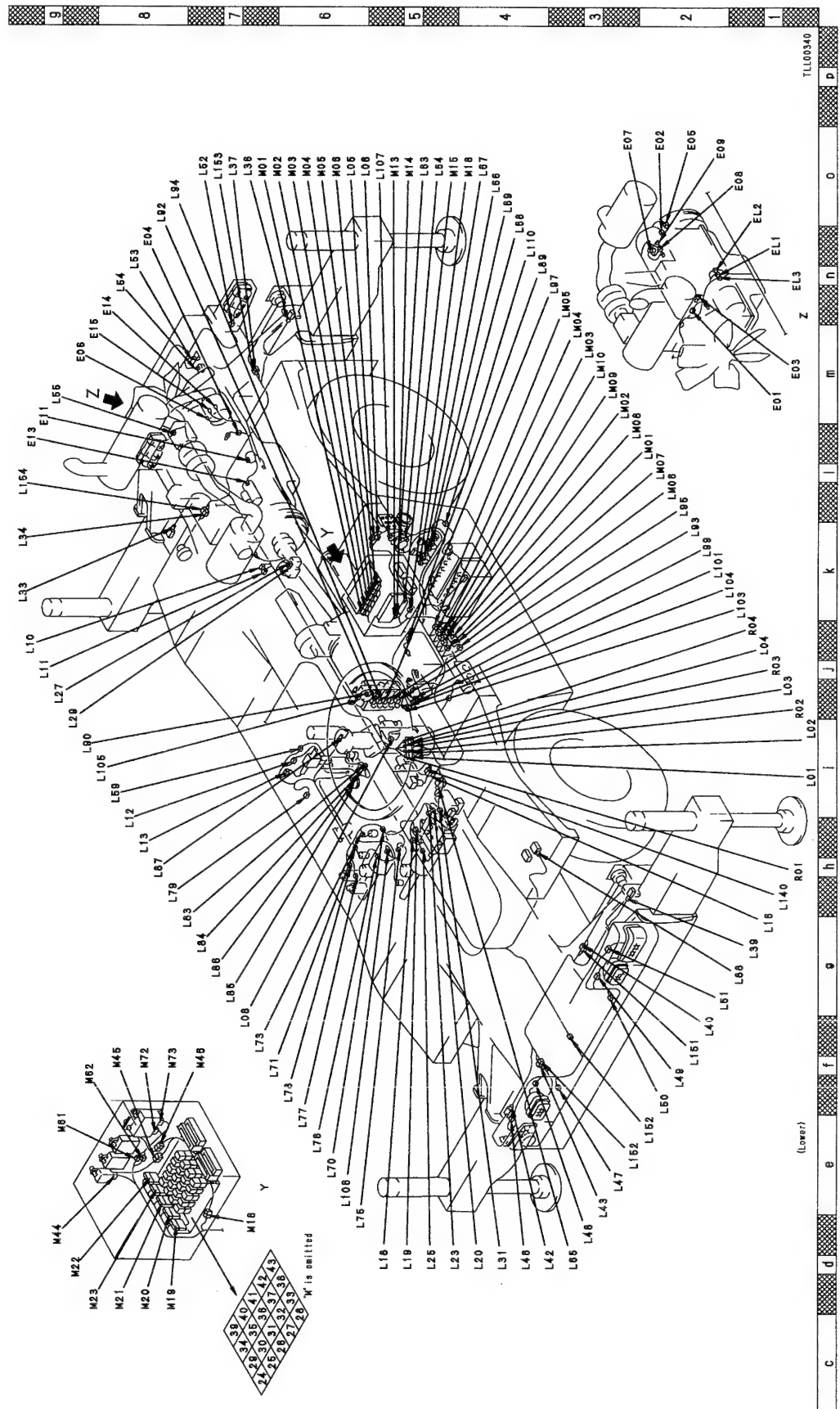
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023S02

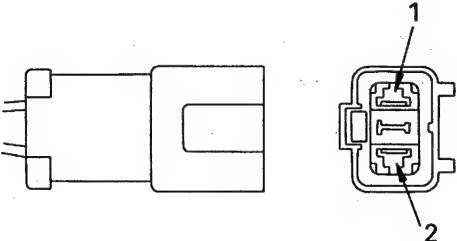
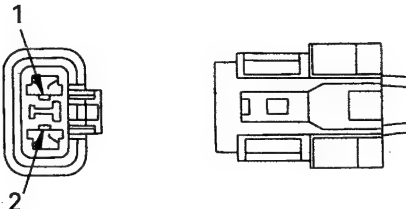
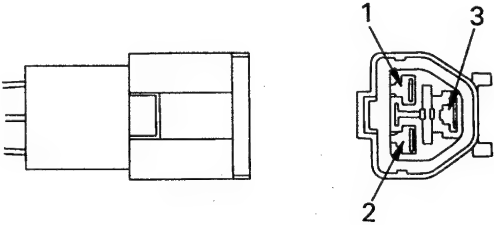
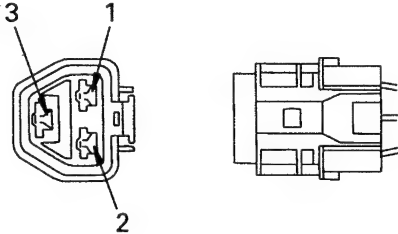
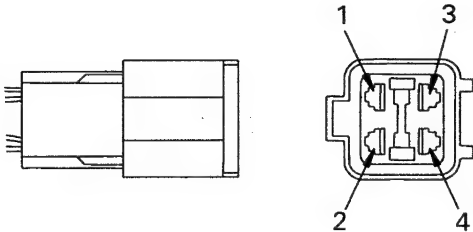
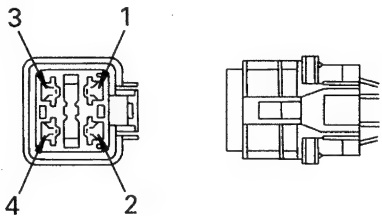
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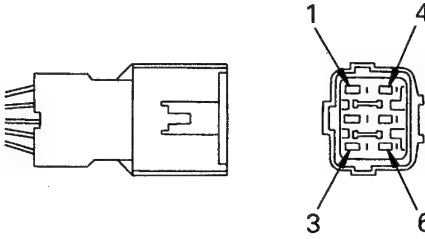
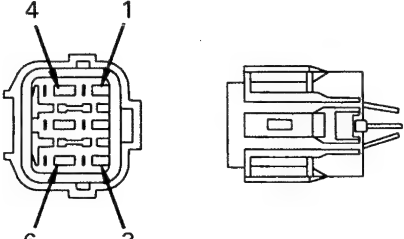
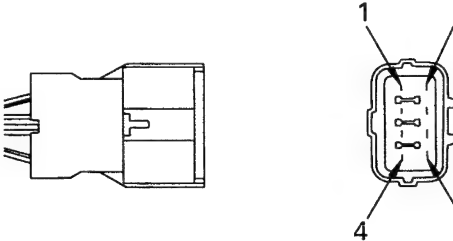
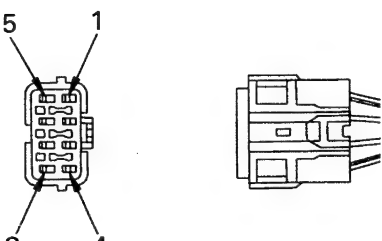
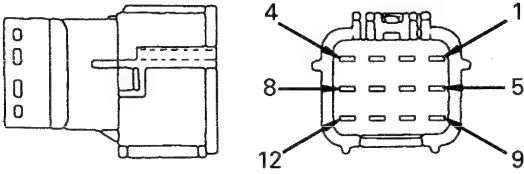
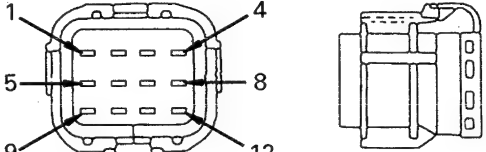
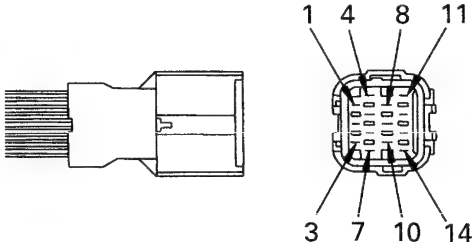
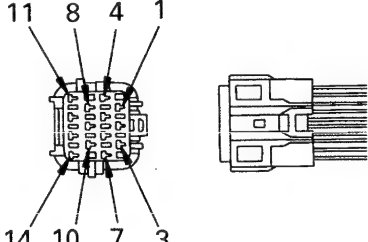
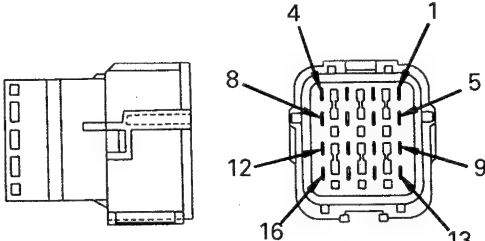
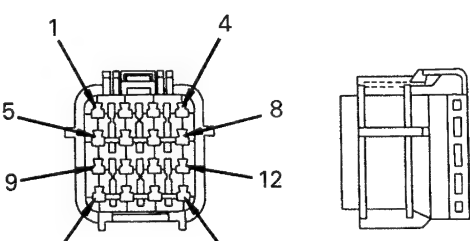


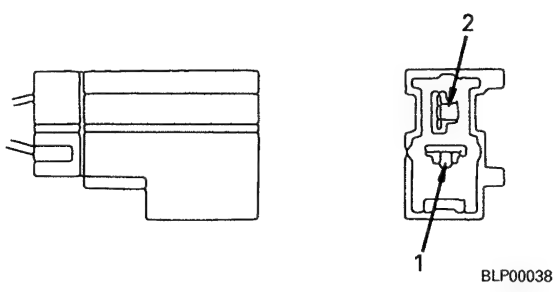
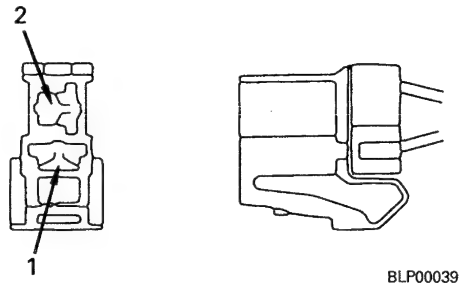
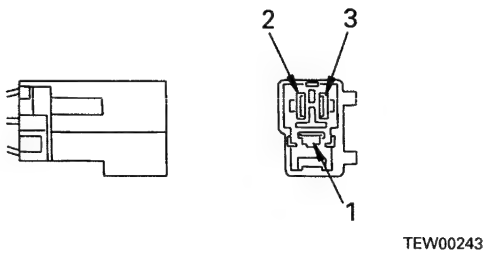
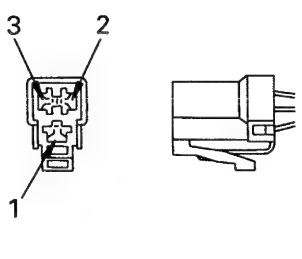
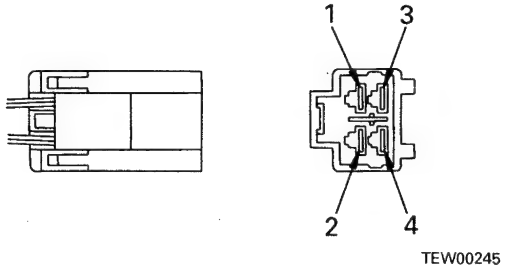
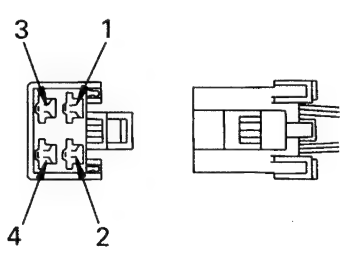
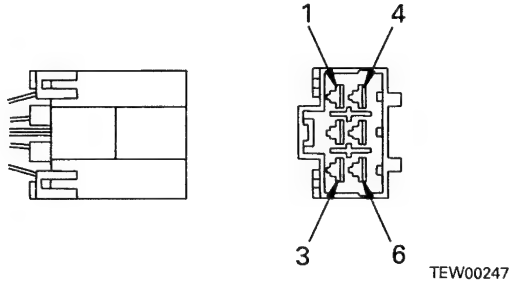
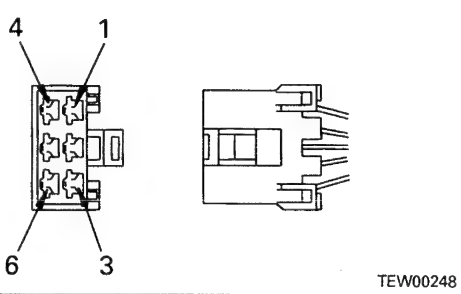
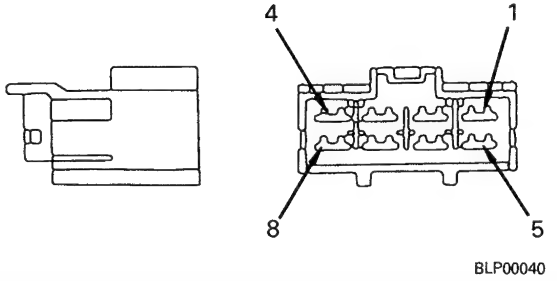
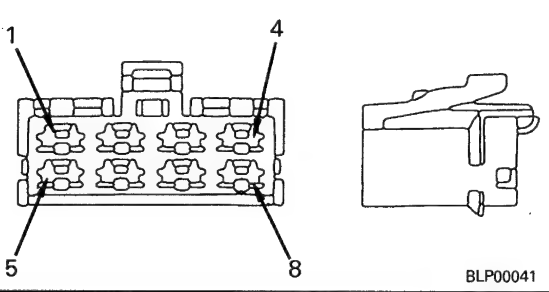
CONNECTION TABLE FOR CONNECTOR PIN NUMBERS

★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

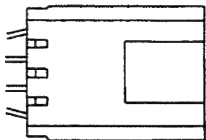
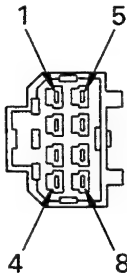
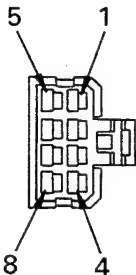
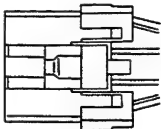
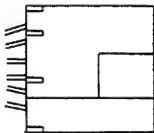
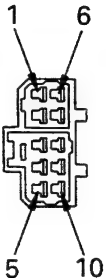
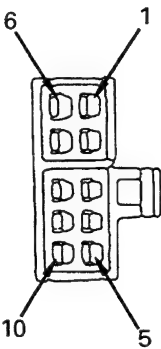
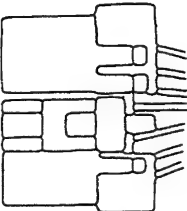
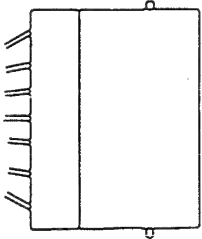

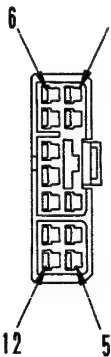
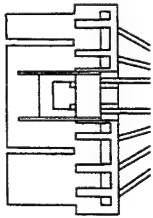
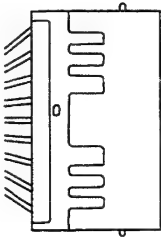
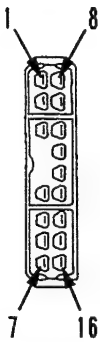
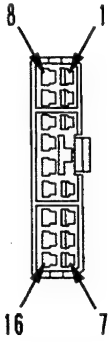
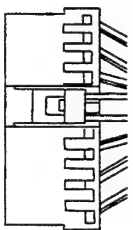
No. of pins	X type connector	
	Male (female housing)	Female (male housing)
2	 <p>TEW00221</p>	 <p>TEW00222</p>
3	 <p>TEW00223</p>	 <p>TEW00224</p>
4	 <p>TEW00225</p>	 <p>TEW00226</p>

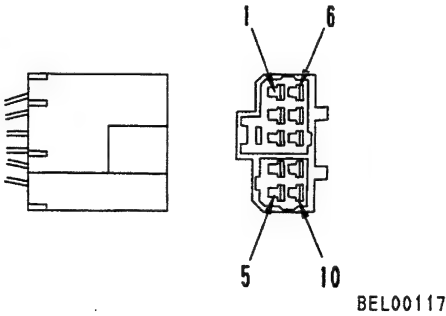
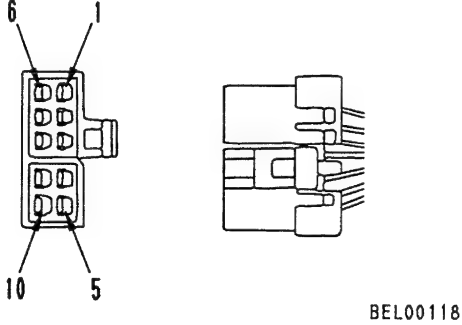
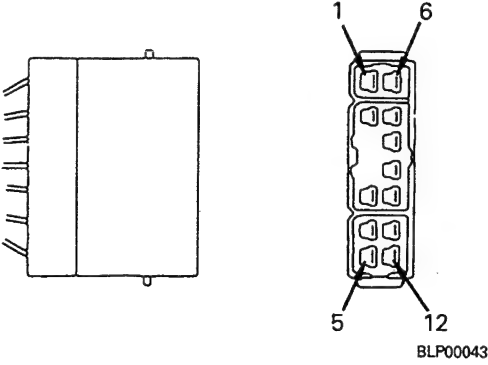
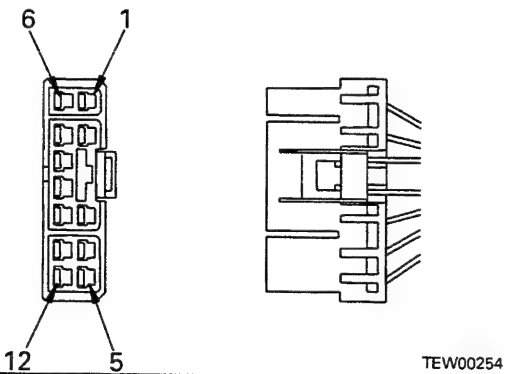
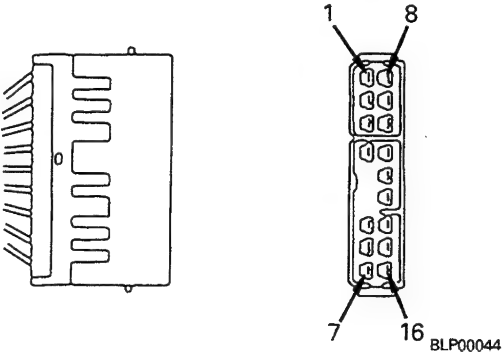
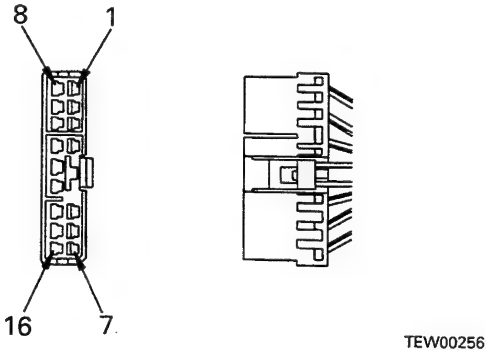
023S02

No. of pins	SWP type connector	
	Male (female housing)	Female (male housing)
6	 TEW00235	 BLP00033
8	 TEW00237	 TEW00238
12	 BLP00034	 BLP00035
14	 TEW00239	 TEW00240
16	 BLP00036	 BLP00037

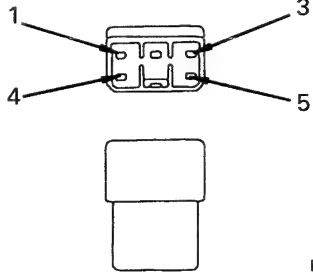
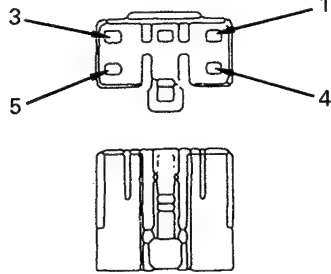
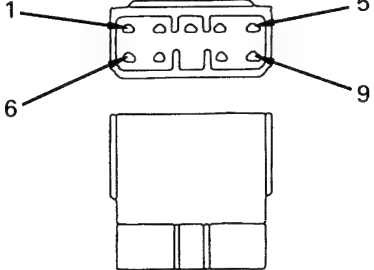
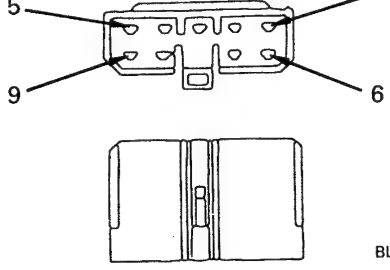
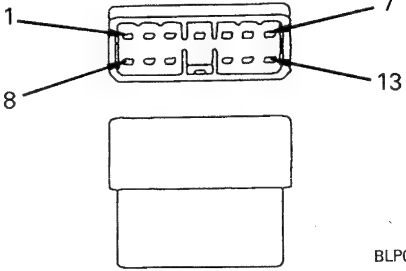
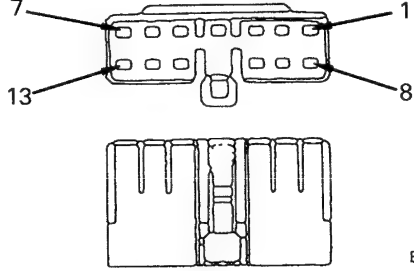
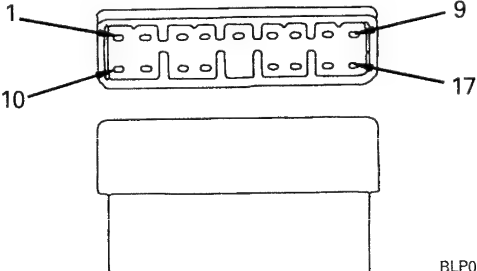
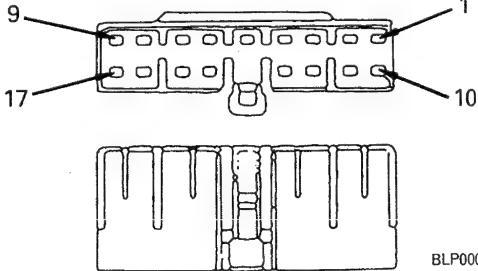
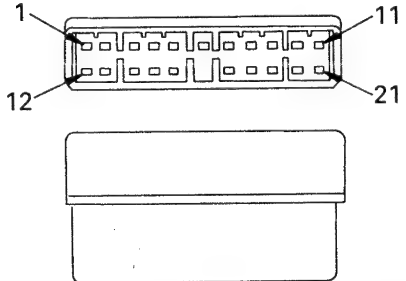
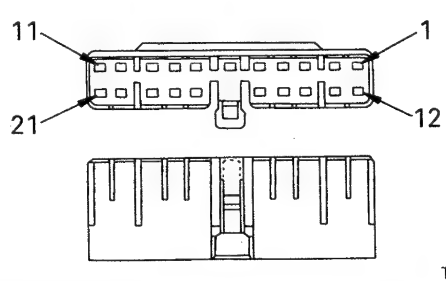
No. of pins	M type connector	
	Male (female housing)	Female (male housing)
2		
3		
4		
6		
8		

023S02

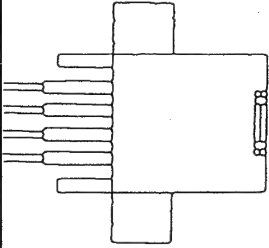
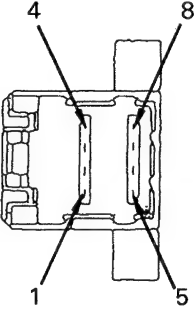
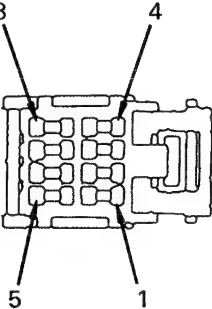
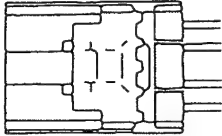
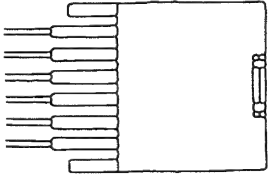
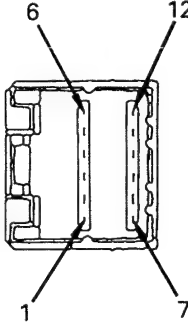
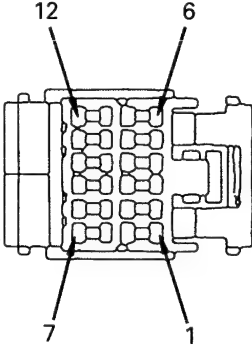
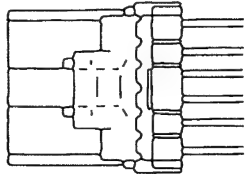
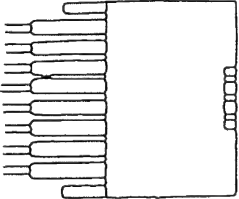
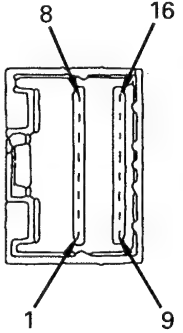
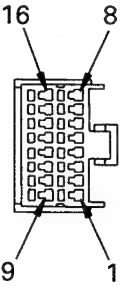
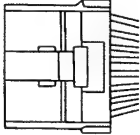
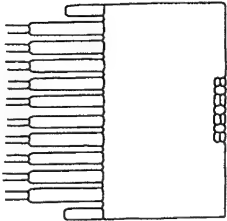
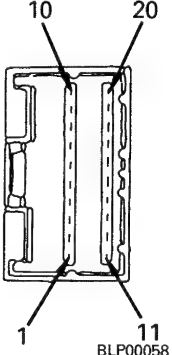
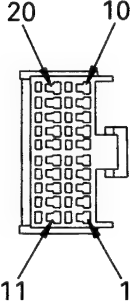
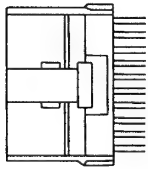
No. of pins	S type connector			
	Male (female housing)		Female (male housing)	
8		 TEW00249	 TEW00250	
10 (White)		 TEW00251	 BLP00042	
12 (White)		 BEL00113	 BEL00114	
16 (White)		 BEP01697	 BEP01698	

No. of pins	S type connector	
	Male (female housing)	Female (male housing)
10 (Blue)		
12 (Blue)		
16 (Blue)		

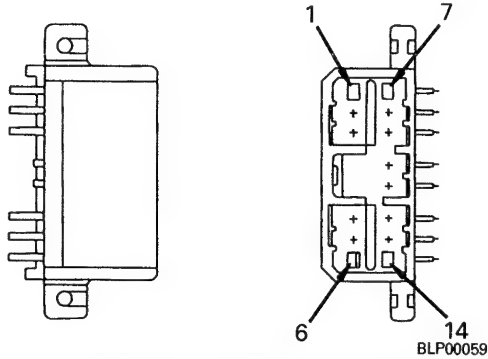
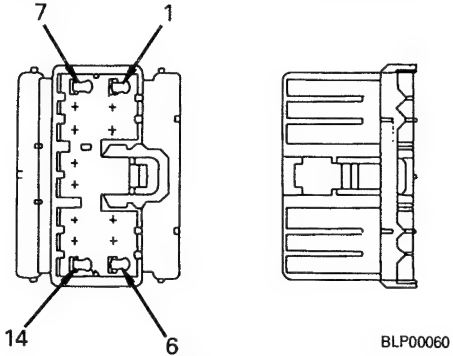
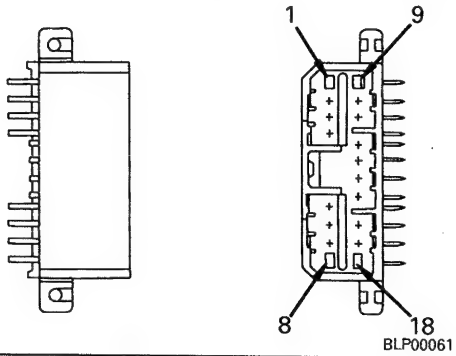
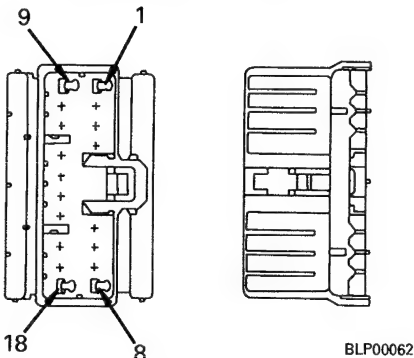
023S02

No. of pins	MIC type connector	
	Male (female housing)	Female (male housing)
5	 BLP00045	 BLP00046
9	 BLP00047	 BLP00048
13	 BLP00049	 BLP00050
17	 BLP00051	 BLP00052
21	 TEW00259	 TEW00260

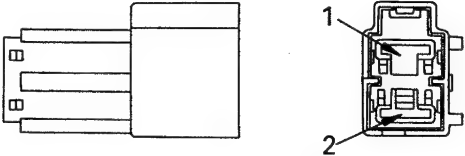
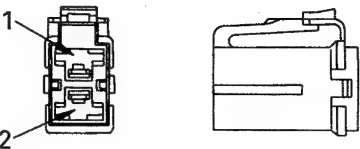
023S02

No. of pins	AMP040 type connector			
	Male (female housing)		Female (male housing)	
8		 BLP00053	 BLP00054	
12		 BLP00055	 BLP00056	
16		 BLP00057	 TEW00232	
20		 BLP00058	 TEW00234	

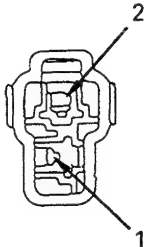
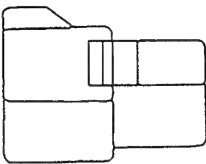
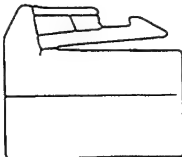
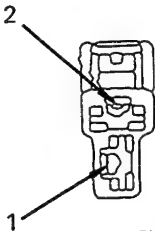
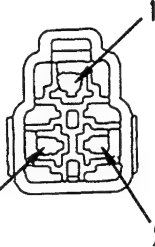
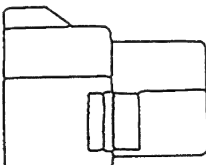

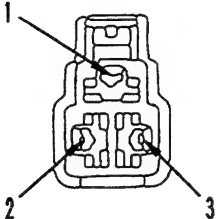
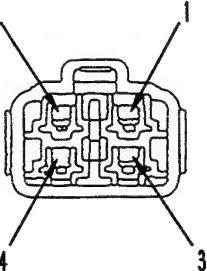
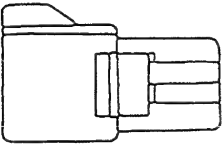
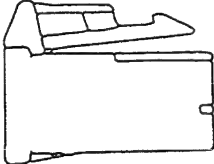
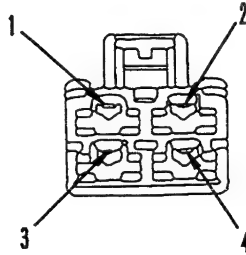
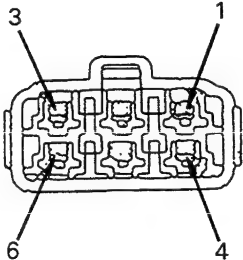
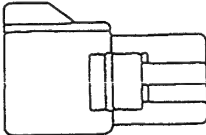
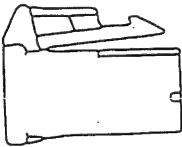
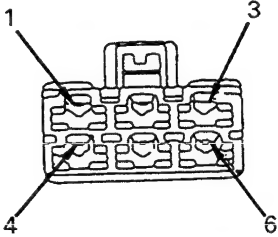
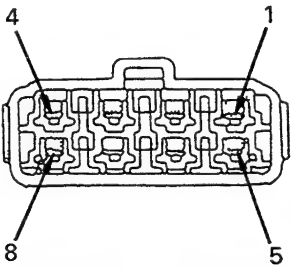
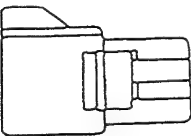
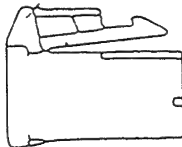
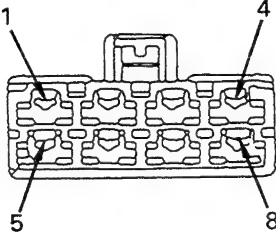
023S02

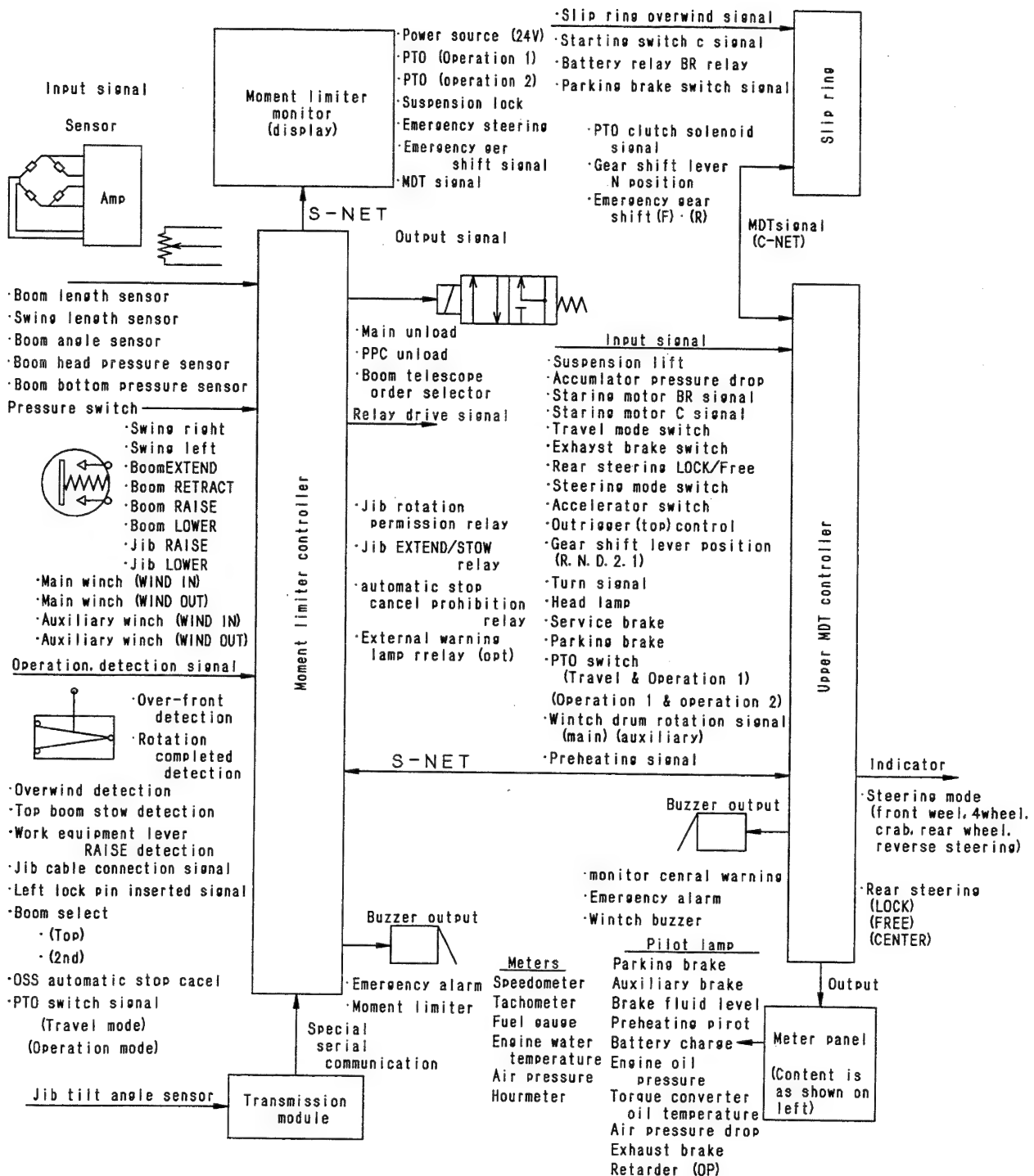
No. of pins	AMP070 type connector	
	Male (female housing)	Female (male housing)
8	 BLP00059	 BLP00060
12	 BLP00061	 BLP00062

023S02

No. of pins	L type connector	
	Male (female housing)	Female (male housing)
2	<div>  </div> <div>TEW00257</div>	<div>  </div> <div>TEW00258</div>

023S02

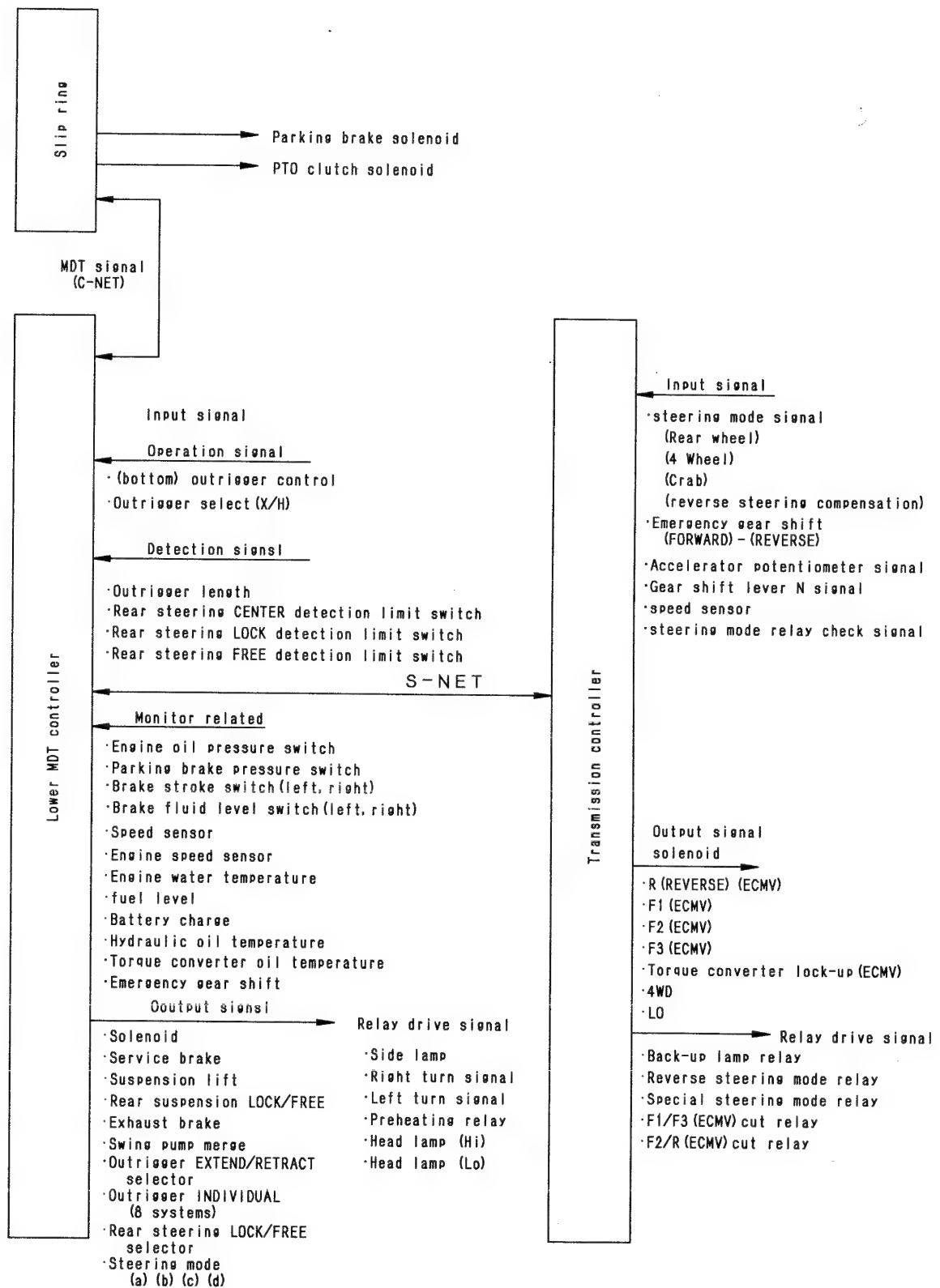
No. of pins	Automobile connector	
	Male (female housing)	Female (male housing)
2	  BLP00063	  BLP00064
3	  TLL00728	  TLL00729
4	  TLL00730	  TLL00731
6	  BLP00069	  BLP00070
8	  BLP00071	  BLP00072

EXPLANATION OF FUNCTIONS OF CONTROL MECHANISM OF
ELECTRICAL SYSTEM

023S02

BKLO0110

023S02

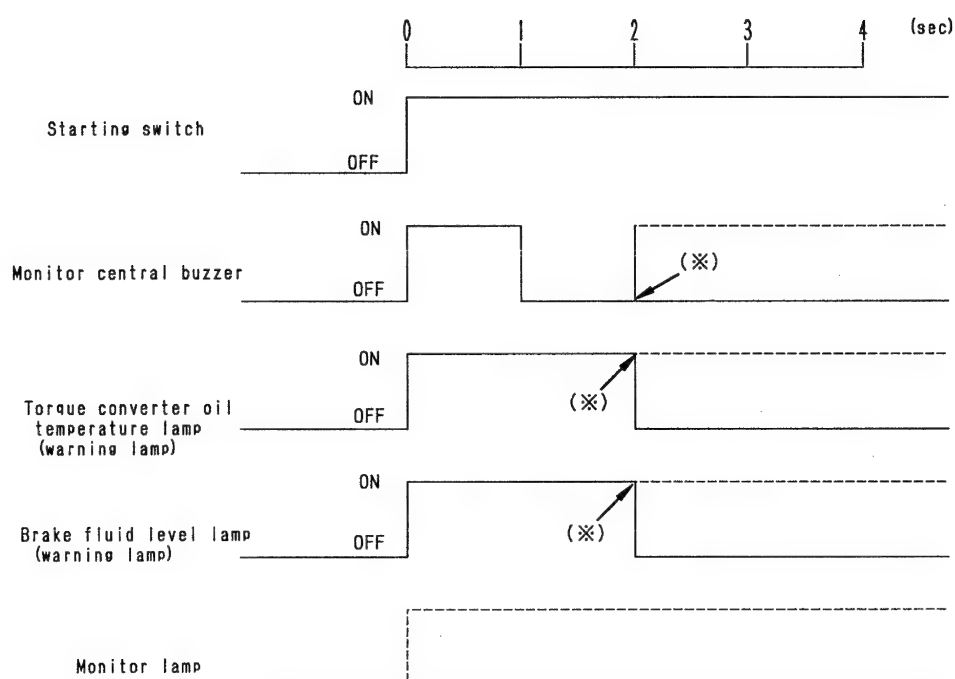


TKL00399

CHECKING ACTUATION AND LIGHTING UP OF MACHINE MONITOR LAMPS

The machine monitor lamps can be divided into two types: the monitor lamps, which carry out the operation of the monitor immediately after the starting switch is turned ON, and the warning lamps (alarm buzzer), which are only actuated when there is an abnormality.

The actuation check for these warning lamps (alarm buzzer) is carried out as follows.



TKL00400

Note: The normal monitor actuation is carried out from the point marked *.

- When the starting switch is turned ON, the monitor central buzzer sounds for 1 second and the torque converter oil temperature lamp and brake fluid level lamp light up for 2 seconds to check that they work properly. After this, they return to the normal monitor operation. The other monitor lamps carry out the normal monitor operation immediately after the starting switch is turned ON.

023S02

1. Outline of control

On this machine, the moment limiter controller and top MDT controller are installed to the upper structure, and the lower MDT controller and transmission controller are installed to the undercarriage.

The moment limiter controller carries out control of the crane equipment, the upper MDT controller mainly carries out the input and transmission of signals, the lower MDT controller controls the outriggers and carries out input and transmission of signals from sensors related to the machine monitor, and the transmission controller controls the transmission and switches the steering mode.

The transmission of signals between controllers is carried out using the S-NET between the moment limiter controller and upper MDT controller and between the lower MDT controller and the transmission controller; the transmission between the upper MDT controller and the lower MD controller is carried out using the C-NET through the swivel joint (slip ring).

The necessary information when operating the crane is shown on the moment limiter monitor (display). The information related to the machine monitor is shown on the meter panel at the front. Except for a few signals, these signals are output from the upper MDT controller.

※ For details of the controller input and output signal system and the arrangement of the controllers, see the diagrams on pages 20-284 – 20-285.

2. Control range of each controller**1) Moment limiter controller**

(Control of the crane equipment)

This inputs the operation signal needed for operation of the crane and signals related to safe operation (length, angle, load, etc.) directly or indirectly (through the lower MDT controller to upper MDT controller to S-NET), and carries out control so that the crane operations can be performed safely. In addition, information needed by the operator related to safe operations (boom, jib length, angle, load, etc.) is shown on the moment limiter monitor (display).

2) Upper MDT controller

(Communication of signals with the lower MDT controller and transmission to the

moment limiter controller and meter panel).

The upper MDT controller inputs the upper structure control signals (except for those that are input directly to the moment limiter controller). It divides the data into data which is necessary for the moment limiter controller, meter panel, or undercarriage, and transmits the data to the correct destination.

In addition, the signals received from the lower MDT controller are transmitted to the moment limiter controller and the panel. The abnormality codes displayed on the moment limiter monitor (display) are saved to memory (5 items) by the upper MDT.

3) Lower MDT controller

(Communication of signals with the outrigger control, transmission controller, and upper MDT controller, and input and transmission of machine monitor signals).

i) Outrigger control

It inputs the signals from the top and bottom outrigger control switches and drives the solenoid for the outrigger specified by the switch.

ii) Input and transmission of machine monitor sensor signals

It inputs the signals from the machine monitor sensors installed to the undercarriage and transmits them to the upper MDT controller.

iii) Transmission of signals

It transmits and receives signals through the S-NET to and from the transmission controller, and sends and receives signals through the (C-NET) swivel joint (slip ring) to and from the upper MDT controller.

4) Transmission controller

(Transmission control and switching of steering mode).

This inputs the necessary signals for travel control directly or indirectly (through the upper MDT controller to lower MDT to S-NET) and drives the solenoids and relays needed for the set travel mode.

It also transmits the data needed by the moment limiter controller through the lower MDT controller.

5) Others

- i) Moment limiter monitor (display)
The data needed by the operator when carrying out crane operations is all shown on the display (in letters or numerals).
In addition, if any abnormality occurs in the control system or communication circuit, the content of the abnormality is displayed by a code at the top of the monitor to warn the operator.
- ii) Meter panel (front panel)
This consists of the meters and caution lamps. Except for a few signals showing the engine speed and travel speed, the signals are output from the upper MDT controller and machine monitor.

3. Actuation of solenoids other than by controller

The following solenoids are operated by the switches and are actuated regardless of any controller.

- Swing brake
(switch to solenoid)
- Pedal/lever selection
(switch to relay to solenoid)
- Swing FREE/LOCK selection
(switch to relay to solenoid)
- Jib selection
(switch to solenoid)
- Jib EXTEND/STOW
(switch to relay to solenoid)
- Free-fall (main) (auxiliary)
(switch to relay to limit switch to solenoid)

4. Content of signals transmitted between S-NET and MDT controller

- 1) Between moment limiter controller and upper MDT controller (S-NET)
 - (1) Accumulator pressure drop signal
 - (2) Outrigger control signal
 - (3) X/H outrigger selection signal
 - (4) PTO mode signal
 - (5) Gear shift lever position signal

- (6) Winch drum speed signal (main) (auxiliary)
- (7) Hydraulic oil temperature 70°C signal
- (8) Overrun display signal
- (9) Side lamp signal (night lighting)
- (10) Neutral safety
- (11) Emergency gear shift signal
- (12) Service meter
- (13) Outrigger length signal
- (15) Throttle position
- (16) Gear shift mode
- (17) Gear shift pattern
- (18) Shift position
- (19) Over-rear stability stop
- (20) Outrigger operation during over-rear stability
- (21) Moment limiter forced N (except when traveling with raised load)
- (22) Abnormality code display
- (23) Memory cancel

2) Between transmission controller and lower MDT controller (S-NET)

- (1) PTO mode
- (2) Gear shift lever position
(R, N, D, 2, L)
- (3) 4WD Hi
- (4) 4WD Lo
- (5) Exhaust brake
- (6) Reverse steering mode
- (7) Steering mode
- (8) Rear steering LOCK/FREE
- (9) Emergency gear shift
- (10) Travel speed limit
- (12) Travel speed signal
- (13) Engine speed
- (14) Shift position
- (15) Throttle position
- (17) Travel speed sensor error
- (18) Overrun

- | | |
|--|---|
| <ul style="list-style-type: none"> (19) Transmission input condition (20) Gear shift pattern (21) Steering solenoid condition (a) (b) (c) (d) (22) Gear shift mode (23) Travel speed (10 km/h) (24) Alarm buzzer (25) Warning lamp (26) Special steering relay condition (27) Reverse steering relay condition (28) Special steering relay troubleshooting (29) Reverse steering relay troubleshooting (30) Moment limiter forced N (except when traveling with raised load) (31) Occurrence of failure | <ul style="list-style-type: none"> (20) ALL (21) Head lamp (Hi) (22) Head lamp (Lo) (23) Side lamp (24) Left turn signal (25) Right turn signal (26) Rear steering LOCK command (27) Rear steering FREE command (28) Outtrigger mode power source (29) Swing angle error or top S-NET error (30) Travel speed limit (31) Upper MDT S-NET error (34) Outtrigger length signal (front right) (35) Outtrigger length signal (front left) (36) Outtrigger length signal (rear right) (37) Outtrigger length signal (rear left) (38) Model selection (39) Top/bottom selection (40) Outtrigger over-rear stability stop |
|--|---|
-
- | | |
|--|--|
| <ul style="list-style-type: none"> 3) Between upper MDT controller and lower MDT controller (C-NET) <ul style="list-style-type: none"> • Upper MDT to lower MDT <ul style="list-style-type: none"> (1) PTO mode (2) Gear shift lever position (R, N, D, 2, L) (3) 4WD Hi (4) 4WD Lo (5) Exhaust brake (6) Reverse steering mode (7) Steering mode (8) Retarder command (9) Auxiliary brake (10) Preheating (11) Suspension lift (12) Outtrigger (EXTEND) (13) Outtrigger (RETRACT) (14) Outtrigger (jack) (15) Outtrigger (slide) (16) Outtrigger (front left) (17) Outtrigger (front right) (18) Outtrigger (rear left) (19) Outtrigger (rear right) | <ul style="list-style-type: none"> • Lower MDT to upper MDT <ul style="list-style-type: none"> (1) Engine speed (2) Travel speed (3) Left turn signal (4) Left turn signal (5) Rear steering LOCK limit switch (6) Rear steering FREE limit switch (7) Rear steering CENTER limit switch (8) Retarder temperature (9) Outtrigger control (10) Outtrigger X/H selection (11) Battery charge (12) Torque converter oil temperature (lamp) (13) Torque converter oil temperature (buzzer) (14) Hydraulic oil temperature (15) Brake fluid level (16) Engine oil pressure (18) Parking lamp |
|--|--|

- (19) Emergency gear shift
- (20) Alarm buzzer
- (21) Special steering relay check
- (22) Travel speed sensors both failure
- (23) Reverse steering relay check
- (24) Neutral safety
- (25) Fuel level
- (26) Engine water temperature
- (28) Overrun display
- (29) Transmission system monitor central buzzer
- (30) Reverse steering LED display
- (31) Steering LED display
- (32) Retarder lamp ON/OFF command
- (34) Outrigger length (front right)
- (35) Outrigger length (front left)
- (36) Outrigger length (rear right)
- (37) Outrigger length (rear left)
- (38) Gear shift mode
- (39) Gear shift pattern
- (40) Shift position
- (41) Throttle position
- (42) Top/bottom selection
- (43) Model selection

5. Specification selection and model selection**1) Specification selection**

The specification selection is carried out by the special 16-position rotary switch.

Rotary switch position	Specification
0	Jib automatic extension X-shaped
1	Jib automatic extension H-shaped
2	Fixed tilt jib X-shaped
3	Fixed tilt jib H-shaped

2) Model selection

This selection is made with the upper MDT controller and lower MDT controller.

- The positions for the LW250-5 are as shown in below.

Model selection terminal	Connection
(W)	GND
(Y)	GND
(X)	OPEN
(Z)	OPEN

DISPLAY METHOD FOR SELF-DIAGNOSIS (ERROR CODES) AND SAVING TO MEMORY

1. Display of self diagnosis (error codes)

If any abnormality occurs in the system, the name of the controller where the abnormality has occurred and the content of the abnormality (error code) are displayed as a code on the moment limiter monitor, and at the same time, they are saved to memory by the upper MDT controller.

- The displayed codes are as follows.

- (1) ATM error EOO
 - Error code
 - Transmission controller
- (2) OSS error EOO
 - Moment limiter controller
- (3) MDTU error EOO
 - Upper MDT controller
- (4) MDTL error EOO
 - Lower MDT controller

※ An example of the display is shown in the diagram on the right.

★ If multiple errors occur, the display repeats them in turn.

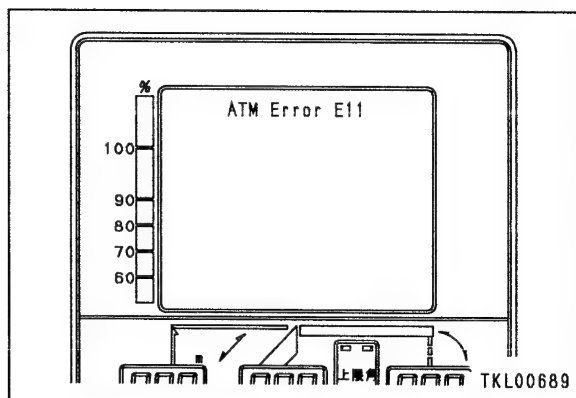
2. Saving error code to memory

The upper MDT controller saves the error code to memory.

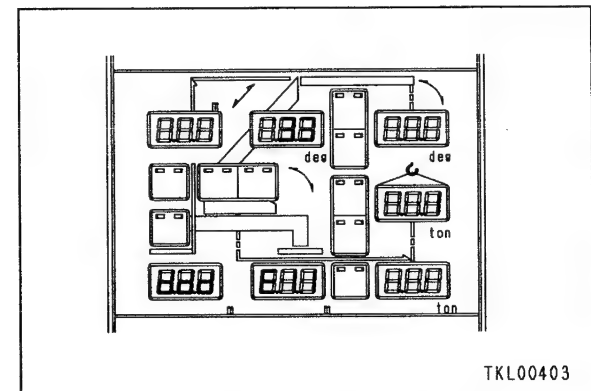
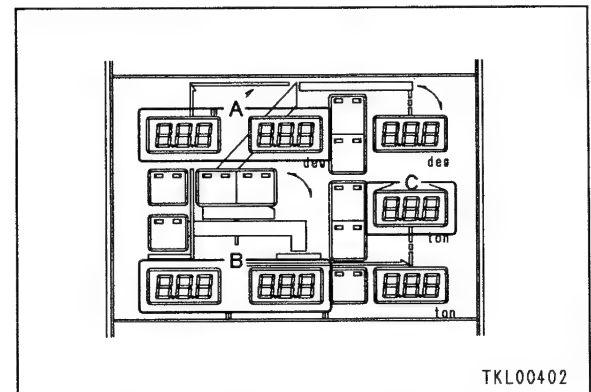
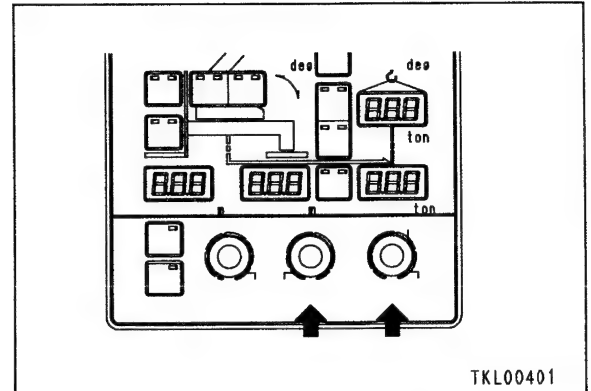
- 1) 5 sets of data can be saved to memory.
- 2) Details of the following 3 points are saved to memory:
 - (1) Time elapsed since occurrence
 - (2) Name of controller
 - (3) Error code
- 3) The errors are saved to memory in the order that they occurs. Any error previously saved to memory is not saved again.
- 4) If there are 5 sets of data already saved in the memory and a 6th error occurs, the oldest set is deleted and is replaced by the new set of data.

3. Method of displaying content of error in memory

The errors saved in the memory can be shown on the digital display on the moment limiter panel by operating the setting switch on the moment limiter panel.

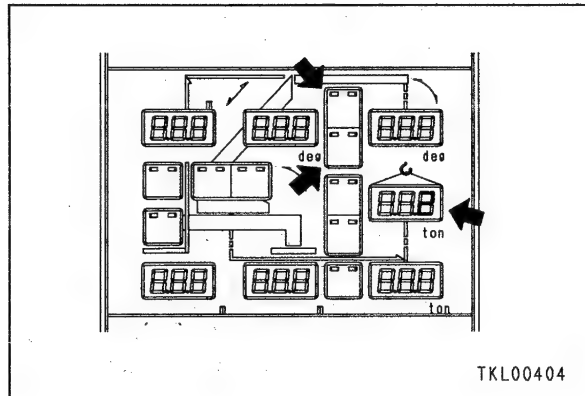


- 1) Order of display operation
 - i) Set to the service mode.
 - (1) Set the PTO mode switch to Operation 1 (PTO 1) or Operation 2 (PTO 2).
 - (2) Set the display mode switch to the check mode.
 - (3) Turn the top working mode switch and bottom working mode switch fully to the left.
 - (4) In this condition, keep the upper limit angle and lower limit angle switches pressed simultaneously for at least 2 seconds.
 - ii) Turn the top working mode switch to position 6. (Turn 5 clicks to the right)
 - iii) Turn the bottom working mode switch to position 11. (Turn 10 clicks to the right)
 - iv) The moment limiter panel switches to the error code display mode, and the error codes and content are shown on the digital display.
 - ★ If no error is recorded in memory, the display is blank.
- 2) Location and content of display
 - i) The display is given on the digital display in the following places:
 - Portion A: Time elapsed since occurrence
 - Portion B (left): Name of controller (with symbol)
 - Portion B (right): Error code
 - Portion C: Memory number (from newest error)
 - ii) Content of display
 - Time elapsed: Time elapsed since occurrence of abnormality
 - Controller name: OSS : AAA
Upper MDT : bbb
Lower MDT : ccc
ATM : ddd
 - Error code: Same as code displayed on moment limiter monitor
 - ★ The content of the display is shown in the tables following this explanation.
 - Memory No.: These are displayed in order from the newest error.



iii) Method of displaying error codes in turn
If there are multiple error codes, they are displayed in turn as follows.

- When the upper limit angle switch is pressed, the details saved in memory (name of controller, error codes, memory number) are displayed in order of occurrence from No. 1 (newest) to No. 5 (oldest).
- When the lower limit angle switch is pressed, the information is displayed in the reverse order, starting with the oldest error.

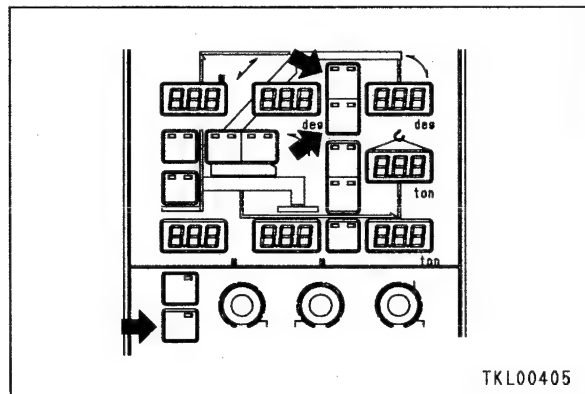


TKL00404

4. Deleting memory

Press the upper limit angle switch + lower limit angle switch + set switch at the same time.

- ★ Keep the switches pressed until the display disappears.



TKL00405

023S02

TABLE OF ERROR CODES, RE-ENACTION

- After the error occurs, if the starting switch is turned OFF and the display goes out, it is possible to re-enact the problems as follows. (MDT related)

Display code	Abnormal system and content of abnormality	Error category	Re-enaction	Memory	Alarm buzzer	Remarks
(Upper MDT related)						
MDTU error E00	MDT system error	▲	★	○	○	
MDTU error E10	Shut off when low voltage			○		
MDTU error E11	Shut off when high temperature			○		
MDTU error E20	Top, bottom don't match (application stopped)	▲	★	○	○	
MDTU error E21	Top, bottom selection warning	▲	★	○	○	Switches to emergency stop mode but is actuated as normal
MDTU error E24	Model doesn't match (application stopped)	▲	★	○	○	
MDTU error E25	Model selection warning	▲	★	○	○	Switches to emergency stop mode but is actuated as normal
MDTU error E28	Abnormality in S-NET communication between MDTs (output stopped)	▲	★	○	○	
MDTU error E29	Abnormality in C-NET communication between MDT and moment limiter	▲	★	○	○	
MDTU error E40	Swing flasher output short circuited with ground		■	○		PTO mode switch: Operation 1
MDTU error E41	Power source for outrigger panel short circuited with ground		■	○		PTO mode switch: Operation 1
MDTU error E43	Outrigger mode power source short circuited with ground		■	○		PTO mode switch: Operation 1
MDTU error E44	Crab mode LED short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E45	Front wheel mode LED short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E46	Rear wheel mode LED short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E47	4-wheel mode LED short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E48	Rear steering LOCK LED short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E49	Rear steering FREE LED short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E4A	Rear steering CENTER LED short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E4B	Reverse steering display lamp short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTU error E4C	Winch rotation buzzer (main winch) short circuited with ground		■	○		PTO mode switch: Operation 1 or Operation 2
MDTU error E4D	Emergency alarm buzzer short circuited with ground	★	■	○	○	
MDTU error E4E	Winch rotation buzzer (auxiliary winch) short circuited with ground		■	○		PTO mode switch: Operation 1 or Operation 2
MDTU error E4F	Monitor central buzzer short circuited with ground	★	■	○	○	
MDTU error E50	Tachometer signal output short circuited		■	○		
MDTU error E51	Speedometer signal output short circuited		■	○		
MDTU error E52	Fuel level signal output short circuited		■	○		
MDTU error E53	Engine water temperature signal output short circuited		■	○		
MDTU error E55	Torque converter oil temperature output short circuited		■	○		
MDTU error E56	Engine oil pressure output short circuited		■	○		

Error category

- ▲ : ▲ (display) + Emergency alarm buzzer + work (or travel) stop
 ★ : Emergency alarm buzzer + error code display
 Blank : Only error code display

Re-enaction

- ★ Turn starting switch ON (engine stopped).
 □ Start engine.
 ■ Carry out operation to actuate actuator.

(MDT related)

Display code	Abnormal system and content of abnormality	Error category	Re-enaction	Memory	Alarm buzzer	Remarks
MDTU error E57	Preheating pilot output short circuited		■	○		
MDTU error E58	Parking brake actuation lamp output short circuited		■	○		
MDTU error E59	Retarder lamp output (opt) short circuited		■	○		
MDTU error E5A	Hi beam pilot output short circuited with ground		■	○		
MDTU error E5B	Hourmeter output short circuited with ground		■	○		
MDTU error E5C	Charge lamp output short circuited with ground		■	○		
MDTU error E5D	Brake fluid level output short circuited with ground		■	○		
MDTU error E5E	Right turn pilot output short circuited with ground		■	○		
MDTU error E5F	Left turn pilot output short circuited with ground		■	○		
MDTU error E72	LED dimmer 1 short circuited with ground		■	○		
MDTU error E73	LED dimmer 2 hot short circuit		★	○		
MDTU error E74	LED dimmer 2 short circuited with ground		■	○		
MDTU error E75	LED dimmer 2 hot short circuit		★	○		
MDTU error E80	Swing flasher output hot short circuit		★	○		
MDTU error E83	Outrigger mode power source hot short circuit		★	○		PTO mode switch: Travel or Operation 2
MDTU error EB3	Disconnection in outrigger mode power source		★	○		PTO mode switch: Travel or Operation 2
MDTU error EE0	PTO mode doesn't match	▲	★	○	○	
MDTU error EE1	Abnormality in 2WD Hi/4WD Hi/4WD Lo input		★	○		
MDTU error EE3	Abnormality in service brake input		□	○		
MDTU error EE4	Abnormality in suspension lift switch	★	★	○		
MDTU error EE5	Abnormality in outrigger control switch		★	○		PTO mode switch: Travel or Operation 2
MDTU error EE6	Outrigger EXTEND + RETRACT input simultaneously, JACK + SLIDE input simultaneously		★	○		
MDTU error EEA	Abnormality in steering mode switch input	★	★	○	○	PTO mode switch: Travel or Operation 2
MDTU error EEC	Rear steering LOCK + FREE command input simultaneously	★	★	○		PTO mode switch: Travel or Operation 2
(Lower MDT related)						
MDTL error E00	MDT system error	▲		○	○	
MDTL error E10	Shut off when low voltage			○		
MDTL error E11	Shut off when high temperature			○		
MDTL error E18	Disconnection in tachometer sensor		★	○		
MDTL error E19	Disconnection in speedometer sensor	★	★	○	○	
MDTL error E20	Top, bottom don't match (application stopped)	▲	★	○	○	
MDTL error E21	Top, bottom selection warning	▲	★	○	○	Switches to emergency stop mode but is actuated as normal
MDTL error E24	Model doesn't match (application stopped)	▲	★	○	○	

Error category

▲ : ▲ (display) + Emergency alarm buzzer + work (or travel) stop
 ★ : Emergency alarm buzzer + error code display
 Blank : Only error code display

Re-enaction

★ Turn starting switch ON (engine stopped).
 □ Start engine.
 ■ Carry out operation to actuate actuator.

19ME02

(MDT related)

Display code	Abnormal system and content of abnormality	Error category	Re-enaction	Memory	Alarm buzzer	Remarks
MDTL error E25	Model selection warning	▲	★	○	○	Switches to emergency stop mode but is actuated as normal
MDTL error E28	Abnormality in C-NET communication between MDTs	▲		○	○	
MDTL error E29	Abnormality in S-NET communication between MDT and transmission controller	▲		○	○	
MDTL error E40	Outrigger jack RL short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E41	Outrigger jack FL short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E42	Outrigger jack RR short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E43	Outrigger jack FR short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E44	Outrigger slide RL short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E45	Outrigger slide FL short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E46	Outrigger slide RR short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E47	Outrigger slide FR short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E48	Outrigger selector EXTEND short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E49	Outrigger selector RETRACT short circuited with ground		■	○		PTO mode switch: Operation 1
MDTL error E4A	Rear steering LOCK solenoid short circuited with ground	★	■	○		PTO mode switch: Travel or Operation 1
MDTL error E4B	Rear steering FREE solenoid short circuited with ground	★	■	○		PTO mode switch: Travel or Operation 1
MDTL error E4C	Service brake short circuited with ground		■	○		
MDTL error E4D	Exhaust brake short circuited with ground		■	○		
MDTL error E4E	Retarder (opt) short circuited with ground		■	○		
MDTL error E4F	Preheating short circuited with ground		■	○		
MDTL error E51	Retarder (opt) speed output short circuited with ground		■	○		
MDTL error E5A	Head lamp Hi relay short circuited with ground		■	○		
MDTL error E5B	Head lamp Lo relay short circuited with ground		■	○		
MDTL error E5C	Side lamp relay short circuited with ground		■	○		
MDTL error E5D	Service lamp (opt) relay short circuited with ground		■	○		
MDTL error E5E	Right turn relay short circuited with ground		■	○		
MDTL error E5F	Left turn relay short circuited with ground		■	○		
MDTL error E60	Steering mode solenoid a short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTL error E61	Steering mode solenoid c short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTL error E62	Steering mode solenoid b short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTL error E63	Steering mode solenoid d short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTL error E64	Pump merge solenoid short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTL error E67	Suspension lift solenoid short circuited with ground		■	○		PTO mode switch: Travel or Operation 1
MDTL error E76	5V output short circuited with ground		★	○		PTO mode switch: Operation 1

Error category

▲ : ▲ (display) + Emergency alarm buzzer + work (or travel) stop
 ★ : Emergency alarm buzzer + error code display
 Blank : Only error code display

Re-enaction

★ Turn starting switch ON (engine stopped).
 □ Start engine.
 ■ Carry out operation to actuate actuator.

(MDT related)

Display code	Abnormal system and content of abnormality	Error category	Re-enaction	Memory	Alarm buzzer	Remarks
MDTL error E80	Outrigger jack RL hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E81	Outrigger jack FL hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E82	Outrigger jack RR hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E83	Outrigger jack FR hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E84	Outrigger jack RL hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E85	Outrigger jack FL hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E86	Outrigger jack RR hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E87	Outrigger jack FR hot short circuit		★	○		PTO mode switch: Travel or Operation 1
MDTL error E88	Outrigger selector EXTEND hot short circuit	▲	★	○	○	PTO mode switch: Travel or Operation 1
MDTL error E89	Outrigger selector RETRACT hot short circuit	▲	★	○	○	PTO mode switch: Travel or Operation 1
MDTL error E8A	Rear steering LOCK solenoid hot short circuit	★	★	○	○	
MDTL error E8B	Rear steering FREE solenoid hot short circuit	★	★	○	○	
MDTL error E8C	Service brake hot short circuit	★	★	○	○	
MDTL error E8D	Exhaust brake hot short circuit		★	○		
MDTL error E8E	Retarder hot short circuit		★	○		
MDTL error E8F	Preheating hot short circuit		★	○		
MDTL error E9A	Head lamp Hi relay hot short circuit		★	○		
MDTL error E9B	Head lamp Lo relay hot short circuit		★	○		
MDTL error E9C	Side lamp relay hot short circuit		★	○		
MDTL error E9E	Right turn relay hot short circuit		★	○		
MDTL error E9F	Left turn relay hot short circuit		★	○		
MDTL error EA0	Steering mode solenoid a hot short circuit		★	○		
MDTL error EA1	Steering mode solenoid c hot short circuit		★	○		
MDTL error EA2	Steering mode solenoid b hot short circuit		★	○		
MDTL error EA3	Steering mode solenoid d hot short circuit		★	○		
MDTL error EA4	Pump merge solenoid hot short circuit	★	★	○	○	
MDTL error EA7	Suspension lift solenoid hot short circuit	★	★	○	○	PTO mode switch: Travel or Operation 1
MDTL error EB0	Disconnection in outrigger jack RL		★	○		
MDTL error EB1	Disconnection in outrigger jack FL		★	○		
MDTL error EB2	Disconnection in outrigger jack RR		★	○		
MDTL error EB3	Disconnection in outrigger jack FR		★	○		
MDTL error EB4	Disconnection in outrigger slide RL		★	○		
MDTL error EB5	Disconnection in outrigger slide FL		★	○		

Error category

▲ : (display) + Emergency alarm buzzer + work (or travel) stop
 ★ : Emergency alarm buzzer + error code display
 Blank : Only error code display

Re-enaction

★ Turn starting switch ON (engine stopped).
 □ Start engine.
 ■ Carry out operation to actuate actuator.

(MDT related)

Display code	Abnormal system and content of abnormality	Error category	Re-enaction	Memory	Alarm buzzer	Remarks
MDTL error EB6	Disconnection in outrigger slide RR		★	○		
MDTL error EB7	Disconnection in outrigger slide FR		★	○		
MDTL error EB8	Disconnection in outrigger selector EXTEND		★	○		PTO mode switch: Operation 1
MDTL error EB9	Disconnection in outrigger selector RETRACT		★	○		PTO mode switch: Operation 1
MDTL error EBA	Disconnection in rear steering LOCK solenoid	★	★	○	○	
MDTL error EBB	Disconnection in rear steering FREE solenoid	★	★	○	○	
MDTL error EBC	Disconnection in service brake		★	○		
MDTL error EBD	Disconnection in exhaust brake		★	○		
MDTL error EBF	Disconnection in preheating		★	○		
MDTL error ECA	Disconnection in head lamp Hi relay		★	○		
MDTL error ECB	Disconnection in head lamp Lo relay		★	○		
MDTL error ECC	Disconnection in side lamp relay		★	○		
MDTL error ECE	Disconnection in right turn relay		★	○		
MDTL error ECF	Disconnection in left turn relay		★	○		
MDTL error ED0	Disconnection in steering mode solenoid a		★	○		
MDTL error ED1	Disconnection in steering mode solenoid c		★	○		
MDTL error ED2	Disconnection in steering mode solenoid b		★	○		
MDTL error ED3	Disconnection in steering mode solenoid d		★	○		
MDTL error ED4	Disconnection in pump merge solenoid	★	★	○	○	
MDTL error ED7	Disconnection in suspension lift		★	○		PTO mode switch: Operation 1
MDTL error EE7	Outrigger control signal hot circuit	⚠	★	○	○	PTO mode switch: Travel or Operation 2
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	★	★	○	○	PTO mode switch: Operation 1
MDTL error EE9	Disconnection in fuel sensor		★	○		
MDTL error EEB	Abnormality in rear steering LOCK limit switch/FREE limit switch	★	★	○		PTO mode switch: Operation 1 When in special steering mode
MDTL error EEE	Speedometer sensors both failure		□	○		Jack up chassis, rotate wheels under no load
MDTL error EEF	MDT speedometer sensor failure		□	○		Jack up chassis, rotate wheels under no load
MDTL error EF0	Special steering failure (emergency stop mode)	⚠	★	○		PTO mode switch: Travel or Operation 1
MDTL error EF1	Reverse steering failure (emergency stop mode)	⚠	★	○		PTO mode switch: Travel or Operation 1
MDTL error EF2	Special steering failure		★	○		PTO mode switch: Travel or Operation 1
MDTL error EF3	Reverse steering failure 1		★	○		PTO mode switch: Travel or Operation 1
MDTL error EF4	Reverse steering failure 2		★	○		PTO mode switch: Travel or Operation 1
MDTL error EFE	Abnormality in right turn relay		■	○		
MDTL error EFF	Abnormality in left turn relay		■	○		

Error category

⚠ : ⚠ (display) + Emergency alarm buzzer + work (or travel) stop
 ★ : Emergency alarm buzzer + error code display
 Blank : Only error code display

Re-enaction

★ Turn starting switch ON (engine stopped).
 □ Start engine.
 ■ Carry out operation to actuate actuator.

(Moment limiter controller related)								
Display code	Abnormal system and content of abnormality	Emergency stop display (▲)	Automatic stop (motion cut)	Re-enaction	Memory	Alarm		Remarks
						Buzzer	Red lamp (opt)	
(Moment limiter controller related)								
OSS error E00	Abnormality in panel communication	○	×	★	○	○	○	
OSS error E01	Panel system error	○	○	★	○	○	○	
OSS error E02	Abnormality in panel rotary switch	○	○	★	○	○	○	
OSS error E10	Moment limiter system error	○	○	★	○	○	○	Depending on location of failure, problem may also be in other place
OSS error E20	Abnormality in S-NET (communication between MDT)	○	○	★	×	○	○	MDT saves to memory, so impossible to save
OSS error E21	Abnormality in outrigger length sensor FL	×	○	★	×	○	○	When set to outrigger mode
OSS error E22	Abnormality in outrigger length sensor FR	×	○	★	×	○	○	When set to outrigger mode
OSS error E23	Abnormality in outrigger length sensor RL		○	★	×	○	○	When set to outrigger mode
OSS error E24	Abnormality in outrigger length sensor RR	×	○	★	×	○	○	When set to outrigger mode
OSS error E30	Abnormality in jib transmission module communication	×	○	★	○	○	○	In jib mode
OSS error E31	Abnormality in tilt angle sensor system	×	○	★	×	○	○	In jib mode
OSS error E41	Abnormality in boom angle sensor system	×	○	★	×	○	○	
OSS error E43	Abnormality in boom length sensor system	×	○	★	×	○	○	
OSS error E44	Abnormality in bottom pressure sensor system	×	○	★	×	○	○	
OSS error E45	Abnormality in head pressure sensor system	×	○	★	×	○	○	
OSS error E46	Abnormality in swing angle sensor	×	○	★	×	○	○	
OSS error E48	Reverse rotation of hoist cylinder axis	×	○	★	×	○	○	
OSS error E50	Main unload solenoid short circuited with ground	×	○	■	○	○	○	
OSS error E51	PPC unload solenoid short circuited with ground	×	×	■	○	○	×	
OSS error E52	Boom telescope selector solenoid short circuited with ground	×	×	■	○	○	×	
OSS error E53	Automatic stop cancel prohibition relay short circuited with ground	×	×	■	○	○	×	
OSS error E58	Jib EXTEND/STOW relay short circuited with ground	×	×	■	○	○	×	
OSS error E59	Jib rotation permission relay short circuited with ground	×	×	■	○	○	×	
OSS error E5C	Moment limiter buzzer short circuited with ground	×	×	■	○	○	×	
OSS error E5D	Emergency alarm buzzer short circuited with ground	×	×	■	○	○	×	
OSS error E68	10 V power source short circuited with ground	×	×	★	○	○	×	
OSS error E6A	15 V power source short circuited with ground	×	×	★	○	○	×	
OSS error E70	Main unload solenoid hot short circuit	○	×	★	○	○	○	Sets to overwind, output OFF
OSS error E71	PPC unload solenoid hot short circuit	×	×	★	○	○	×	Sets to outrigger mode, output OFF
OSS error E72	Boom telescope selector solenoid hot short circuit	×	×	★	○	○	×	Sets to automatic tele-scope mode, top boom stowed, output OFF
OSS error E73	Automatic stop cancel prohibition relay hot short circuit	×	×	★	○	×	×	Makes it possible to carry out automatic stop, output OFF (See STRUCTURE AND FUNCTION, page 10-324)


Remarks: The symbols in the Emergency stop display (▲ error codes), Automatic stop (motion cut), Memory, Alarm (Buzzer, Red lamp) columns have the following meanings:
 ○: Do
 ×: Do not do

Re-enaction

- ★ Turn starting switch ON (engine stopped).
- Start engine.
- Carry out operation to actuate actuator.

(Moment limiter controller related)

[illegible]

Remarks: The symbols in the Emergency stop display ( error codes), Automatic stop (motion cut), Memory, Alarm (Buzzer, Red lamp) columns have the following meanings:

- : Do
- ×: Do not do

Re-enaction
 ★ Turn starting switch ON (engine stopped).
 □ Start engine.
 ■ Carry out operation to actuate actuator.

(Transmission controller related)

Display code	Abnormal system and content of abnormality	Error category	Re-enaction	Memory	Alarm buzzer	Remarks
(Transmission controller related)						
ATM error E11	Disconnection in tachometer sensor		■	○		
ATM error E12	Disconnection in speed sensor 1	★	■	○	○	
ATM error E13	Disconnection in speed sensor 2	★	■	○	○	Jack up chassis, rotate wheels under no load
ATM error E14	Disconnection in accelerator potentiometer		★	○		
ATM error E17	Disconnection in shift lever	★	★	○	○	
ATM error E18	Disconnection in FR signal for interlock		★	○		
ATM error E19	No input for solenoid power source monitor		★	○		
ATM error E24	Accelerator potentiometer short circuited with ground		★	○		
ATM error E25	Abnormality in emergency gear shift switch or abnormality in PTO 2 switch		■	○		PTO mode switch: Travel or Operation 1
ATM error E32	Abnormality in speed sensor 1	★	■	○	○	Jack up chassis, rotate wheels under no load
ATM error E33	Abnormality in speed sensor 2	★	■	○	○	Jack up chassis, rotate wheels under no load
ATM error E35	MDT at other than N with interlock signal N		■	○		PTO mode switch: Travel or Operation 1
ATM error E37	Abnormality in shift lever (2 or more signals ON)		■	○		PTO mode switch: Travel or Operation 1
ATM error E38	Interlock F + R signals ON simultaneously		■	○		PTO mode switch: Travel or Operation 1
ATM error E39	Interlock signal F/R but MDT at N		■	○		PTO mode switch: Travel or Operation 1
ATM error E3F	Abnormality in S-NET (communication between MDTs)		★	○		PTO mode switch: Travel or Operation 1
ATM error E53	Overrun		■		○	Only [Overrun] message is displayed
ATM error E55	Drop in battery voltage	⚠	★	○	○	PTO mode switch: Travel or Operation 1
ATM error E5A	Special steering system short circuited with ground		★	○		PTO mode switch: Travel or Operation 1
ATM error E5B	Disconnection in special steering system		★	○		PTO mode switch: Travel or Operation 1
ATM error E5C	Reverse steering system short circuited with ground		★	○		PTO mode switch: Travel or Operation 1
ATM error E5D	Disconnection in reverse steering system		★	○		PTO mode switch: Travel or Operation 1
ATM error E70	Disconnection in R solenoid (ECMV) system	⚠	■	○	○	PTO mode switch: Travel or Operation 1
ATM error E71	Disconnection in F2 solenoid (ECMV) system	⚠	■	○	○	PTO mode switch: Travel or Operation 1
ATM error E72	Disconnection in F1 solenoid (ECMV) system	⚠	■	○	○	PTO mode switch: Travel or Operation 1
ATM error E73	Disconnection in F3 solenoid (ECMV) system	⚠	■	○	○	PTO mode switch: Travel or Operation 1
ATM error E74	Disconnection in lock-up solenoid (ECMV) system	⚠	■	○	○	PTO mode switch: Travel or Operation 1
ATM error E78	Disconnection in Lo solenoid system		★	○		PTO mode switch: Travel or Operation 1
ATM error E79	Disconnection in 4WD solenoid system		★	○		PTO mode switch: Travel or Operation 1
ATM error E7B	Disconnection in reverse steering compensation relay system		★	○		PTO mode switch: Travel or Operation 1
ATM error E7C	Disconnection in F2, R solenoid cut relay system		★	○		PTO mode switch: Travel or Operation 1
ATM error E7D	Disconnection in back lamp relay		★	○		PTO mode switch: Travel or Operation 1

Error category

⚠ : ⚠ (display) + Emergency alarm buzzer + work (or travel) stop
 ★ : Emergency alarm buzzer + error code display
 Blank : Only error code display

Re-enaction




★ Turn starting switch ON (engine stopped).
 □ Start engine.
 ■ Carry out operation to actuate actuator.

19ME02

(Transmission controller related)

[illegible]

Error category

 :  (display) + Emergency alarm buzzer + work (or travel) stop
 : Emergency alarm buzzer + error code display
 Blank : Only error code display

Re-enaction

- ★ Turn starting switch ON (engine stopped).
- Start engine.
- Carry out operation to actuate actuator.

METHOD OF USING JUDGE- MENT TABLE

This judgement table is a tool to determine if the problem with the machine is caused by an abnormality in the electrical system or by an abnormality in the hydraulic or mechanical system. The symptoms are then used to decide which troubleshooting

table (E-O O, H-O O, etc.) matches the symptoms. The judgement table is designed so that it is easy to determine from the self-diagnostic display which troubleshooting table to go to.

- ★ The abnormality display (warning) given by the monitor panel leads directly to troubleshooting of the machine monitor (M-O O). (See troubleshooting of the machine monitor system)

[Method of using judgement table]

- A ○ mark is put at the places where the failure mode and self-diagnostic display match, so check if there is an error code shown on the graphic display of the monitor panel.
 - If an error code is displayed, go to the troubleshooting code at the bottom of the judgement table (EU-○○).
 - If there is a problem but no error code is displayed, go to the troubleshooting code at the right side of the judgement table (H-○○).
 - For failure modes where there is no ○ mark, go directly to the troubleshooting code at the right side.

METHOD OF USING TROUBLESHOOTING CHARTS

1. Category of troubleshooting code number

Troubleshooting code No.	Component
S- ○○	Troubleshooting of engine related parts
EU-○○	Troubleshooting of upper MDT system
EL-○○	Troubleshooting of lower MDT system
EM-○○	Troubleshooting of moment limiter system
ET-○○	Troubleshooting of transmission controller system
H- ○○	Troubleshooting of hydraulic, mechanical system
M- ○○	Troubleshooting of machine monitor
E- ○○	Troubleshooting of electrical system for other parts

2. Method of using troubleshooting table for each troubleshooting mode

(1) Troubleshooting code number and problem

The title of the troubleshooting chart gives the troubleshooting code and problem with the machine.

(2) General precautions

When carrying out troubleshooting for the problem, precautions that apply to all items are given at the top of the page and marked with ★.

The precautions marked ★ are not given in the ☐, but must always be followed when carrying out the check inside the ☐.

(3) Distinguishing conditions

Even with the same problem, the method of troubleshooting may differ according to the model, component, or problem. In such cases, the problem is further divided into sections marked with small letters (for example, a), b)), so go to the appropriate section to carry out troubleshooting. If the troubleshooting table is not divided into sections, start troubleshooting from the first check item.

(4) Method of following troubleshooting chart

- Check or measure the item inside ☐ ^{YES}/_{NO}, and according to the answer follow either the YES line or the NO line to go to the next ☐. (Note: The number written at the top right corner of the ☐ is an index number; it does not indicate the order to follow.)
- Following the YES or NO lines according to the results of the check or measurement will lead finally to the Cause column. Check the cause and take the action given in the Remedy column on the right.
- Below the ☐ there are the methods for inspection or measurement, and the judgement values. If the judgement values below the ☐ are correct or the answer to the question inside the ☐ is YES, follow the YES line; if the judgement value is not correct, or the answer to the question is NO, follow the NO line.
- Below the ☐ is given the preparatory work needed for inspection and measurement, and the judgement values. If this preparatory work is neglected, or the method of operation or handling is mistaken, there is danger that it may cause mistaken judgement, or the equipment may be damaged. Therefore, before starting inspection or measurement, always read the instructions carefully, and start the work in order from Item 1.

(5) Troubleshooting tools

When carrying out the troubleshooting, prepare the necessary troubleshooting tools. For details, see TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING.

(6) Installation position, pin number

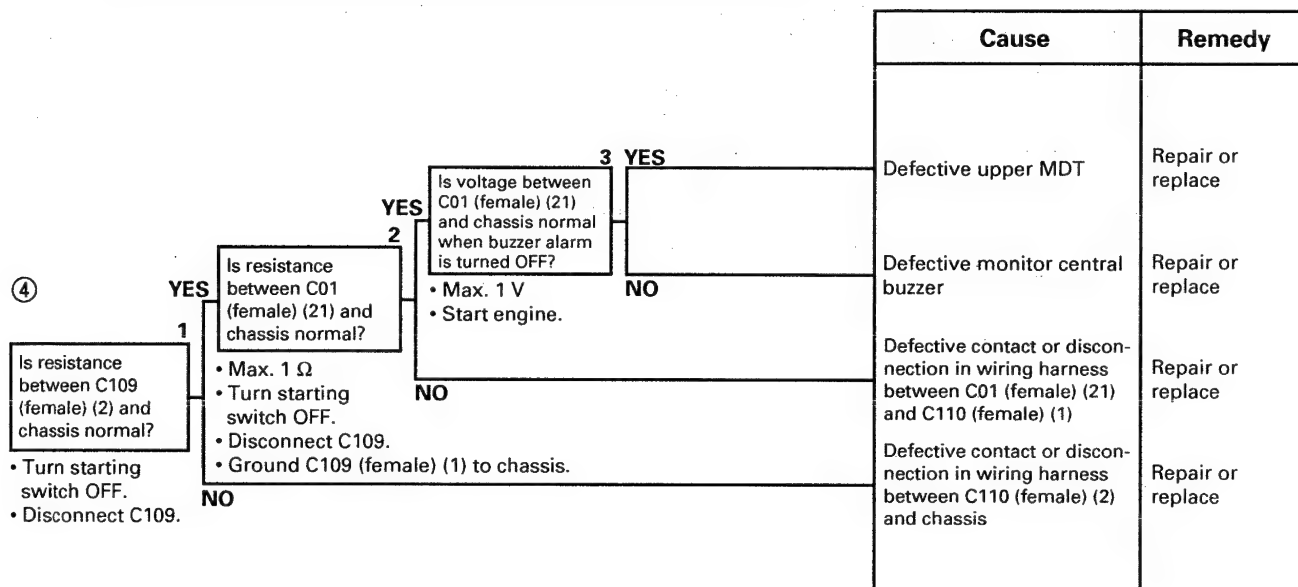
A diagram or chart is given for the connector type, installation position, and connector pin number connection. When carrying out troubleshooting, see this chart for details of the connector pin number and location for inspection and measurement of the wiring connector number appearing in the troubleshooting flow chart for each problem.

< Example >

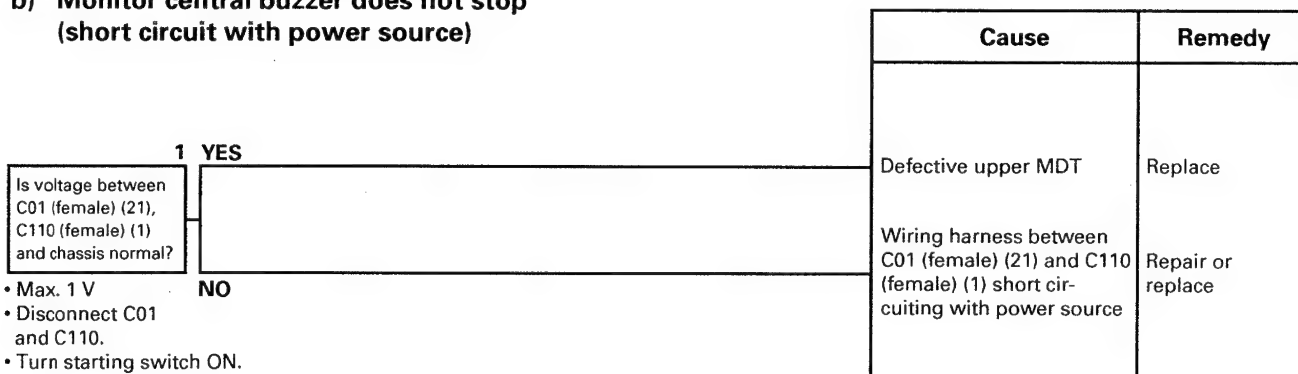
① E-11 Abnormality in monitor central buzzer system

- ② ★ When error code (MDTU error E4F) is not displayed.
 ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
 ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 ★ Always connect any disconnected connectors before going on to the next step.

③ a) Monitor central buzzer does not sound (disconnection)



b) Monitor central buzzer does not stop (short circuit with power source)



TROUBLESHOOTING OF ENGINE SYSTEM (S MODE)

Method of using troubleshooting charts	20-302
S- 1 Starting performance is poor (starting always takes time)	20-306
S- 2 Engine does not start.....	20-308
(1) Engine does not turn	20-308
(2) Engine turns but no exhaust smoke comes out (fuel is not being injected)	20-309
(3) Exhaust smoke comes out, but engine does not start (fuel is being injected)	20-310
S- 3 Engine does not pick up smoothly (follow up is poor)	20-311
S- 4 Engine stops during operations	20-312
S- 5 Engine does not rotate smoothly (hunting)	20-313
S- 6 Engine lacks output (no power)	20-314
S- 7 Exhaust gas is black (incomplete combustion)	20-315
S- 8 Oil consumption is excessive (or exhaust gas is blue)	20-316
S- 9 Oil becomes contaminated quickly	20-317
S-10 Fuel consumption is excessive	20-318
S-11 Oil is in cooling water, or water spurts back, or water level goes down	20-319
S-12 Oil pressure caution lamp lights up (drop in oil pressure	20-320
S-13 Oil level rises (water, fuel in oil).....	20-321
S-14 Water temperature becomes too high (overheating)	20-322
S-15 Abnormal noise is made	20-323
S-16 Vibration is excessive	20-324

023S02

METHOD OF USING TROUBLESHOOTING CHART

This troubleshooting chart is divided into three sections: **questions**, **check items**, and **troubleshooting**. The questions and check items are used to pinpoint high probability causes that can be located from the failure symptoms or simple inspection without using troubleshooting tools. Next, troubleshooting tools or direct inspection are used to check the most probable causes causes to make final confirmation.

[Questions]

Sections (A) + (B) in the chart on the right corresponds to the items where answers can be obtained from the user. The items in (B) are items that can be obtained from the user, depending on the user's level.

[Check items]

The serviceman carries out simple inspection to narrow down the causes. The items under (C) in the chart on the right correspond to this. The serviceman narrows down the causes from information (A) that he has obtained from the user and the results of (C) that he has obtained from his own inspection.

[Troubleshooting]

Troubleshooting is carried out in the order of probability, starting with the causes that have been marked as having the highest probability from information gained from [Questions] and [Check items].

		Causes		
		(1)	(2)	(3)
Questions	(a)	○		
	(b)			○
	(c)		○	
	(d)	○		
	(e)			○
Check items				
Trouble-shooting	i	●		
	ii		●	
	iii			●

023S02

The basic method of using the troubleshooting chart is as follows.

Items listed for **[Questions]** and **[Check items]** that have a relationship with the Cause items are marked with ○, and of these, causes that have a high probability are marked with ⊙.

Check each of the **[Questions]** and **[Check items]** in turn, and marked the ○ or ⊙ in the chart for items where the problem appeared. The vertical column (Causes) that has the highest number of points is the most probable cause, so start troubleshooting for that item to make final confirmation of the cause.

- ※1. For [Confirm recent repair history] in the [Questions] Section, ask the user, and mark the Cause column with △ to use as reference for locating the cause of the failure. However, do not use this when making calculations to narrow down the causes.
- ※2. Use the △ in the Cause column as reference for [Degree of use (Operated for long period)] in the [Questions] section as reference. As a rule, do not use it when calculating the points for locating the cause, but it can be included if necessary to determine the order for troubleshooting.

		Causes							
		Seized turbocharger, interference	Clogged air cleaner element	Worn piston ring, cylinder	Clogged, seized injection nozzle	Improper injection timing	Defective injection pump (excessive injection)		
※1	Confirm recent repair history								
※2	Degree of use								
	Operated for long period	△	△	△					

023S02

• Example of troubleshooting when exhaust gas is black

Let us assume that [Clogged air cleaner] is taken to be the cause of black exhaust gas. Three symptoms have causal relationship with this problem: [Exhaust gas slowly became black], [Power slowly became weaker], and [Dust indicator lamp is lighted up].

If we look from these three symptoms to find the causes, we find that there is a relationship with five causes. Let us explain here the method of using this causal relationship to pinpoint the most probable cause.

S-7 Exhaust gas is black (incomplete combustion)

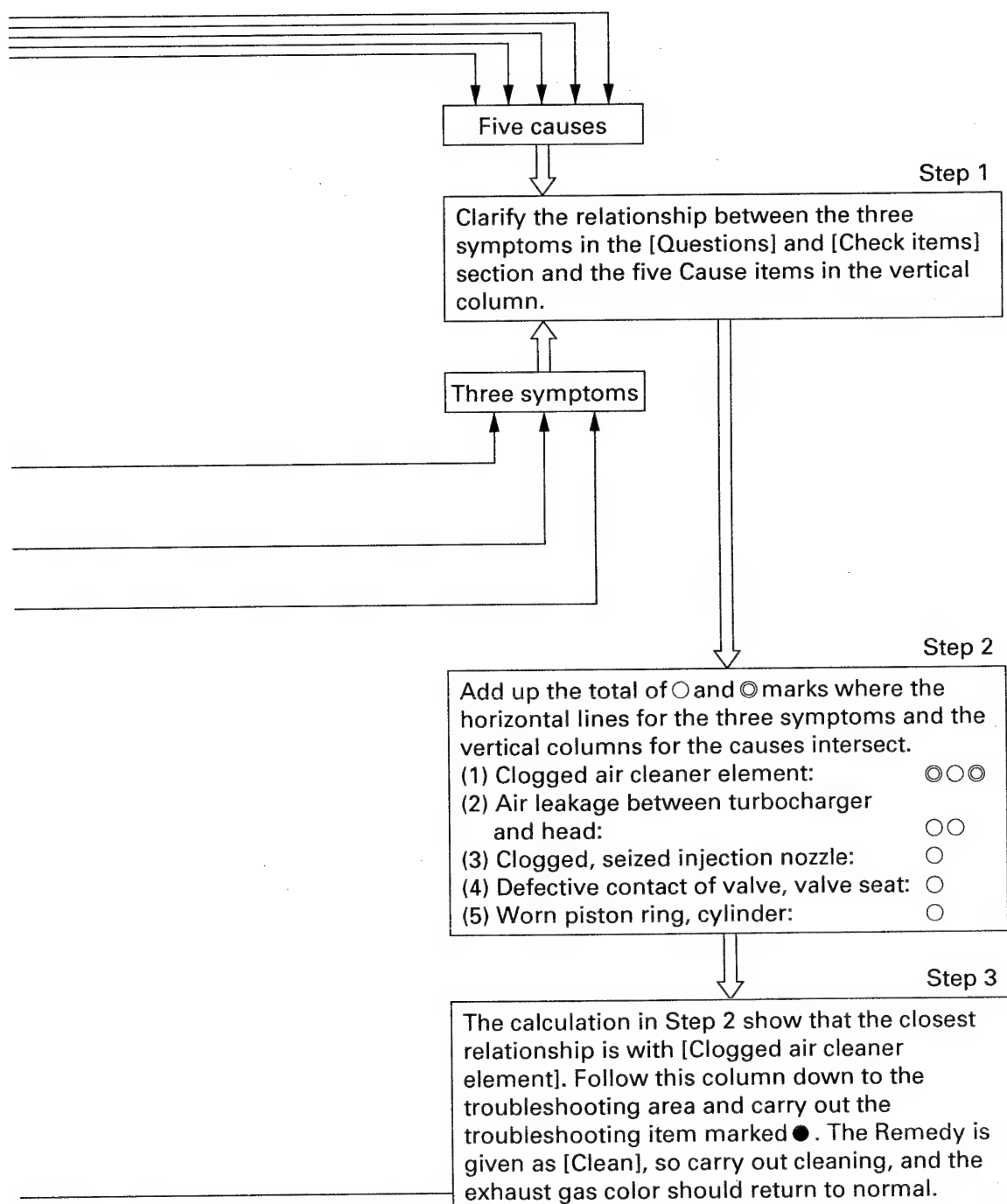
General causes why exhaust gas is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection of fuel

		Causes									
		Seized turbocharger, interference	Exhaust air cleaner clogged	Worn piston ring, cylinder	Clogged air filter	Improper injection timing	Defective injection pump	Crushed valve clearance	Leakage of air between turbocharger and head	Defective injection pump (excessive injection)	Defective injection pump (rack, plunger seized)
Questions	Confirm recent repair history										
	Degree of use										
	Color of exhaust gas										
	Engine oil must be added more frequently										
	Power was lost										
	Non-specified fuel has been used										
	Noise of interference is heard from around turbocharger										
	Dust indicator is red										
	Blow-by gas is excessive										
	Engine pickup is poor and combustion is irregular										
Check items	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										
	Match marks on fuel injection pump are out of alignment										
	Seal on injection pump has come off										
	Clanging sound is heard from around cylinder head										
	Exhaust noise is abnormal										
	Muffler is crushed										
	Leakage of air between turbocharger and head, loose clamp										
	When turbocharger is rotated by hand, it is found to be heavy										
	When air cleaner is inspected directly, it is found to be clogged										
	When compression pressure is measured, it is found to be low										
Troubleshooting	Speed of some cylinders does not change when operating on reduced cylinders										
	When check is made using delivery method, injection timing is found to be incorrect										
	Injection pump test shows that injection amount is incorrect										
	When valve clearance is checked directly it is found to be outside standard value										
	When muffler is removed, exhaust gas color returns to normal										
	When control rack is pushed, it is found to be heavy or does not return										
Remedy		Replace	Replace	Replace	Adjust	Adjust	Replace	Repair	Replace	Replace	Replace

023S02

023S02



General causes why exhaust smoke comes out but engine takes time to start

- ★ Battery charging rate

Charging rate Ambient temperature	100 %	90 %	80 %	75 %	70 %
20°C	1.28	1.26	1.24	1.23	1.22
0°C	1.29	1.27	1.25	1.24	1.23
-10°C	1.30	1.28	1.26	1.25	1.24

- The specific gravity should exceed the value for the charging rate of 70% in the above table.
- In cold areas the specific gravity must be near the value for the charging rate of 100% in the above table.

023S02

[illegible]

S-2 Engine does not start

(1) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
 - ★ If internal parts of the engine are seized, carry out troubleshooting for "Engine stops during operations".
- Defective electrical system

Causes							
Defective or deteriorated battery	Defective starting motor	Broken ring gear	Defective safety relay	Defective battery relay	Defective battery terminal connection	Defective starting switch	Defective wiring in starting circuit

Questions	Check items									
	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△		△					
	Condition of horn when starting switch is turned ON	Horn sounds						○	◎	
		Horn does not sound or volume is low	◎							
	When starting switch is turned to START, pinion moves out, but	Makes grating noise		◎	◎					
		Soon disengages again			◎					
		Makes rattling noise and does not turn	○	○						
	When starting switch is turned to START, pinion does not move out								◎	
	When starting switch is turned to ON, there is no clicking sound					◎				◎
	Battery terminal is loose						◎			
	When battery is checked, battery electrolyte is found to be low		◎							

Troubleshooting										
	Specific gravity of electrolyte, voltage of battery is low		●							
	For the following conditions 1) - 4), turn the starting switch OFF, connect the cord, and carry out troubleshooting at ON								●	
	1) When terminal B and terminal C of starting switch are connected, engine starts	Turns								
		Does not turn		●						
	2) When terminal B and terminal C of starting motor are connected, engine starts				●					
	3) When terminal B and terminal C of safety relay are connected, starting motor turns					●				
	4) There is no electricity between battery relay terminal B and terminal M						●			
	When ring gear is inspected directly, tooth surface is found to be chipped				●					
	Remedy		Replace	Replace	Replace	Replace	Replace	Replace	Replace	

023S02

(2) Engine turns but no exhaust smoke comes out
(fuel is not being injected)

General causes why engine turns but no exhaust smoke comes out

- Supply of fuel impossible
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

★ Standards for use of fuel

TYPE OF FUEL	AMBIENT TEMPRATURE									
	-22	-4	14	32	50	68	86	104	122°F	
	-30	-20	-10	0	10	20	30	40	50°C	
Diesel fuel										ASTM D975 No.2
										ASTM D975 No.1

Causes								
Broken injection pump drive shaft, key								
Defective injection pump (rack, plunger seized)								
Seized, broken feed pump piston								
Clogged fuel filter, strainer								
Clogged feed pump strainer								
Clogged, leaking fuel piping								
Clogged air breather hole in fuel tank cap								
Improper fuel used								

	Questions									
Check items	Confirm recent repair history									
	Degree of use of machine									
	Operated for long period									
	Exhaust smoke suddenly stops coming out (when starting again)	◎	◎	◎						
	Replacement of filters has not been carried out according to Operation Manual				◎	◎				
	There is leakage from fuel piping							◎		
	Mud is stuck to fuel tank cap								◎	
	When fuel filter is drained, fuel does not come out									◎
Check items	When engine is cranked with starting motor, 1) Injection pump coupling does not turn	◎								
	2) No fuel comes out even when fuel filter air bleed plug is loosened	◎		○	○	○				○
	3) No fuel spurts out even when injection tube sleeve nut is loosened	◎	◎	◎						
	Rust and water are found when fuel tank is drained					○	○			

	Troubleshooting									
Troubleshooting	Inspect injection pump directly	●								
	When control rack is pushed, it is found to be heavy, or does not return		●							
	Inspect feed pump directly			●						
	When fuel filter, strainer are inspected directly, they are found to be clogged				●					●
	When feed pump strainer is inspected directly, it is found to be clogged					●				
	When fuel tank cap is inspected directly, it is found to be clogged							●		
Remedy		Replace	Replace	Replace	Clean	Clean	Correct	Correct	Replace	

023S02

(3) Exhaust smoke comes out but engine does not start (Fuel is being injected)

General causes why exhaust smoke comes out but engine does not start

- Lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel and oil

Causes										
Defective, broken valve system (valve, rocker lever, etc.)										
Defective injection pump (rack, plunger stuck)										
Worn piston ring, cylinder liner										
Clogged fuel filter, strainer										
Clogged feed pump strainer										
Defective air cleaner element										
Defective intake air heater system (electrical intake air heater)										
Leakage, clogging, air in fuel system										
Clogged injection nozzle, defective spray										
Clogged air breather hole in fuel tank cap										
Improper fuel used										

Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period								
	Suddenly failed to start	⊙	⊙							
	When engine is cranked, abnormal noise is heard from around head	⊙								
	Engine oil must be added more frequently			⊙						
	Non-specified fuel is being used		○						○	
	Replacement of filters has not been carried out according to Operation Manual				⊙	⊙	⊙			
	Rust and water are found when fuel tank is drained				⊙	⊙				
	Dust indicator is red						⊙			
	Preheating indicator lamp does not light up						⊙			
Check items	Starting motor cranks engine slowly							⊙		
	Mud is stuck to fuel tank cap								○	
	When fuel lever is placed at FULL position, it does not contact stopper		○							
	When engine is cranked with starting motor, 1) Little fuel comes out even when injection tube sleeve nut is loosened		⊙							
	2) No fuel comes out even when fuel filter air bleed plug is loosened				⊙	⊙				○
	There is leakage from fuel piping							⊙		
	When fuel filter is drained, no fuel comes out									⊙

Troubleshooting	Remove head cover and check directly	●												
	When control rack is pushed, it is found to be heavy, or does not return		●											
	When compression pressure is measured, it is found to be low			●										
	When fuel filter, strainer are inspected directly, they are found to be clogged				●									●
	When feed pump strainer is inspected directly, it is found to be clogged					●								
	When air cleaner is inspected directly, it is found to be clogged						●							
	Heater mount does not become warm							●						
	Either specific gravity of electrolyte or voltage of battery is low, or both are low								●					
	When feed pump is operated, reaction is too light or too heavy									●				
	When injection nozzle is tested as individual part, spray condition is found to be poor										●			
When fuel cap is inspected directly, it is found to be clogged											●			
		Remedy	Replace	Replace	Clean	Clean	Clean	Repair	Replace	Replace	Repair	Clean	Clean	Replace

023S02

S-3 Engine does not pick up smoothly (follow-up is poor)

★ Check that there is no error code displayed.
General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used

		Causes											
		Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump strainer	Clogged injection nozzle, defective spray	Worn piston ring, cylinder liner	Seized turbocharger, interference	Improper valve clearance	Clogged air breather hole in fuel tank cap	Clogged, leaking fuel piping	Defective contact of valve and valve seat		
Questions	Confirm recent repair history												
	Degree of use of machine	△	△	△		△							△
	Replacement of filters has not been carried out according to Operation Manual	◎	◎	◎									
	Non-specified fuel is being used		◎	◎	◎	◎							
	Engine oil must be added more frequently					◎							
	Dust indicator is red	◎											
	Rust and water are found when fuel tank is drained		◎	◎									
	Noise of interference is heard from around turbocharger					◎							
	Engine pick-up suddenly became poor			○		◎		○	○				
	Color of exhaust gas					◎							
Check items	Blue under light load					◎							
	Black	◎		◎		◎						○	
	Clanging sound is heard from around cylinder head						◎						
	Mud is stuck to fuel tank cap							◎					
	There is leakage from fuel piping								◎				
	High idling speed under no load is normal, but speed suddenly drops when load is applied		◎	◎				○					
	There is hunting from engine (rotation is irregular)		○	◎	○			○					
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low			◎	○								
	Blow-by gas is excessive					◎							
	Troubleshooting	When air cleaner is inspected directly, it is found to be clogged	●										
When fuel filter, strainer are inspected directly, they are found to be clogged			●										
When feed pump strainer is inspected directly, it is found to be clogged				●									
Speed does not change when operation of certain cylinders is stopped					●								
When control rack is pushed, it is found to be heavy, or does not return						●							
When compression pressure is measured, it is found to be low							●					●	
When turbocharger is rotated by hand, it is found to be heavy								●					
When valve clearance is checked directly, it is found to be outside standard value									●				
When fuel tank cap is inspected directly, it is found to be clogged										●			
When feed pump is operated, reaction is too light or too heavy											●		
Remedy		Clean	Clean	Clean	Repair	Replace	Replace	Replace	Adjust	Clean	Repair	Replace	

023S02

S-4 Engine stops during operations

- ★ Check that the fuel tank level gauge shows that there is still fuel remaining.
General causes why engine stops during operations
 - Seized parts inside engine
 - Insufficient supply of fuel
 - Overheating
★ If there is overheating and the engine stops, carry out troubleshooting for overheating.

★ Check that the fuel tank level gauge shows that there is still fuel remaining.

General causes why engine stops during operations

- Seized parts inside engine
- Insufficient supply of fuel
- Overheating

★ If there is overheating and the engine stops, carry out troubleshooting for overheating.

		Causes													
		Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken dynamic valve system (valve, rocker lever, etc.)	Broken, seized gear train	Clogged fuel pump drive shaft, key	Clogged fuel filter, strainer	Broken, seized feed pump strainer	Clogged, leaking feed pump piston	Clogged air breather hole in fuel tank cap	Defective injection pump (rack, plunger stuck)				
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period										△	△		
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly										◎	◎		○
		Engine stopped slowly										◎	○		
		There was hunting and engine stopped												○	○
		Engine overheated and stopped												○	○
	Replacement of filters has not been carried out according to Operation Manual										◎	◎			
	Non-specified fuel is being used												○	○	
	When feed pump is operated, reaction is too light or too heavy												○	○	
	Mud is stuck to fuel tank cap													◎	
Check items	Try to turn by hand using barring tool	Does not turn at all										◎	◎		
		Turns in opposite direction												◎	
		Moves amount of backlash												◎	
		Injection pump shaft does not turn												◎	
	Rust and water are found when fuel tank is drained												◎	◎	
Metal particles are found when oil is drained										◎	◎				

		Causes											
		Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken dynamic valve system (valve, rocker lever, etc.)	Broken, seized gear train	Clogged fuel pump drive shaft, key	Clogged fuel filter, strainer	Broken, seized feed pump strainer	Clogged, leaking feed pump piston	Clogged air breather hole in fuel tank cap	Defective injection pump (rack, plunger stuck)		
Troubleshooting	Remove oil pan and inspect directly	●	●										
	Remove head cover and inspect directly			●									
	When gear train is inspected, it does not turn				●								
	When fuel filter, strainer are inspected directly, they are found to be clogged					●							
	When feed pump strainer is inspected directly, it is found to be clogged						●						
	Inspect feed pump directly							●					
	When control rack is pushed, it is found to be heavy, or does not return										●		
Remedy		Replace	Replace	Replace	Replace	Replace	Clean	Clean	Replace	Correct	Clean	Replace	

023S02

S-5 Engine does not rotate smoothly (hunting)

★ Check that there is no error code displayed.
General causes why engine does not rotate smoothly

- Air in fuel system
- Defective governor mechanism

		Causes								
		Defective operation of governor	Defective adjustment of governor	Defective operation of control rack	Low idling speed is too low	Clogged feed pump strainer	Clogged fuel filter, strainer	Clogged air in circuit between fuel tank and feed pump	Clogged air in circuit between feed pump and nozzle	Clogged air breather hole in fuel tank cap
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period			△	△				
	Condition of hunting	Occurs at a certain speed range	◎	◎	◎	○				
		Occurs at low idling	○		◎	○	○	○		
		Occurs even when speed is raised	○	○	○					○
	Replacement of filters has not been carried out according to Operation Manual				◎	◎				
	Rust, water are found when fuel tank is drained				○	○				
	Leakage from fuel piping						◎	◎		
	Mud is stuck to fuel tank cap									◎
	When feed pump is operated, 1) No response or light response, return is quick						◎	◎		
Check items	2) No response or light response, return is normal						◎			
	Engine speed sometimes rises too far		◎	◎						
	Engine is sometimes difficult to stop		◎		◎					
	Seal on injection pump has come off			◎		◎				
Troubleshooting	When governor lever is moved it is found to be stiff		●		●					
	When injection pump is tested, governor is found to be improperly adjusted			●						
	When control rack is pushed, it is found to be heavy, or does not return				●					
	When fuel tank cap is inspected directly, it is found to be clogged									
	When feed pump strainer is inspected directly, it is found to be clogged					●				
	When fuel filter, strainer are inspected directly, they are found to be clogged						●			●
Remedy		Adjust	Adjust	Adjust	Adjust	Clean	Clean	Correct	Correct	Clean

S-6 Engine lacks output (no power)

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used
(if non-specified fuel is used, output drops)
- Lack of output due to overheating
- ★ If there is overheating and insufficient output, carry out troubleshooting for overheating.

			Causes											
			Clogged air cleaner element	Seized turbocharger, interference	Worn piston ring, cylinder liner	Clogged fuel filter, strainer	Clogged feed pump strainer	Seized injection nozzle, defective spray	Improper valve pump plunger	Defective valve clearance	Bent fuel linkage, defective adjustment	Clogged, leaking fuel piping	Clogged air breather hole in fuel tank cap	Overheating
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period	△	△	△	△			△					
	Power was lost	Suddenly	◎											◎
		Gradually	○	○	○	○	○		○					
	Engine oil must be added more frequently			◎										
	Replacement of filters has not been carried out according to Operation Manual		◎		◎	◎								
	Non-specified fuel is being used				◎	◎	◎	◎						
	Dust indicator is red		◎											
	Color of exhaust gas	Black	◎	◎										
		Blue under light load		◎										
Check items	Noise of interference is heard from around turbocharger			◎										
	Blow-by gas is excessive			◎										
	Engine pickup is poor and combustion is irregular			◎			◎				○	○		
	High idling speed under no load is normal, but speed suddenly drops when load is applied				◎	◎						○		
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low						◎	○						
	There is hunting from engine (rotation is irregular)				○	○					○	○		
	Clanging sound is heard from around cylinder head							◎						
	High idling speed of engine is low						○			◎				
	Leakage from fuel piping										◎			
	Water temperature gauge is in red range													◎

Troubleshooting	When air cleaner is inspected directly, it is found to be clogged	●												
	When turbocharger is rotated by hand, it is found to be heavy		●											
	When compression pressure is measured, it is found to be low			●						●				
	When fuel filter, strainer are inspected directly, they are found to be clogged				●									
	When feed pump strainer is inspected directly, it is found to be clogged					●								
	Speed does not change when operation of certain cylinders is stopped						●							
	When control rack is pushed, it is found to be heavy, or does not return							●						
	When valve clearance is checked directly, it is found to be outside standard value								●					
	When lever is placed at FULL position, it does not contact stopper									●				
	When feed pump is operated, reaction is too light or too heavy										●			
	When fuel tank cap is inspected directly, it is found to be clogged											●		
Remedy		Clean	Replace	Replace	Clean	Clean	Correct	Replace	Adjust	Replace	Adjust	Correct	Clean	—

Carry out troubleshooting for overheating

023S02

S-7 Exhaust smoke is black (incomplete combustion)

General causes why exhaust smoke is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection of fuel

		Causes									
		Seized turbocharger, interference	Clogged air cleaner element	Worn piston ring, cylinder liner	Clogged, seized injection nozzle	Improper injection timing	Improper injection pump (excessive injection)	Crushed, clogged muffler	Leakage of air between turbocharger and head	Defective contact of valve and valve seat	Defective injection pump (rack, plunger seized)
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△	△	△				△		
	Color of exhaust gas	Suddenly became black	◎								○
		Gradually became black	◎					○			
		Blue under light load		◎							
	Engine oil must be added more frequently			◎							
	Power was lost	Suddenly	◎		○		○				○
		Gradually		○	○						
	Non-specified fuel is being used				○						
	Noise of interference is heard from around turbocharger	◎									
Check items	Dust indicator is red	◎									
	Blow-by gas is excessive		◎								
	Engine pickup is poor and combustion is irregular	○		◎		○	○	○			○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low			◎							○
	Match marks on fuel injection pump are out of alignment				◎						
	Seal on injection pump has come off				◎						
	Clanging sound is heard from around cylinder head					◎					
	Exhaust noise is abnormal	○		○			◎				
	Muffler is crushed						◎				
	Leakage of air between turbocharger and head, loose clamp							◎			
Troubleshooting	When turbocharger is rotated by hand, it is found to be heavy	●									
	When air cleaner is inspected directly, it is found to be clogged		●								
	When compression pressure is measured, it is found to be low			●						●	
	Speed does not change when operation of certain cylinders is stopped			●							
	When check is made using dial gauge method, injection timing is found to be incorrect				●						
	Injection pump test shows that injection amount is incorrect					●					
	When valve clearance is checked directly it is found to be outside standard value						●				
	When muffler is removed, exhaust color returns to normal							●			
	When control rack is pushed, it is found to be heavy, or does not return										●
Remedy		Replace	Clean	Replace	Replace	Adjust	Adjust	Adjust	Replace	Correct	Replace
											Replace

S-8 Oil consumption is excessive (or exhaust smoke is blue)

★ Do not run the engine at idling for more than 20 minutes continuously. (Both low and high idling)

General causes why oil consumption is excessive

- Abnormal combustion of oil
- External leakage of oil
- Wear of lubrication system

		Causes											
		Broken piston ring	Worn piston ring	Clogged breather or breather hose	Leakage from oil filter or oil cooler	Leakage from oil piping	Leakage from oil drain plug	Broken oil cooler	Worn seal at turbine end	Worn seal at blower end	Turbocharger	Dust sucked in from intake system	Worn valve (stem, guide), broken seal
Questions	Confirm recent repair history												
	Degree of use of machine	Operated for long period	△						△	△			△
	Oil consumption suddenly increased	◎					○						
	Engine oil must be added more frequently	◎					○						
	Engine oil becomes contaminated quickly	○	◎	○									
	Exhaust smoke is blue under light load	◎	◎										
	Amount of blow-by gas	Excessive	◎	◎					○			○	
		None		◎									
	Area around engine is dirty with oil		◎	◎	◎	◎							
	There is oil in engine cooling water						◎						
Check items	When exhaust pipe is removed, inside is found to be dirty with oil							◎				○	
	When turbocharger air supply pipe is removed, inside is found to be dirty with oil								◎				
	Oil enters damper chamber (oil level rises)									◎			
	Clamps for intake system are loose										◎		
Troubleshooting	When compression pressure is measured, it is found to be low	●	●										
	When breather element is inspected, it is found to be clogged with dirty oil			●									
	There is external leakage of oil from engine			●	●	●	●						
	Pressure-tightness test of oil cooler shows there is leakage						●						
	Excessive play of turbocharger shaft							●	●				
	Inspect rear seal directly									●			
	When intake manifold is removed, dust is found inside										●		
	When intake manifold is removed, inside is found to be dirty with oil											●	
Remedy		Replace	Replace	Clean	Correct	Correct	Correct	Replace	Replace	Replace	Correct	Correct	Correct

023S02

S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly

- Intake of exhaust gas due to internal wear
- Clogging of lubrication passage
- Improper fuel
- Improper oil used
- Operation under excessive load

		Causes								
		Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil filter	Worn valve, valve guide	Clogged oil cooler	Clogged turbocharger drain pipe	Defective seal at turbocharger turbine end	Defective oil filter safety valve	Exhaust smoke is black
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△		△		△			
	Engine oil must be added more frequently		◎							
	Non-specified oil is being used			○						
Check items	Color of exhaust gas	Blue under light load	◎							
		Black							◎	
	Amount of blow-by gas is excessive		◎		○	○	○			
	Area around engine is dirty with oil		○							
	When oil filter is inspected, metal particles are found		○	◎	○					
	When exhaust pipe is removed, inside is found to be dirty with oil			◎						
	Engine oil temperature rises quickly				◎					
Troubleshooting	When compression pressure is measured, it is found to be low	●			●					
	When breather element is inspected directly, hose is found to be clogged with dirt or dirty oil		●							
	When oil filter is inspected directly, it is found to be clogged			●						
	When oil cooler is inspected directly, it is found to be clogged				●					
	Turbocharger drain tube is clogged					●				
	Excessive play of turbocharger shaft						●			
	When oil filter safety valve is directly inspected, spring is found to be catching or broken							●		
Remedy		Replace	Clean	Replace	Replace	Clean	Clean	Replace	Replace	—

Carry out troubleshooting for "Exhaust smoke is black".

023S02

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive

- Leakage of fuel
- Improper condition of fuel injection
- Excessive injection of fuel

		Causes							
		Defective injection pump (excessive injection) Defective nozzle holder spray Defective injection pump plunger Improper fuel injection timing External leakage from fuel piping Leakage of fuel inside head cover Defective oil seal inside feed pump Defective adjustment of fuel control linkage							
Questions	Confirm recent repair history								
	Degree of use of machine	Operated for long period	△	△				△	
	Condition of fuel consumption	More than for other machines of same model	◎		○				
		Gradually increased		○	○				
		Suddenly increased				○	○		
	Exhaust smoke color	Black	◎	○	○				○
		White				○			
	Seal on injection pump has come off		◎						
	There is irregular combustion		◎						
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low		◎	○					
Check items	Match mark on injection pump is misaligned			◎					
	There is external leakage of fuel from engine				◎				
	Engine oil level rises and smells of diesel fuel	○				◎	◎		
	Engine low idling speed is high	○						◎	
	Injection pump measurement shows that injection amount is excessive	●							
	Speed does not change when operation of certain cylinders is stopped		●						
	When control rack is pushed, it is found to be heavy, or does not return			●					
Troubleshooting	When check is made using dial gauge method, injection timing is found to be incorrect				●				
	Remove head cover and inspect directly					●			
	Remove feed pump and inspect directly						●		
	When engine speed is measured, low idling speed is found to be high							●	
	Remedy	Adjust	Replace	Replace	Adjust	Correct	Correct	Correct	Adjust

023S02

S-11 Oil is in cooling water, or water spurts back, or water level goes down

General causes why oil is in cooling water

- Internal leakage in lubrication system
- Internal leakage in cooling system

			Causes							
			Broken engine oil cooler core, O-ring	Broken cylinder head, head gasket	Insufficient protrusion of cylinder liner	Broken cylinder liner O-ring, holes caused by pitting	Internal cracks in cylinder block	Broken power train oil cooler		
Check items	Questions	Confirm recent repair history								
	Degree of use of machine	Operated for long period	△			△				
	Oil level	Suddenly increased	○	○						
		Gradually increased				○	○			
	Hard water is being used as cooling water (tap water is not being used)		○			○				
	Engine oil level has risen, oil is cloudy white		◎			○	○			
	Excessive air bubbles inside radiator, spurts back			◎	◎					
	Power train oil is milky white							◎		
	When power train oil is drained, water comes out							◎		
	Trouble-shooting	Pressure-tightness test of oil cooler shows there is leakage		●						
Pressure-tightness test of cylinder head shows there is leakage			●							
Remove cylinder head and inspect directly				●						
Remove oil pan and inspect directly					●	●				
			Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Replace

023S02

S-12 Oil pressure caution lamp lights up (drop in oil pressure)

General causes why oil pressure lamp lights up

- Leakage, clogging, wear of lubricating system
- Defective oil pressure control
- Improper oil used (improper viscosity)
- Deterioration of oil due to overheating

★ Standards for engine oil selection

TYPE OF OIL	AMBIENT TEMPERATURE							
	-30	-20	-10	0	10	20	30	40°C
Engine oil								SAE30CD
								SAE10WCD
								SAE10W-30CD
								SAE15W-40CD

Causes									
Clogged oil filter									
Worn bearing, journal									
Clogged strainer inside oil pan									
Clogged, broken oil pipe inside oil pan									
Broken suction pipe inside oil pan									
Defective oil pump									
Defective regulator valve									
Leaking relief valve									
Leaking, crushed hydraulic piping									
Defective oil pressure sensor									
Water, fuel in oil									

Questions	Confirm recent repair history																		
	Degree of use of machine	Operated for long period	△	△				△											
	Replacement of filters has not been carried out according to Operation Manual		◎																
	Non-specified oil is being used		○	○															
Check items	Condition when oil pressure lamp flashes	Flashes at low idling		◎						○									
		Flashes at low, high idling			◎	◎	◎	◎	○	○									
		Sometimes flashes							◎	◎		○							
	There is clogging, leakage from hydraulic piping (external)										◎								
	Metal particles are found when oil is drained			◎															
	Metal particles are stuck to oil filter element			◎				○											
	Oil is cloudy white or smells of diesel oil																	◎	

Troubleshooting	When oil filter is inspected directly, it is found to be clogged	●	●																
	Remove oil pan and inspect directly			●	●	●													
	Oil pump rotation is heavy, there is play						●												
	There is catching of relief valve or regulator valve, spring or valve guide is broken							●	●										
	When oil pressure is measured, it is found to be within standard value															●			
Remedy		Clean	Clean	Clean	Clean	Correct	Replace	Adjust	Adjust	Correct	Replace	Carry out troubleshooting for "Oil level rises".							

023S02

S-13 Oil level rises (water, fuel in oil)

★ If there is oil in the cooling water, carry out troubleshooting for "Oil is in cooling water".

General causes why oil level rises

- Water in oil
- Fuel in oil (diluted, and smells of diesel fuel)
- Entry of oil from other component

		Causes									
		Broken oil cooler core, O-ring	Defective nozzle holder sleeve	Broken cylinder head, head gasket (including precombustion chamber)	Clogged water pump breather hole	Worn, damaged rear seal	Leakage of fuel inside head surface	Defective part inside head cover	Defective thermostat seal	Damaged cylinder liner O-ring	Cracks inside cylinder block
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△		△	△				△	
	When engine is first started, drops of water come from muffler		⊙								
	Exhaust smoke is white		⊙				○	○			
	There is oil in radiator cooling water	⊙	○	○					○	○	
	Leave radiator cap open. When engine is run at idling, an abnormal number of bubbles appear, or water spurts back			⊙					○		
	Water pump breather hole is clogged with mud				⊙						
	When water pump breather hole is cleaned, water comes out				⊙						
	Oil level goes down in damper chamber					⊙					
	Engine oil smells of diesel fuel						⊙	⊙	⊙		
Check items	Fuel must be added more frequently						⊙	⊙	⊙		
	Pressure-tightness test of oil cooler shows there is leakage	●									
	Pressure-tightness test of cylinder head shows there is leakage		●								
	When compression pressure is measured, it is found to be low			●							
	Remove water pump and inspect directly				●						
	Remove rear seal and inspect directly					●					
	Remove head cover and inspect directly						●				
	Remove injection pump and inspect directly							●			
	Contact with thermostat seal valve is defective								●		
	Remove oil pan and check directly									●	●
Remedy		Replace	Replace	Replace	Replace	Correct	Correct	Replace	Replace	Replace	Replace

023S02

S-14 Water temperature becomes too high (overheating)

General causes why water temperature becomes too high

- Lack of cooling air (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Defective cooling circulation system
- ★ Carry out troubleshooting for chassis.

		Causes											
		Broken water pump	Clogged, crushed radiator fins	Clogged radiator core	Defective thermostat (does not open)	Excessive elongation of fan belt, worn fan pulley	Clogged, broken oil cooler	Defective radiator pressure valve	Damaged cylinder head, head gasket	External leakage from cooling water piping	Loose fan belt		
Questions	Confirm recent repair history												
	Degree of use of machine	Operated for long period	△	△					△	△			
	Condition of overheating	Suddenly overheated	◎			○							
		Always tends to overheat	◎	◎	○	○							
	Water temperature gauge	Rises quickly		◎									
		Does not go down from red range			◎								
Check items	Fan belt whines under sudden acceleration (belt slips)												
	Cloudy white oil is floating on cooling water												
	Cooling water flows out from overflow hose												
	Excessive air bubbles inside radiator, water spurts back												
	Engine oil level has risen, oil is cloudy white												
	There is play when fan pulley is rotated												
	Radiator shroud, inside of underguard are clogged with dirt or mud												
	When light bulb is held behind radiator, no light passes through												
	Water is leaking because of cracks in hose or loose clamps												
	When belt tension is inspected, it is found to be loose												
Troubleshooting	Temperature difference between top and bottom radiator tanks is excessive												
	Temperature difference between top and bottom radiator tanks is too small												
	When water filler port is inspected, core is found to be clogged												
	When function test is carried out on thermostat, it does not open even at cracking temperature												
	When water temperature is measured, it is found to be normal												
	When oil cooler is inspected directly, it is found to be clogged												
	When measurement is made with radiator cap tester, set pressure is found to be low												
	When compression pressure is measured, it is found to be low												
	Remove oil pan and inspect directly												
	Check fan belt, pulley directly												
Remedy		Replace	Correct	Correct	Replace	Replace	Correct	Replace	Replace	Replace	Replace	Correct, replace	Adjust

023S02

★ Judge if the noise is an internal noise or an external noise.

- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system

023S02

S-16 Vibration is excessive

★ If there is abnormal noise together with the vibration, carry out troubleshooting for "Abnormal noise is made".

General causes why vibration is excessive

- Defective parts (abnormal wear, breakage)
- Improper alignment
- Abnormal combustion

		Causes					
		Worn connecting rod, main bearing	Worn balancer, cam bushing	Loose engine mounting bolts, broken cushion	Improper gear train backlash	Defective dynamic valve system (valve, rocker lever, etc.)	Defective injection pump (excessive injection)
Questions	Confirm recent repair history						
	Degree of use of machine	Operated for long period	△	△	△		
	Condition of vibration	Suddenly increased				○	
		Gradually increased	○	○	○		
	Non-specified oil is being used		○	○			
	Metal particles are found in oil filter		◎	◎			
	Metal particles are found when oil is drained		◎	◎			
	Oil pressure is low at low idling		○	○			
	Vibration occurs at mid-range speed				○		
	Vibration follows engine speed				○	○	
Check items	Exhaust smoke is black					◎	○
	Seal on injection pump has come off						◎
Troubleshooting	Remove oil pan and inspect directly		●				
	Remove side cover and inspect directly			●			
	Inspect directly for loose engine mounting bolts, inspect cushion				●		
	Remove front cover and inspect directly					●	
	Remove head cover and inspect directly						●
	Injection pump test shows that injection amount is incorrect						●
Remedy		Replace	Replace	Replace	Correct	Replace	Adjust

023S02

TTROUBLESHOOTING OF UPPER MDT CONTROLLER SYSTEM

(EU MODE)

Table of error codes and troubleshooting codes	20-353
Action of controller and condition of machine when abnormality occurs	20-362
Judgement table for upper MDT, and hydraulic and mechanical systems	20-380
Electrical circuit diagram of power source, starting, charging, and preheating systems	20-384
Electrical circuit diagram of network system	20-386
Electrical circuit diagram of brake system	20-387
Electrical circuit diagram of steering system	20-388
Electrical circuit diagram of suspension system	20-390
Electrical circuit diagram of outrigger system	20-392
Electrical circuit diagram of machine monitor system	20-394
Electrical circuit diagram of turn signal and swing flasher systems	20-396
Electrical circuit diagram of lamp, horn, and grease systems	20-398
EU- 1 MDTU error E00 (MDT system error) is displayed	20-400
EU- 2 MDTU error E10 (Shut off when low voltage) is displayed	20-400
EU- 3 MDTU error E11 (Shut off when high temperature) is displayed	20-401
EU- 4 MDTU error E20 (Top, bottom don't match (application stopped)) is displayed	20-402
EU- 5 MDTU error E21 (Top, bottom selection warning) is displayed	20-403
EU- 6 MDTU error E24 (Model doesn't match (application stopped)) is displayed	20-404
EU- 7 MDTU error E25 (Model selection warning) is displayed	20-405
EU- 8 MDTU error E28 (Abnormality in C-NET communication between MDTs (output stopped)) is displayed	20-406
EU- 9 MDTU error E29 (Abnormality in S-NET communication between MDT and moment limiter) is displayed	20-407
EU-10 MDTU error E40 (Swing flasher output short circuited with ground) is displayed	20-408
EU-11 MDTU error E41 (Power source for outrigger panel short circuited with ground) is displayed	20-409
EU-13 MDTU error E43 (Outrigger mode short circuited with ground) is displayed	20-410
EU-14 MDTU error E44 (Crab mode display LED short circuited with ground) is displayed	20-411
EU-15 MDTU error E45 (Front wheel mode display LED short circuited with ground) is displayed	20-411
EU-16 MDTU error E46 (Rear wheel mode display LED short circuited with ground) is displayed	20-412
EU-17 MDTU error E47 (4-wheel mode display LED short circuited with ground) is displayed ...	20-412
EU-18 MDTU error E48 (Rear steering [wheel] LOCK LED short circuited with ground) is displayed	20-413
EU-19 MDTU error E49 (Rear steering [wheel] FREE LED short circuited with ground) is displayed	20-413
EU-20 MDTU error E4A (Rear steering [wheel] CENTER LED short circuited with ground) is displayed	20-414
EU-21 MDTU error E4B (Reverse steering display LED short circuited with ground) is displayed	20-415
EU-22 MDTU error E4C (Winch rotation buzzer (main winch) short circuited with ground) is displayed	20-415

EU-23 MDTU error E4D	(Emergency alarm buzzer short circuited with ground) is displayed	20-416
EU-24 MDTU error E4E	(Winch rotation buzzer (auxiliary winch) short circuited with ground) is displayed	20-417
EU-25 MDTU error E4F	(Monitor central buzzer short circuited with ground) is displayed	20-418
EU-26 MDTU error E50	(Tachometer signal output system short circuited) is displayed	20-419
EU-27 MDTU error E51	(Speedometer signal output system short circuited) is displayed	20-420
EU-28 MDTU error E52	(Fuel level signal output system short circuited) is displayed	20-421
EU-29 MDTU error E53	(Engine water temperature signal output system short circuited) is displayed	20-422
EU-30 MDTU error E55	(Torque converter oil temperature output system short circuited) is displayed	20-423
EU-31 MDTU error E56	(Engine oil pressure output system short circuited) is displayed	20-424
EU-32 MDTU error E57	(Preheating pilot output system short circuited) is displayed	20-425
EU-33 MDTU error E58	(Parking brake actuation lamp output system short circuited) is displayed	20-426
EU-35 MDTU error E5A	(Hi beam pilot output system short circuited with ground) is displayed	20-427
EU-36 MDTU error E5B	(Hourmeter output system short circuited with ground) is displayed	20-428
EU-37 MDTU error E5C	(Charge lamp output system short circuited with ground) is displayed	20-429
EU-38 MDTU error E5D	(Brake fluid (oil) level output lamp short circuited with ground) is displayed	20-430
EU-39 MDTU error E5E	(Right turn pilot short circuited with ground) is displayed	20-431
EU-40 MDTU error E5F	(Left turn pilot short circuited with ground) is displayed	20-432
EU-41 MDTU error E72/E1E	(LED dimmer 1 [shift position display LED system short circuited with ground]) is displayed	20-433
EU-42 MDTU error E73/E1E	(LED dimmer 2 [shift position display LED system short circuited with power source]) is displayed	20-433
EU-43 MDTU error E74/E1F	(LED dimmer 2 [rear wheel LOCK LED system short circuited with ground]) is displayed	20-434
EU-44 MDTU error E75/E1F	(LED dimmer 2 [rear wheel LOCK LED system short circuited with power source]) is displayed	20-434
EU-46 MDTU error E80	(Swing flasher output short circuited with power source) is displayed	20-435
EU-47 MDTU error E83	(Outrigger mode power source short circuited with power source) is displayed	20-436
EU-48 MDTU error EB3	(Disconnection in outrigger mode power source) is displayed	20-437
EU-49 MDTU error EE0	(PTO mode doesn't match) is displayed	20-438
EU-50 MDTU error EE1	(Abnormality in 2WD Hi/4WD Hi/4WD Lo signal) is displayed	20-440
EU-51 MDTU error EE3	(Abnormality in service brake input) is displayed	20-441
EU-52 MDTU error EE4	(Abnormality in suspension lift switch) is displayed	20-442
EU-53 MDTU error EE5	(Abnormality in outrigger control switch) is displayed	20-444
EU-54 MDTU error EE6	(Top outrigger EXTEND + RETRACT switches input simultaneously) is displayed	20-447
MDTU error EE6	(Top outrigger JACK + SLIDE input simultaneously) is displayed	20-447
EU-55 MDTU error EEA	(Abnormality in steering mode switch input) is displayed	20-450
EU-56 MDTU error EEC	(Rear steering LOCK + FREE commands input simultaneously) is displayed	20-452

TABLE OF ERROR CODES AND TROUBLESHOOTING CODES

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
(Upper MDT related)			
MDTU error E00	MDT system error	Action impossible, travel, operation stopped	EU- 1
MDTU error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EU- 2
MDTU error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EU- 3
MDTU error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EU- 4
MDTU error E21	Top, bottom selection warning	Travel, operation stopped	EU- 5
MDTU error E24	Model doesn't match (application stopped)	Action impossible, travel, operation stopped	EU- 6
MDTU error E25	Model selection warning	Travel, operation stopped	EU- 7
MDTU error E28	Abnormality in C-NET communication between MDTs (output stopped)	Travel, operation stopped	EU- 8
MDTU error E29	Abnormality in S-NET communication between MDT and moment limiter	Operation stopped	EU- 9
MDTU error E40	Swing flasher output short circuited with ground	Swing flasher does not flash	EU-10
MDTU error E41	Power source for outrigger panel short circuited with ground	Outrigger cannot be operated	EU-11
MDTU error E43	Outrigger mode power source short circuited with ground	Outrigger cannot be operated	EU-13
MDTU error E44	Crab mode LED short circuited with ground	Crab mode LED does not light up	EU-14
MDTU error E45	Front wheel mode LED short circuited with ground	Front wheel mode LED does not light up	EU-15
MDTU error E46	Rear wheel mode LED short circuited with ground	Rear wheel mode LED does not light up	EU-16
MDTU error E47	4-wheel mode LED short circuited with ground	4-wheel mode LED does not light up	EU-17
MDTU error E48	Rear steering LOCK LED short circuited with ground	Rear steering LOCK LED does not light up	EU-18
MDTU error E49	Rear steering FREE LED short circuited with ground	Rear steering FREE LED does not light up	EU-19
MDTU error E4A	Rear steering CENTER LED short circuited with ground	Rear steering CENTER LED does not light up	EU-20
MDTU error E4B	Reverse steering display lamp short circuited with ground	Reverse steering display lamp does not light up	EU-21
MDTU error E4C	Reverse steering display lamp short circuited with ground	Main winch buzzer does not sound	EU-22
MDTU error E4D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	EU-23
MDTU error E4E	Winch rotation buzzer (auxiliary winch) short circuited with ground	Auxiliary winch buzzer does not sound	EU-24
MDTU error E4F	Monitor central buzzer short circuited with ground	Monitor central buzzer does not sound	EU-25
MDTU error E50	Tachometer signal output short circuited	Tachometer does not work	EU-26
MDTU error E51	Speedometer signal output short circuited	Speedometer does not work	EU-27
MDTU error E52	Fuel level signal output short circuited	Fuel gauge does not work	EU-28
MDTU error E53	Engine water temperature signal output short circuited	Engine water temperature gauge does not work	EU-29
MDTU error E55	Torque converter oil temperature output short circuited	Torque converter overheat caution lamp does not light up	EU-30
MDTU error E56	Engine oil pressure output short circuited	Engine oil pressure caution lamp does not light up	EU-31

023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTU error E57	Preheating pilot output short circuited	Preheating pilot lamp does not light up	EU-32
MDTU error E58	Parking brake actuation lamp output short circuited	Parking brake indicator lamp does not light up	EU-33
MDTU error E59	Retarder lamp output short circuited	Magnetic retarder output lamp does not light up	EU-34
MDTU error E5A	Hi beam pilot output short circuited with ground	Hi beam pilot lamp does not light up	EU-35
MDTU error E5B	Hourmeter output short circuited with ground	Service meter does not work	EU-36
MDTU error E5C	Charge lamp output short circuited with ground	Battery charge caution lamp does not light up	EU-37
MDTU error E5D	Brake fluid (oil) level output short circuited with ground	Brake fluid (oil) level lamp does not light up	EU-38
MDTU error E5E	Right turn pilot output short circuited with ground	Right turn pilot lamp does not flash	EU-39
MDTU error E5F	Left turn pilot output short circuited with ground	Left turn pilot lamp does not flash	EU-40
MDTU error E72	LED dimmer 1 short circuited with ground	Shift position LED is not dimmed when using night lighting (lamp ON)	EU-41
MDTU error E73	LED dimmer 1 short circuited with power source	Shift position LED goes out or becomes excessively dim	EU-42
MDTU error E74	LED dimmer 2 short circuited with ground	Rear steering LOCK LED is not dimmed when using night lighting (lamp ON)	EU-43
MDTU error E75	LED dimmer 2 short circuited with power source	Rear steering LOCK LED goes out or becomes excessively dim	EU-44
MDTU error E80	Swing flasher output short circuited with power source	Swing flasher lamp does not go out	EU-46
MDTU error E83	Outrigger mode power source short circuited with power source	Bottom outrigger operation possible at position other than Operation 1 (PTO 1)	EU-47
MDTU error EB3	Disconnection in outrigger mode power source	Outrigger cannot be operated	EU-48
MDTU error EE0	PTO mode doesn't match	Action impossible (controller at PTO 1) travel, operation stopped	EU-49
MDTU error EE1	Abnormality in 2WD Hi/4WD Hi/4WD Lo input	Action impossible (controller at 4WD Hi)	EU-50
MDTU error EE3	Abnormality in service brake input	Possible to apply parking brake	EU-51
MDTU error EE4	Abnormality in suspension lift switch	Impossible to use suspension lift	EU-52
MDTU error EE5	Abnormality in outrigger control switch	Top outrigger cannot be operated	EU-53
MDTU error EE6	Outrigger EXTEND + RETRACT input simultaneously, JACK + SLIDE input simultaneously	Top outrigger cannot be operated	EU-54
MDTU error EEA	Abnormality in steering mode switch input	Steering mode does not switch	EU-55
MDTU error EEC	Rear steering LOCK + FREE command input simultaneously	Rear steering LOCK/FREE cannot be operated	EU-56
(Lower MDT related)			
MDTL error E00	MDT system error	Action impossible, travel, operation stopped	EL- 1
MDTL error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EL- 2
MDTL error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EL- 3
MDTL error E18	Disconnection in tachometer sensor	Tachometer does not work	EL- 4
MDTL error E19	Disconnection in speedometer sensor	Speedometer does not work	EL- 5
MDTL error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EL- 6
MDTL error E21	Top, bottom selection warning	Travel, operation stopped	EL- 7
MDTL error E24	Model doesn't match (application stopped)	Action impossible, travel, operation stopped	EL- 8

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E25	Model selection warning	Travel, operation stopped	EL- 9
MDTL error E28	Abnormality in C-NET communication between MDTs	Travel, operation stopped	EL-10
MDTL error E29	Abnormality in S-NET communication between MDT and transmission controller	Travel, operation stopped	EL-11
MDTL error E40	Outrigger jack RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-22
MDTL error E41	Outrigger jack FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-23
MDTL error E42	Outrigger jack RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-24
MDTL error E43	Outrigger jack FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-25
MDTL error E44	Outrigger slide RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-26
MDTL error E45	Outrigger slide FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-27
MDTL error E46	Outrigger slide RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-28
MDTL error E47	Outrigger slide FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-29
MDTL error E48	Outrigger selector EXTEND short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-30
MDTL error E49	Outrigger selector RETRACT short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-31
MDTL error E4A	Rear steering LOCK solenoid short circuited with ground	Rear steering LOCK cannot be operated	EL-32
MDTL error E4B	Rear steering FREE solenoid short circuited with ground	Rear steering FREE cannot be operated	EL-33
MDTL error E4C	Service brake short circuited with ground	Auxiliary brake cannot be applied	EL-34
MDTL error E4D	Exhaust brake short circuited with ground	Exhaust brake cannot be applied	EL-35
MDTL error E4E	Retarder short circuited with ground	Retarder brake cannot be applied	EL-36
MDTL error E4F	Preheating short circuited with ground	Preheating does not work	EL-37
MDTL error E51	Retarder speed output short circuited with ground	Retarder brake cannot be applied	EL-39
MDTL error E5A	Head lamp Hi relay short circuited with ground	Hi beam does not work	EL-43
MDTL error E5B	Head lamp Lo relay short circuited with ground	Lo beam does not work	EL-44
MDTL error E5C	Side lamp relay short circuited with ground	Side lamp does not work	EL-45
MDTL error E5D	Service lamp relay short circuited with ground	Service lamp does not work	EL-46
MDTL error E5E	Right turn relay short circuited with ground	Turn signal indicator does not work	EL-47
MDTL error E5F	Left turn relay short circuited with ground	Turn signal indicator does not work	EL-48
MDTL error E60	Steering mode solenoid a short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-49
MDTL error E61	Steering mode solenoid c short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-50
MDTL error E62	Steering mode solenoid b short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-51
MDTL error E63	Steering mode solenoid d short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-52
MDTL error E64	Pump merge solenoid short circuited with ground	Lack of speed when outrigger ALL switch is operated	EL-53
MDTL error E67	Suspension lift solenoid short circuited with ground	Impossible to use suspension lift	EL-55
MDTL error E76	5V output short circuited with ground	Outrigger cannot be set, possible to actuate in emergency setting	EL-56

023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E80	Outrigger jack RL short circuited with power source	Abnormal telescoping of outrigger	EL-57
MDTL error E81	Outrigger jack FL short circuited with power source	Abnormal telescoping of outrigger	EL-58
MDTL error E82	Outrigger jack RR short circuited with power source	Abnormal telescoping of outrigger	EL-59
MDTL error E83	Outrigger jack FR short circuited with power source	Abnormal telescoping of outrigger	EL-60
MDTL error E84	Outrigger slide RL short circuited with power source	Abnormal telescoping of outrigger	EL-61
MDTL error E85	Outrigger slide FL short circuited with power source	Abnormal telescoping of outrigger	EL-62
MDTL error E86	Outrigger slide RR short circuited with power source	Abnormal telescoping of outrigger	EL-63
MDTL error E87	Outrigger slide FR short circuited with power source	Abnormal telescoping of outrigger	EL-64
MDTL error E88	Outrigger selector EXTEND short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-65
MDTL error E89	Outrigger selector RETRACT short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-66
MDTL error E8A	Rear steering LOCK solenoid short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-67
MDTL error E8B	Rear steering FREE solenoid short circuited with power source	Rear steering FREE (travel carefully)	EL-68
MDTL error E8C	Service brake short circuited with power source	Impossible to release auxiliary brake	EL-69
MDTL error E8D	Exhaust brake short circuited with power source	Impossible to release exhaust brake	EL-70
MDTL error E8E	Retarder short circuited with power source	Impossible to release retarder brake	EL-71
MDTL error E8F	Preheating short circuited with power source	Preheating continues, abnormal engine exhaust color, drop in horsepower	EL-72
MDTL error E9A	Head lamp Hi short circuited with power source	Stays lighted at Hi beam	EL-73
MDTL error E9B	Head lamp Lo short circuited with power source	Stays lighted at Lo beam	EL-74
MDTL error E9C	Side lamp short circuited with power source	Side lamp stays lighted up	EL-75
MDTL error E9E	Right turn relay short circuited with power source	Turn signal remains actuated	EL-76
MDTL error E9F	Left turn relay short circuited with power source	Turn signal remains actuated	EL-77
MDTL error EA0	Steering mode solenoid a short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-78
MDTL error EA1	Steering mode solenoid c short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-79
MDTL error EA2	Steering mode solenoid b short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-80
MDTL error EA3	Steering mode solenoid d short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-81
MDTL error EA4	Pump merge solenoid short circuited with power source	Impossible to operate swing	EL-82
MDTL error EA7	Suspension lift solenoid short circuited with power source	Impossible to extend outrigger	EL-83
MDTL error EB0	Disconnection in outrigger jack RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-84
MDTL error EB1	Disconnection in outrigger jack FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-85
MDTL error EB2	Disconnection in outrigger jack RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-86
MDTL error EB3	Disconnection in outrigger jack FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-87
MDTL error EB4	Disconnection in outrigger slide RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-88
MDTL error EB5	Disconnection in outrigger slide FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-89

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error EB6	Disconnection in outrigger slide RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-90
MDTL error EB7	Disconnection in outrigger slide FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-91
MDTL error EB8	Disconnection in outrigger selector EXTEND	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-92
MDTL error EB9	Disconnection in outrigger selector RETRACT	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-93
MDTL error EBA	Disconnection in rear steering LOCK solenoid	Impossible to set rear steering to LOCK (when at LOCK, impossible to rear steering to FREE)	EL-94
MDTL error EBB	Disconnection in rear steering FREE solenoid	Impossible to set rear steering to FREE	EL-95
MDTL error EBC	Disconnection in service brake	Impossible to operate auxiliary brake	EL-96
MDTL error EBD	Disconnection in exhaust brake	Impossible to operate exhaust brake	EL-97
MDTL error EBF	Disconnection in preheating	Impossible to operate preheating	EL-98
MDTL error ECA	Disconnection in head lamp Hi relay	Impossible to operate Hi beam	EL-99
MDTL error ECB	Disconnection in head lamp Lo relay	Impossible to operate Lo beam	EL-100
MDTL error ECC	Disconnection in side lamp relay	Impossible to operate side lamp	EL-101
MDTL error ECE	Disconnection in right turn relay	Impossible to operate turn signal	EL-102
MDTL error ECF	Disconnection in left turn relay	Impossible to operate turn signal	EL-103
MDTL error ED0	Disconnection in steering mode solenoid a	Rear steering set to LOCK, travel with front 2-wheel steering	EL-104
MDTL error ED1	Disconnection in steering mode solenoid c	Rear steering set to LOCK, travel with front 2-wheel steering	EL-105
MDTL error ED2	Disconnection in steering mode solenoid b	Rear steering set to LOCK, travel with front 2-wheel steering	EL-106
MDTL error ED3	Disconnection in steering mode solenoid d	Rear steering set to LOCK, travel with front 2-wheel steering	EL-107
MDTL error ED4	Disconnection in pump merge solenoid	Lack of speed when outrigger ALL switch is operated	EL-108
MDTL error ED7	Disconnection in suspension lift	Impossible to use suspension lift	EL-109
MDTL error EE7	Outrigger control signal short circuited with power source	Immediately stops travel, impossible to operate steering, actuates emergency steering	EL-110
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	Takes no particular action, impossible to detect occurrence of secondary problem	EL-111
MDTL error EE9	Disconnection in fuel sensor	Fuel level unknown	EL-112
MDTL error EEB	Abnormality in rear steering LOCK limit switch/FREE limit switch	Rear steering set to LOCK, travel with front 2-wheel steering	EL-113
MDTL error EEE	Failure of both speedometer sensors	No speedometer display, rear steering set to LOCK, travel with front 2-wheel steering	EL-114
MDTL error EEF	MDT speedometer sensor failure	Rear steering set to LOCK, travel with front 2-wheel steering	EL-115
MDTL error EF0	Special steering failure (emergency stop mode)	Immediately stops travel	EL-116
MDTL error EF1	Reverse steering failure (emergency stop mode)	Immediately stops travel	EL-117
MDTL error EF2	Special steering failure	Immediately stops travel, rear steering set to LOCK, travel with front 2-wheel steering	EL-118
MDTL error EF3	Reverse steering failure 1	Travels with normal steering, cannot set to reverse steering	EL-119
MDTL error EF4	Reverse steering failure 2	Immediately stops travel, rear steering set to LOCK, travel with normal steering	EL-120
MDTL error EFE	Abnormality in right turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-121
MDTL error EFF	Abnormality in left turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-122

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
(Moment limiter controller related)			
OSS error E00	Abnormality in panel communication	Impossible to change working mode	EM- 1
OSS error E01	Panel system error	Impossible to change working mode	EM- 2
OSS error E02	Abnormality in panel rotary switch	Impossible to change working mode	EM- 3
OSS error E10	Moment limiter system error	Action impossible, stops work	EM- 4
OSS error E20	Abnormality in S-NET (communication between MDTs)	Action impossible, stops work	EM- 5
OSS error E21	Abnormality in outrigger length sensor FL system	Outrigger cannot be set, outrigger emergency setting mode	EM- 6
OSS error E22	Abnormality in outrigger length sensor FR system	Outrigger cannot be set, outrigger emergency setting mode	EM- 7
OSS error E23	Abnormality in outrigger length sensor RL system	Outrigger cannot be set, outrigger emergency setting mode	EM- 8
OSS error E24	Abnormality in outrigger length sensor RR system	Outrigger cannot be set, outrigger emergency setting mode	EM- 9
OSS error E30	Abnormality in jib transmission module communication	Impossible to operate jib	EM-10
OSS error E31	Abnormality in tilt angle sensor system	Impossible to operate jib, jib angle unknown	EM-11
OSS error E41	Abnormality in boom angle sensor system	Impossible to operate boom, boom angle unknown, hook load unknown	EM-12
OSS error E43	Abnormality in boom length sensor system	Impossible to operate boom, boom length unknown, hook load unknown	EM-13
OSS error E44	Abnormality in bottom pressure sensor system	Impossible to operate boom, hook load unknown	EM-14
OSS error E45	Abnormality in head pressure sensor system	Impossible to operate boom, hook load unknown	EM-15
OSS error E46	Abnormality in swing angle sensor system	Impossible to operate boom, swing position unknown	EM-16
OSS error E48	Reverse rotation of hoist cylinder axis power	Boom hoist cylinder stroke end, impossible to operate boom, hook load unknown	EM-17
OSS error E50	Main unload solenoid short circuited with ground	Work equipment does not move	EM-18
OSS error E51	PPC unload solenoid short circuited with ground	Jib tilt does not work	EM-19
OSS error E52	Jib telescope selector solenoid short circuited with ground	Top telescope cylinder does not work	EM-20
OSS error E53	Automatic stop cancel prohibition relay short circuited with ground	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	EM-21
OSS error E58	Jib EXTEND/STOW relay short circuited with ground	Impossible to extend or stow jib	EM-26
OSS error E59	Jib rotation permission relay short circuited with ground	Impossible to extend or stow jib (impossible to rotate)	EM-27
OSS error E5C	Moment limiter buzzer short circuited with ground	Moment limiter buzzer does not sound	EM-30
OSS error E5D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	EM-31
OSS error E68	10 V power source short circuited with ground	Impossible to operate boom, hook load unknown	EM-32
OSS error E6A	15 V power source short circuited with ground	Impossible to operate boom, hook load unknown	EM-33
OSS error E70	Main unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop	EM-34
OSS error E71	PPC unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop (jib LOWER only)	EM-35
OSS error E72	Jib telescope selector solenoid short circuited with power source	2nd boom telescope cylinder does not move	EM-36
OSS error E73	Automatic stop cancel prohibition relay short circuited with power source	Impossible to use automatic stop cancel	EM-37
OSS error E78	Jib EXTEND/STOW relay short circuited with power source	Impossible to operate jib	EM-41

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
OSS error E79	Jib rotation permission relay short circuited with power source	Impossible to extend or stow jib	EM-42
OSS error E88	Disconnection in main unload solenoid	Stays at automatic stop	EM-43
OSS error E89	Disconnection in PPC unload solenoid	Stays at automatic stop (jib LOWER only)	EM-44
OSS error E8A	Disconnection in jib telescope selector solenoid	Top boom telescope cylinder does not move	EM-45
OSS error E8B	Disconnection in automatic stop cancel prohibition relay	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	EM-46
OSS error EA0	Over-front limit switch short circuited with ground	For on-tire operation, traveling with raised load, over-front load table is not given	EM-47
OSS error EA1	Abnormality in top boom stow limit switch	Boom telescope abnormal, rated load limited	EM-48
OSS error EA2	Abnormality in boom selection switch	Manual telescope impossible	EM-49
OSS error EA3	Left lock pin input short circuited with power source	Abnormality in jib EXTEND/STOW	EM-50
OSS error EA5	Abnormality in PTO switch	Action impossible (controller at PTO 1 condition)	EM-52
OSS error EA6	H/X selection doesn't match (outrigger)	Action impossible (controller at X-shape condition)	EM-53
OSS error EA7	Specification selection rotary switch setting not available	Action impossible, stops work	EM-54
OSS error EA8	PPC pressure switch boom RAISE short circuited with ground	Automatic stop	EM-55
OSS error EA9	PPC pressure switch boom LOWER short circuited with ground	Automatic stop	EM-56
OSS error EAA	PPC pressure switch boom EXTEND short circuited with ground	Automatic stop	EM-57
OSS error EAB	PPC pressure switch boom RETRACT short circuited with ground	Automatic stop	EM-58
OSS error EAC	PPC pressure switch jib RAISE short circuited with ground	Automatic stop	EM-59
OSS error EAD	PPC pressure switch jib LOWER short circuited with ground	Automatic stop	EM-60
OSS error EB0	PPC pressure switch boom RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-61
OSS error EB1	PPC pressure switch boom EXTEND + RETRACT input simultaneously	Automatic stop reset impossible	EM-62
OSS error EB2	PPC pressure switch jib RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-63
OSS error EB3	PPC pressure switch swing left + right input simultaneously	Automatic stop reset impossible	EM-64
OSS error EB4	PPC pressure switch main winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-65
OSS error EB5	PPC pressure switch auxiliary winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-66
(Transmission controller related)			
ATM error E11	Disconnection in tachometer sensor	Shock when shifting gear but travel possible	ET- 1
ATM error E12	Disconnection in speed sensor 1	Nothing in particular (emergency stop when secondary problem occurs)	ET- 2
ATM error E13	Disconnection in speed sensor 2	Nothing in particular (emergency stop when secondary problem occurs)	ET- 3
ATM error E14	Disconnection in accelerator potentiometer	Shock when shifting gear but travel possible	ET- 4
ATM error E17	Disconnection in shift lever	Time lag when shifting gear	ET- 5
ATM error E18	Disconnection in FR signal for interlock	Time lag when shifting gear	ET- 6
ATM error E19	No input for solenoid power source monitor	Normal travel possible (detection impossible when secondary problem occurs)	ET- 7
ATM error E24	Accelerator potentiometer short circuited with ground	Shock when shifting gear but travel possible	ET- 8

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
ATM error E25	Abnormality in emergency gear shift switch or abnormality in PTO 2 switch	Normal travel possible (emergency stop when secondary problem occurs)	ET- 9
ATM error E32	Abnormality in speed sensor 1	Normal travel possible (emergency stop when secondary problem occurs)	ET-10
ATM error E33	Abnormality in speed sensor 2	Normal travel possible (emergency stop when secondary problem occurs)	ET-11
ATM error E35	MDT at other than N with interlock signal N	Travel possible in emergency gear shift mode	ET-12
ATM error E37	Abnormality in shift lever (2 or more signals ON)	Travel possible in emergency gear shift mode from neutral	ET-13
ATM error E38	Interlock F + R signals ON simultaneously	Travel possible (time lag when shifting gear)	ET-14
ATM error E39	Interlock signal F or R but MDT at N	Travel possible in emergency gear shift mode	ET-15
ATM error E3F	Abnormality in S-NET (communication between MDTs)	Travel possible under certain conditions (★)	ET-16
ATM error E53	Overrun	Normal travel possible (overrun warning only)	ET-17
ATM error E55	Drop in battery voltage	Stop, travel possible with emergency gear shift mode	ET-18
ATM error E5A	Special steering system short circuited with ground	Normal travel possible	ET-19
ATM error E5B	Disconnection in special steering system	Impossible to change from front wheel mode	ET-20
ATM error E5C	Reverse steering system short circuited with ground	Normal travel possible	ET-21
ATM error E5D	Disconnection in reverse steering system	Impossible to change to reverse steering mode	ET-22
ATM error E70	Disconnection in R solenoid (ECMV) system	Cannot travel in reverse	ET-23
ATM error E71	Disconnection in F2 solenoid (ECMV) system	Cannot travel forward	ET-24
ATM error E72	Disconnection in F1 solenoid (ECMV) system	Cannot travel forward	ET-25
ATM error E73	Disconnection in F3 solenoid (ECMV) system	Cannot travel forward	ET-26
ATM error E74	Disconnection in lock-up solenoid (ECMV) system	Torque converter lock-up impossible	ET-27
ATM error E78	Disconnection in Lo solenoid system	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-28
ATM error E79	Disconnection in 4WD solenoid system	4WD travel impossible (travel possible in 2WD Hi)	ET-29
ATM error E7B	Disconnection in reverse steering compensation relay system	Travel possible except in reverse steering mode	ET-30
ATM error E7C	Disconnection in F2, R solenoid cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-31
ATM error E7D	Disconnection in back-up lamp relay	Back-up lamp does not light up in REVERSE	ET-32
ATM error E7E	Disconnection in F1, F3 solenoid (ECMV) cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-33
ATM error E7F	Disconnection in special steering relay system	Travel possible in front wheel mode	ET-34
ATM error E80	R solenoid (ECMV) system short circuited	Cannot travel in reverse	ET-35
ATM error E81	F2 solenoid (ECMV) system short circuited	Cannot travel forward	ET-36
ATM error E82	F1 solenoid (ECMV) system short circuited	Cannot travel forward	ET-37
ATM error E83	F3 solenoid (ECMV) system short circuited	Cannot travel forward	ET-38
ATM error E84	Lock-up solenoid (ECMV) system short circuited	Torque converter lock-up impossible	ET-39
ATM error E88	Lo solenoid system short circuited	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-40
ATM error E89	4WD solenoid system short circuited	4WD travel impossible (travel possible in 2WD Hi)	ET-41




Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
ATM error E8B	Reverse steering compensation system short circuited	Travel possible except in reverse steering mode	ET-42
ATM error E8C	F2, R solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-43
ATM error E8D	Back-up lamp relay system short circuited	Back-up lamp does not light up in REVERSE	ET-44
ATM error E8E	F1, F3 solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-45
ATM error E8F	Special steering mode relay system short circuited	Travel possible in front wheel mode	ET-46
ATM error E90,E91	R or F2 solenoid system short circuited with power source	Cannot travel	ET-47
ATM error E92,E93	F3 or F1 solenoid system short circuited with power source	Cannot travel forward	ET-48
ATM error E94	Lock-up solenoid system short circuited with power source	Torque converter lock-up impossible	ET-49

- ★ For "certain conditions" for ATM error E3F in the Problem on machine column, see the transmission controller related section in ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS.

ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS




Error code	Abnormal system	Nature of abnormality
MDTU error E00	MDT system error	1) System error inside upper MDT (internal defect)
MDTU error E10	Shut off when low voltage	1) Drop in battery voltage
MDTU error E11	Shut off when high temperature	1) Rise in temperature inside upper MDT
MDTU error E20	Top, bottom don't match (application stopped)	1) Defective contact or disconnection in wiring harness between C04 (female) (8) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) 2) Contact of C04 (female) (18) with GND 3) Defective contact or disconnection in wiring harness between M03 (female) (18) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 4) Contact of M03 (female) (8) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs when starting)
MDTU error E21	Top, bottom selection warning	1) Defective contact or disconnection in wiring harness between C04 (female) (8) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) 2) Contact of C04 (female) (18) with GND 3) Defective contact or disconnection in wiring harness between M03 (female) (18) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 4) Contact of M03 (female) (8) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs after starting)
MDTU error E24	Model doesn't match (application stopped)	1) Defective contact or disconnection in wiring harness between C04 (female) (9),(10) – C02 (11),(21) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) and connecting point of L03 (male) (1),(2) and LM04 (female) (10), LM03 (male) (10) 2) Contact of C04 (female) (19),(20) with GND 3) Defective contact or disconnection in wiring harness between M03 (female) (9),(10) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 4) Contact of M03 (female) (19),(20) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs when starting)

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
—	1) Output stopped	1) Travel, operation stopped (action impossible)	EU-1
1) Battery voltage: Min. 20 V	1) Output stopped	1) Travel, operation stopped	EU-2
1) Internal temperature of	1) Output stopped	1) Travel, operation stopped (action impossible) • Wait for the internal tem- perature to go down, then start the engine again.	EU-3
Voltage 1) Between upper MDT terminal C04 (8) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (18) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (18) and M02 (11), (21): Max. 1 V 4) Between lower MDT terminal M03 (8) and M02 (11), (21): 15 – 30 V	1) Output stopped 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Travel, operation stopped (action impossible)	EU-4
Voltage 1) Between upper MDT terminal C04 (8) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (18) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (18) and M02 (11), (21): Max. 1 V 4) Between lower MDT terminal M03 (8) and M02 (11), (21): 15 – 30 V	1) Displays emergency stop mode  2) Actuates emergency alarm buzzer 3) Carries out other outputs as normal	1) Travel, operation stopped	EU-5
Voltage 1) Between upper MDT terminal C04 (9), (10) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (19), (20) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (9), (10) and M02 (11), (21): Max. 1 V 4) Between lower MDT terminal M03 (19), (20) and M02 (11), (21): 15 – 30 V	1) Output stopped 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Travel, operation stopped (action impossible)	EU-6

Error code	Abnormal system	Nature of abnormality
MDTU error E25	Model selection warning	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between C04 (female) (9),(10) – C02 (11),(21) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) and connecting point of L03 (male) (1),(2) and LM04 (female) (13), LM03 (male) (10) 2) Contact of C04 (female) (19),(20) with GND 3) Defective contact or disconnection in wiring harness between M03 (female) (9),(10) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 4) Contact of M03 (female) (19),(20) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs after starting)
MDTU error E28	Abnormality in C-NET communication between MDTs	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between C05 (female) (5) – CR1 (1) – R03 (7) – (slip ring) – L03 (7) – LM02 (1) – M06 (female) (5), or short circuit with ground 2) Defective contact or disconnection in wiring harness between C05 (female) (13) – CR1 (2) – R04 (12) – (slip ring) – L04 (12) – LM03 (1) – M06 (female) (13) 3) Defective contact or disconnection in wiring harness between C05 (female) (6) – CR1 (3) – R03 (8) – (slip ring) – L03 (8) – LM02 (2) – M06 (female) (6), or short circuit with ground 4) Defective contact or disconnection in wiring harness between C05 (female) (14) – CR1 (4) – R04 (14) – (slip ring) – L04 (14) – LM03 (2) – M06 (female) (14) 5) Defective upper MDT 6) Defective lower MDT
MDTU error E29	Abnormality in S-NET communication between upper MDT and moment limiter	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between C05 (female) (4) and C15 (female) (3) 2) Defective contact or disconnection in wiring harness between C05 (female) (12) and C15 (female) (11) 3) Wiring harness between C05 (female) (4) and C15 (female) (3) short circuiting with chassis ground 4) Wiring harness between C05 (female) (12) and C15 (female) (11) short circuiting with chassis ground 5) Defective upper MDT 6) Defective moment limiter controller
MDTU error E40	Swing flasher relay output short circuited with ground	<ol style="list-style-type: none"> 1) Defective swing flasher relay 2) Wiring harness between C01 (female) (3) – C22 (1) – C30 (female) (1) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E41	Power source for outrigger panel short circuited with ground	<ol style="list-style-type: none"> 1) Defective outrigger EXTEND/STOW switch 2) Defective outrigger SLIDE/JACK switch 3) Defective outrigger INDIVIDUAL switch 4) Wiring harness between C01 (female) (14) – CP3 (2) – P09 (male) (1), P10 (male) (1), P79, P81, P83, P85, P87 short circuiting with chassis ground 5) Defective upper MDT
MDTU error E43	Outrigger mode short circuited with ground	<ol style="list-style-type: none"> 1) Defective outrigger selector relay 2) Defective outrigger power source relay 3) Defective slip ring 4) Wiring harness between L03 (female) (4) – L03 (7) – M21 (5) – M37 (female) (5), M38 (female) (1) short circuiting with chassis ground 5) Wiring harness between C01 (female) (15) – CR3 (8) – R03 (female) (4) short circuiting with chassis ground 6) Defective upper MDT

023502

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage 1) Between upper MDT terminal C04 (9), (10) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (19), (20) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (9), (10) – M02 (11), (21): Max. 1 V 4) Between lower MDT terminal M03 (19), (20) and M02 (11), (21): 15 - 30 V	1) Displays emergency stop mode  2) Actuates emergency alarm buzzer 3) Carries out other outputs as normal	1) Travel, operation stopped	EU-7
Voltage (Between upper MDT terminal C05 (5), (13) and (6), (14)): 7 - 11V	1) When engine is started, side lamps and head lamps Lo light up, left and right turn signal lamps flash 2) Steering mode is set to HOLD, outrigger mode power source is output 3) Displays emergency stop mode  4) Actuates emergency alarm buzzer	1) Travel, operation stopped	EU-8
Voltage (between upper MDT terminal C05 (4), (12) and (10)): 4 - 8V	1) Impossible to switch normal/reverse steering 2) Swing flasher stopped 3) Displays emergency stop mode  4) Actuates emergency alarm buzzer	1) Travel, operation stopped	EU-9
PTO switch: Operation 1, Operation 2 Work equipment lever stand: Raised Voltage (between C01 (3) and chassis) • When operating swing: 17 – 30 V • When swing control lever is at N: Max. 1 V	1) Stops output to swing flasher relay.	1) Swing flasher does not flash.	EU-10
When shift lever is at N Voltage (between C01 (14) and chassis) • PTO switch: Operation 1: 17 – 30 V • PTO switch: Travel or Operation 2: Max. 1 V	1) Stops supply (output) of power source to outrigger EXTEND/STOW switch, outrigger SLIDE/JACK switch, outrigger INDIVIDUAL switch	1) Top outrigger cannot be operated	EU-11
When shift lever is at N Voltage (between C01 (15) and chassis) • PTO switch: Operation 1: 17 – 30 V • PTO switch: Travel or Operation 2: Max. 1 V	1) Stops output to outrigger selector relay, outrigger power source relay	1) Outrigger cannot be operated	EU-13

Error code	Abnormal system	Nature of abnormality
MDTU error E44	Crab mode LED short circuited with ground	1) Defective steering mode switch 2) Wiring harness between C01 (female) (5) – CP5 (6) – P29 (male) (7) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E45	Front wheel mode LED short circuited with ground	1) Defective steering mode switch 2) Wiring harness between C01 (female) (16) – CP5 (2) – P29 (male) (3) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E46	Rear wheel mode LED short circuited with ground	1) Defective steering mode switch 2) Wiring harness between C01 (female) (7) – CP5 (8) – P29 (male) (9) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E47	4-wheel mode LED short circuited with ground	1) Defective steering mode switch 2) Wiring harness between C01 (female) (17) – CP5 (4) – P29 (male) (5) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E48	Rear steering LOCK display LED short circuited with ground	1) Wiring harness between rear steering LOCK display LED and P36 (male) short circuiting with chassis ground 2) Wiring harness between C01 (female) (8) – CP6 (3) – P36 (female) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E49	Rear steering FREE display LED short circuited with ground	1) Wiring harness between rear steering FREE display LED and P32 (male) short circuiting with chassis ground 2) Wiring harness between C01 (female) (18) – CP6 (5) – P32 (female) short circuiting with chassis ground 3) Defective upper MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
PTO switch: Travel or Operation 1 Voltage (between C01 (5) and chassis) • Steering mode switch at crab mode: 17 – 30 V • Steering mode switch not at crab mode: Max. 1 V	1) Stops output to steering mode (crab mode) LED	1) Steering mode (crab mode) LED does not light up.	EU-14
PTO switch: Travel or Operation 1 Voltage (between C01 (16) and chassis) • Steering mode switch at front wheel mode: 17 – 30 V • Steering mode switch not at front wheel mode: Max. 1 V	1) Stops output to steering mode (front wheel mode) LED	1) Steering mode (front wheel mode) LED does not light up.	EU-15
PTO switch: Travel or Operation 1 Voltage (between C01 (7) and chassis) • Steering mode switch at rear wheel mode: 17 – 30 V • Steering mode switch not at rear wheel mode: Max. 1 V	1) Stops output to steering mode (rear wheel mode) LED	1) Steering mode (rear wheel mode) LED does not light up.	EU-16
PTO switch: Travel or Operation 1 Voltage (between C01 (17) and chassis) • Steering mode switch at 4-wheel mode: 17 – 30 V • Steering mode switch not at 4- wheel mode: Max. 1 V	1) Stops output to steering mode (4-wheel mode) LED	1) Steering mode (4-wheel mode) LED does not light up.	EU-17
PTO switch: Travel or Operation 1 Voltage (between C01 (8) and chassis) • Rear steering at LOCK: 17 – 30 V • Rear steering at FREE: Max. 1 V	1) Stops output to rear steer- ing LOCK display LED	1) Rear steering LOCK display LED does not light up.	EU-18
PTO switch: Travel or Operation 1 Voltage (between C01 (18) and chassis) • Rear steering at FREE: 17 – 30 V • Rear steering at LOCK: Max. 1 V	1) Stops output to rear steer- ing FREE display LED	1) Rear steering FREE display LED does not light up.	EU-19

023S02

Error code	Abnormal system	Nature of abnormality
MDTU error E4A	Rear steering CENTER display LED short circuited with ground	1) Wiring harness between rear steering CENTER display LED and P34 (male) short circuiting with chassis ground 2) Wiring harness between C01 (female) (9) – CP6 (4) – P34 (female) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E4B	Reverse steering display LED short circuited with ground	1) Short circuit between P68 (male) (3) and (5) (defective reverse steering display LED) 2) Wiring harness between C01 (female) (19) – CP12 (9) – CP10 (9) – P68 (female) (5) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E4C	Winch rotation buzzer (main winch) short circuited with ground	1) Defective winch buzzer 2) Wiring harness between C01 (female) (10) – CP9 (13) – P58 (male) (2) short circuiting with chassis ground 3) Wiring harness between P58 (male) (1) – CP9 (15) – C108 (female) (1) short circuiting with chassis ground 4) Defective upper MDT
MDTU error E4D	Emergency alarm buzzer short circuited with ground	1) Defective emergency alarm buzzer 2) Wiring harness between C01 (female) (20) – C155 (2),(1) – C136 (female) (1) – C110 (female) (1) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E4E	Monitor central buzzer short circuited with ground	1) Defective winch buzzer 2) Wiring harness between C01 (female) (11) – CP9 (14) – P58 (male) (3) short circuiting with chassis ground 3) Wiring harness between P58 (male) (1) – CP9 (15) – C108 (female) (1) short circuiting with chassis ground 4) Defective upper MDT
MDTU error E4F	Monitor central buzzer short circuited with ground	1) Defective monitor central buzzer 2) Wiring harness between C01 (female) (21) and C109 (female) (1), C135 (female) (1) short circuiting with chassis ground 3) Defective upper MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
PTO switch: Travel or Operation 1 Voltage (between C01 (9) and chassis) • Rear steering CENTER detected: 17 – 30 V • Not at rear steering CENTER : Max. 1 V	1) Stops output to rear steering CENTER display LED	1) Rear steering CENTER display LED does not light up.	EU-20
PTO switch: Travel or Operation 1 and swing angle 180° Voltage (between C01 (19) and chassis) • Reverse steering switch ON: 17 – 30 V • Reverse steering switch OFF: Max. 1 V	1) Stops output to reverse steering display lamp (LED)	1) Reverse steering display lamp (LED) does not light up.	EU-21
Fine operation of winch Voltage (between C01 (10) and chassis) • Proximity sensor ON (LED ON): 17 – 30 V • Proximity sensor OFF (LED OFF): Max. 1V	1) Stops output to main winch buzzer	1) Main winch buzzer does not sound	EU-22
Voltage (between C01 (20) and chassis) • When emergency alarm buzzer is sounding (for 3 sec after check mode IN): 17 – 30 V • When emergency alarm buzzer is stopped: Max. 1 V	1) Stops output to emergency alarm buzzer 2) Sounds monitor central buzzer as substitute	1) Emergency alarm buzzer does not sound	EU-23
Fine operation of winch Voltage (between C01 (11) and chassis) • Proximity sensor ON (LED ON): 17 – 30 V • Proximity sensor OFF (LED OFF): Max. 1V	1) Stops output to auxiliary winch buzzer	1) Auxiliary winch buzzer does not sound	EU-24
Voltage (between C01 (21) and chassis) • For 1 sec after starting switch is turned ON: 17 – 30 V • More than 1 sec after starting switch is turned ON: Max. 1 V	1) Stops output to monitor central buzzer 2) Sound emergency alarm buzzer as substitute	1) Monitor central buzzer does not sound	EU-25

023S02

Error code	Abnormal system	Nature of abnormality
MDTU error E50	Tachometer signal output short circuited	1) Defective tachometer 2) Wiring harness between C03 (female) (1) and C80 (female) (5) short circuited with power source 3) Defective upper MDT
MDTU error E51	Speedometer signal output short circuited	1) Defective speedometer 2) Wiring harness between C03 (female) (9) and C79 (female) (5) short circuited with power source 3) Defective upper MDT
MDTU error E52	Fuel level signal output short circuited	1) Defective fuel gauge 2) Wiring harness between C03 (female) (2) and C79 (female) (10) short circuited with power source 3) Defective upper MDT
MDTU error E53	Engine water temperature signal output short circuited	1) Defective engine water temperature gauge 2) Wiring harness between C03 (female) (10) and C80 (female) (3) short circuited with power source 3) Defective upper MDT
MDTU error E55	Torque converter oil temperature output short circuited	1) Defective torque converter overheat caution lamp 2) Wiring harness between C03 (female) (11) and C80 (female) (10) short circuited with power source 3) Defective upper MDT
MDTU error E56	Engine oil pressure output short circuited	1) Defective engine oil pressure caution lamp 2) Wiring harness between C03 (female) (4) and C80 (female) (9) short circuited with power source 3) Defective upper MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between C03 (1) and chassis) 7.5 – 15.5 V (Measure at AC range)	1) Stops signal output to ta- chometer	1) Tachometer does not move	EU-26
Voltage (between C03 (9) and chassis) 7.5 – 15.5 V (Measure at AC range)	1) Stops signal output to speedometer	1) Speedometer does not move	EU-27
Voltage (between C03 (2) and chassis) FULL : 0.5 – 1.6 V EMPTY : 3.5 – 7.5 V	1) Stops signal output to fuel gauge	1) Fuel gauge does not move	EU-28
Voltage (between C03 (10) and chas- sis) 100°C : 0.9 – 1.7 V 50°C : 2.5 – 5.5 V	1) Stops signal output to en- gine water temperature gauge	1) Engine water temperature gauge does not move	EU-29
Voltage (between C03 (female) (11) and chassis) Torque converter oil temperature: More than 120°C : Max. 1 V Torque converter oil temperature: Less than 110°C : 17 – 30V	1) Stops signal output to torque converter overheat caution lamp	1) Torque converter overheat caution lamp does not light up	EU-30
Voltage (between C03 (4) and chassis) • Engine oil pressure: More than 0.05 MPa (0.5 kg/cm ²) (engine started): 17 – 30 V • Engine oil pressure: Less than 0.05 MPa (0.5 kg/cm ²) (starting switch ON): Max. 1 V	1) Stops signal output to en- gine oil pressure caution lamp	1) Engine oil pressure caution lamp does not light up	EU-31

023S02

Error code	Abnormal system	Nature of abnormality
MDTU error E57	Preheating pilot output short circuited	1) Defective preheating pilot lamp 2) Wiring harness between C03 (female) (12) and C80 (female) (4) short circuited with power source 3) Defective upper MDT
MDTU error E58	Parking brake actuation lamp output short circuited	1) Defective parking brake indicator lamp 2) Wiring harness between C03 (female) (5) and C79 (female) (13) short circuited with power source 3) Defective upper MDT
MDTU error E5A	Hi beam pilot output short circuited with ground	1) Defective Hi beam pilot lamp 2) Wiring harness between C03 (female) (6) and C79 (female) (2) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E5B	Service meter (hourmeter) output short circuited with ground	1) Defective service meter (hourmeter) 2) Wiring harness between C03 (female) (14) and C80 (female) (1) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E5C	Charge lamp output short circuited with ground	1) Defective battery charge caution lamp 2) Wiring harness between C03 (female) (7) and C80 (female) (6) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E5D	Brake fluid (oil) level lamp output short circuited with ground	1) Defective brake fluid (oil) level lamp 2) Wiring harness between C03 (female) (15) and C79 (female) (9) short circuiting with chassis ground 3) Defective upper MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between C03 (12) and chassis) • Starting switch at HEAT : Max. 1 V • Starting switch at ON : 17 – 30 V	1) Stops signal output to preheating pilot lamp	1) Preheating pilot lamp does not light up	EU-32
Voltage (between C03 (5) and chassis) • Parking brake switch at PARKING: Max. 1 V • Parking brake switch at OFF: 17 – 30 V	1) Stops signal output to parking brake indicator lamp	1) Parking brake indicator lamp does not light up	EU-33
Voltage (between C03 (5) and chassis) • Lamp switch stage 2 ON (Hi beam): 17 – 30 V • Lamp switch OFF: Max. 1 V	1) Stops signal output to Hi beam pilot lamp	1) Hi beam pilot lamp does not light up	EU-35
Voltage (between C03 (14) and chassis) • When starting engine: 17 – 30 V	1) Stops signal output to service meter (hourmeter)	1) Service meter does not move	EU-36
Voltage (between C03 (7) and chassis) • Engine started: Max. 1 V • Starting switch at ON: 17 – 30 V	1) Stops signal output to battery charge caution lamp	1) Battery charge caution lamp does not light up	EU-37
Voltage (between C03 (15) and chassis) • For 2 sec immediately after starting switch is turned ON: 17 – 30 V	1) Stops signal output to brake fluid (oil) level lamp	1) Brake fluid (oil) level lamp does not light up	EU-38


Error code	Abnormal system	Nature of abnormality
MDTU error E5E	Right turn pilot relay output short circuited with ground	1) Defective right turn pilot relay 2) Wiring harness between C03 (female) (8) - C21 (11) - C28 (female) (1) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E5F	Left turn pilot output short circuited with ground	1) Defective left turn pilot relay 2) Wiring harness between C03 (female) (16) - C21 (12) - C29 (female) (1) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E72/E1E	LED dimmer 1 (shift position display LED system) short circuited with ground	1) Wiring harness between C02 (female) (9) and CP1 (male) (8) short circuiting with chassis ground 2) Wiring harness between LED and CP1 (male) (8) short circuiting with chassis ground 3) Defective upper MDT
MDTU error E73/E1E	LED dimmer 1 (shift position display LED system) short circuited with power source	1) Wiring harness between C02 (female) (9) and CP1 (male) (8) short circuited with power source 2) Wiring harness between CP1 (female) (8) and LED short circuited with power source 3) Short circuit in wiring harness between CP1 (female) (1),(2),(3),(4),(5) - LED - CP1 (female) (8) 4) Defective upper MDT
MDTU error E74/E1F	LED dimmer 2 (rear steering LOCK display LED system) short circuited with ground	1) Wiring harness between C02 (female) (18) and CP6 (male) (6) short circuiting with chassis ground 2) Wiring harness between CP6 (male) (6) and LED short circuiting with chassis ground 3) Defective upper MDT
MDTU error E75/E1F	LED dimmer 2 (rear steering LOCK display LED system) short circuited with power source	1) Wiring harness between C02 (female) (18) and CP6 (male) (6) short circuited with power source 2) Wiring harness between CP6 (female) (6) and LED short circuited with power source 3) Short circuit in wiring harness between CP6 (female) (3),(4),(5) - LED - CP6 (female) (6) 4) Defective upper MDT

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between C03 (8) and chassis) • Right turn signal ON: 17 – 30 V (right turn signal lever ON) • Turn signal lever OFF: Max. 1 V	1) Stops output to right turn pilot relay	1) Right turn pilot lamp does not light up	EU-39
Voltage (between C03 (16) and chassis) • Left turn signal ON: 17 – 30 V (left turn signal lever ON) • Turn signal lever OFF: Max. 1 V	1) Stops output to left turn pi- lot relay	1) Left turn pilot lamp does not light up	EU-40
Voltage (between C02 (9) and chassis) • Night lighting ON: 8 – 21 V • Night lighting OFF: 4 – 6 V	1) When using night lighting (lamp ON), stops dimmer output to shift position dis- play LED 2) Saves error code MDTU er- ror E1E together with E72	1) Shift position display LED is not dimmed when using night lighting (lamp ON)	EU-41
Voltage (between C02 (9) and chassis) • Night lighting ON: 8 – 21 V • Night lighting OFF: 4 – 6 V	1) Does not take any particu- lar action 2) Saves error code MDTU er- ror E1E together with E73	1) Shift position display LED goes out or is greatly dimmed when using night lighting (lamp ON)	EU-42
Voltage (between C02 (18) and chassis) • Night lighting ON: 8 – 21 V • Night lighting OFF: 4 – 6 V	1) When using night lighting (lamp ON), stops dimmer output to rear steering LOCK display LED 2) Saves error code MDTU er- ror E1F together with E74	1) Rear steering LOCK display LED is not dimmed when using night lighting (lamp ON)	EU-43
Voltage (between C02 (18) and chassis) • Night lighting ON: 8 – 21 V • Night lighting OFF: 4 – 6 V	1) Does not take any particu- lar action 2) Saves error code MDTU er- ror E1F together with E75	1) Rear steering LOCK display LED goes out or is greatly dimmed when using night lighting (lamp ON)	EU-44

023S02

Error code	Abnormal system	Nature of abnormality
MDTU error E80	Swing flasher relay output short circuited with power source	<ol style="list-style-type: none"> 1) Wiring harness between C01 (female) (3) – C22 (1) – C30 (male) (1) short circuited with power source 2) Defective upper MDT
MDTU error E83	Outrigger mode power source short circuited with power source	<ol style="list-style-type: none"> 1) Wiring harness between C01 (female) (15) – CR3 (8) – R03 (female) (4) short circuited with power source 2) Wiring harness between L03 (female) (4) – LM03 (7) – M21 (5) – M37 (female) (5), M38 (female) (1) short circuited with power source 3) Defective slip ring
MDTU error EB3	Disconnection in outrigger mode power source	<ol style="list-style-type: none"> 1) Defective outrigger selector relay and outrigger power source relay 2) Defective contact or disconnection in wiring harness between C01 (female) (15) – CR3 (8) – R03 (female) (4) 3) Defective contact or disconnection in wiring harness between L03 (female) (4) – LM03 (7) – M21 (5) – M37 (female) (5), M38 (female) (1) 4) Defective contact or disconnection in wiring harness between M37 (female) (6), M38 (female) (2) – M19 (16), M20 (16) – M04 (14), M05 (14) - chassis 5) Defective slip ring
MDTU error EE0	PTO mode doesn't match	<ol style="list-style-type: none"> 1) Defective PTO mode switch 2) Defective contact, disconnection, or short circuited with power source in wiring harness between P04 - CP2 (2) - C04 (female) (1) 3) Defective contact or disconnection in wiring harness between P02 - CP2 (5) - C14 (female) (8) 4) Defective contact, disconnection, or short circuited with power source in wiring harness between P06 - CP2 (4) - C04 (female) (2) 5) Defective contact or disconnection in wiring harness between P06 - CP2 (4) - C14 (female) (18) 6) Defective contact, disconnection, or short circuited with power source in wiring harness between P06 - CP2 (4) - C14 (female) (18) - intermediate connecting point of CP2 (4) and C14 (female) (18) - C34 (female) (1) 7) Defective upper MDT 8) Defective moment limiter controller
MDTU error EE1	Abnormality in 2WD Hi/4WD Hi/4WD Lo signal	<ol style="list-style-type: none"> 1) Defective travel mode switch 2) Wiring harness between C02 (female) (15) - CP4 (6) - P25 (female) (3) short circuited with power source 3) Wiring harness between C02 (female) (4) - CP4 (5) - P25 (female) (2) short circuited with power source 4) Defective upper MDT
MDTU error EE3	Abnormality in service brake input	<ol style="list-style-type: none"> 1) Defective parking brake switch 2) Wiring harness between C02 (female) (17) - CP6 (10) - P21 (male) (2) short circuited with power source 3) Defective upper MDT

023S02

Condition when normal (voltage, current, resistance)					Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
PTO switch: Travel or Operation 1 Work equipment lever stand: Raised Voltage (between C01 (3) and chassis) • When operating swing: 17 – 30 V • When swing lever is at neutral: Max. 1 V					1) Does not take any particular action	1) Swing flasher continues flashing	EU-46
Shift lever at N Voltage (between C01 (15) and chassis) • PTO switch: Operation 1: 17 – 30 V • PTO switch: Travel or Operation 2: Max. 1 V					1) Does not take any particular action	1) Possible to operate bottom outrigger at position other than Operation 1 (PTO 1)	EU-47
Shift lever at N Voltage (between C01 (15) and chassis) • PTO switch: Operation 1: 17 – 30 V • PTO switch: Travel or Operation 2: Max. 1 V					1) Does not take any particular action	1) Cannot operate outrigger	EU-48
Voltage					1) Set PTO mode to Operation 1. 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Possible to operate at Operation 1 position 2) Stops operation, travel	EU-49
Upper MDT connector C04	Moment limiter connector C14	Travel	Operation 1	Operation 2			
Between (1) – chassis	—	20 – 30V	20 – 30V	Max. 1 V			
Between (2) – chassis	—	Max. 1 V	20 – 30V	20 – 30V			
—	Between (8) – chassis	20 – 30V	Max. 1 V	Max. 1 V			
—	Between (18) – chassis	Max. 1 V	20 – 30V	20 – 30V			
Voltage (between C02 (4) and chassis) • Travel mode switch: 4WD Hi: 20 – 30 V • Travel mode switch: 2WD Hi or 4WD Lo: Max. 1 V Voltage (between C02 (15) and chassis) • Travel mode switch: 4WD Lo: 20 – 30 V • Travel mode switch: 2WD Hi or 4WD Hi: Max. 1 V					1) Sets to 4WD Hi mode	1) Possible to travel in 4WD Hi	EU-50
Voltage (between C02 (17) and chassis) • Parking brake switch OFF: Max. 1 V • Parking brake switch AUXILIARY: 20 – 30 V					1) When parking brake is applied, actuates auxiliary brake (when parking brake is released, stops auxiliary brake output)	1) Possible to use auxiliary brake under conditions on left	EU-51

Error code	Abnormal system	Nature of abnormality
MDTU error EE4	Abnormality in suspension lift switch	<ol style="list-style-type: none"> 1) Defective suspension lift switch 2) Wiring harness between C02 (female) (7) – CP9 (11) – P70 (female) (6) short circuited with power source 3) Defective upper MDT 4) Suspension lift switch stays at ON continuously for more than 1 minute.
MDTU error EE5	Abnormality in outrigger control switch	<ol style="list-style-type: none"> 1) Defective outrigger INDIVIDUAL, EXTEND/STOW, or SLIDE/JACK switch 2) Wiring harness between C06 (female) (2) – CP3 (3) – P09 (male) (3) short circuited with power source 3) Wiring harness between C06 (female) (12) – CP3 (4) – P09 (male) (2) short circuited with power source 4) Wiring harness between C06 (female) (11) – CP3 (5) – P10 (male) (3) short circuited with power source 5) Wiring harness between C06 (female) (1) – CP3 (6) – P10 (male) (2) short circuited with power source 6) Wiring harness between C06 (female) (15) – CP3 (11) – P88 short circuited with power source 7) Wiring harness between C06 (female) (3) – CP3 (9) – P84 short circuited with power source 8) Wiring harness between C01 (female) (14) – CP3 (2) – P09 (male) (1), P79, P81, P83, P85, or P87 short circuited with power source 9) Wiring harness between C06 (female) (4) – CP3 (7) – P80 short circuited with power source 10) Wiring harness between C06 (female) (13) – CP3 (10) – P86 short circuited with power source 11) Wiring harness between C06 (female) (14) – CP3 (8) – P82 short circuited with power source 12) Defective upper MDT
MDTU error EE6	Top outrigger EXTEND + RE-TRACT input simultaneously, JACK + SLIDE input simultaneously	<ol style="list-style-type: none"> 1) Defective top outrigger SLIDE/JACK and EXTEND/STOW switch 2) Wiring harness between C06 (female) (1) – CP3 (6) – P10 (male) (2) short circuited with power source 3) Wiring harness between C06 (female) (11) – CP3 (5) – P10 (male) (3) short circuited with power source 4) Wiring harness between C06 (female) (2) – CP3 (3) – P09 (male) (3) short circuited with power source 5) Wiring harness between C06 (female) (12) – CP3 (4) – P09 (male) (2) short circuited with power source 6) Defective upper MDT
MDTU error EEA	Abnormality in steering mode switch	<ol style="list-style-type: none"> 1) Defective steering mode switch 2) Defective contact, disconnection, or short circuited with power source in wiring harness between C02 (female) (1) – CP5 (1) – P29 (male) (2) 3) Defective contact, disconnection, or short circuited with power source in wiring harness between C02 (female) (2) – CP5 (3) – P29 (male) (4) 4) Defective contact, disconnection, or short circuited with power source in wiring harness between C02 (female) (12) – CP5 (5) – P29 (male) (6) 5) Defective contact, disconnection, or short circuited with power source in wiring harness between C02 (female) (13) – CP5 (7) – P29 (male) (8) 6) Defective upper MDT
MDTU error EEC	Rear steering LOCK + FREE command input simultaneously	<ol style="list-style-type: none"> 1) Defective rear steering LOCK switch 2) Wiring harness between C04 (female) (13) – CP6 (7) – P30 (male) (1) short circuited with power source 3) Wiring harness between C04 (female) (3) – CP6 (8) – P30 (male) (2) short circuited with power source 4) Defective upper MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
When suspension lock switch is at suspension LOCK: Voltage (between C02 (7) and chassis) • Suspension lift switch ON : 20 – 30 V OFF : Max. 1 V	1) Turns suspension lift output OFF 2) Actuates emergency alarm buzzer	1) Impossible to use suspen- sion lift	EU-52
Voltage (between C06 (2) and chassis) Voltage (between C06 (12) and chas- sis) Voltage (between C06 (11) and chas- sis) Voltage (between C06 (1) and chassis) Voltage (between C06 (15) and chas- sis) • See Standard Value Table on page 20 – 17. Voltage (between C06 (3) and chassis) Voltage (between C06 (4) and chassis) Voltage (between C06 (13) and chas- sis) Voltage (between C06 (14) and chas- sis) • See Standard Value Table on page 20 – 18.	1) Ignores top outrigger switch operation	1) Cannot operate top outrigger	EU-53
Voltage (between C06 (3) and chassis) Voltage (between C06 (4) and chassis) Voltage (between C06 (13) and chas- sis) Voltage (between C06 (14) and chas- sis) • See Standard Value Table on page 20 – 18.	1) Ignores top outrigger switch operation	1) Cannot operate top outrigger	EU-54
Voltage (between C02 (1) and chassis) • Front wheel mode: 20 – 30 V • Other mode: Max. 1 V • Voltage (between C02 (2) and chassis) • 4-wheel mode: 20 – 30 V • Other mode: Max. 1 V • Voltage (between C02 (12) and chas- sis) • Crab mode: 20 – 30 V • Other mode: Max. 1 V • Voltage (between C02 (13) and chas- sis) • Rear wheel mode: 20 – 30 V • Other mode: Max. 1 V	1) Holds present steering mode 2) Actuates emergency alarm buzzer and monitor central buzzer 3) Present steering mode LED lights up, other steering mode LEDs flash	1) Steering mode does not switch.	EU-55
Voltage (between C04 (3) and chassis) When rear steering CENTER is detected • When rear steering LOCK switch, can- cel switch are at LOCK: 20 – 30 V • When rear steering LOCK switch, cancel switch are at CANCEL or neutral: Max. 1 V Voltage (between C04 (13) and chassis) • When rear steering LOCK switch, can- cel switch are at CANCEL: 20 – 30 V • When rear steering LOCK switch, cancel switch are at LOCK or neutral: Max. 1 V	1) Turns rear steering LOCK output OFF 2) Turns rear steering FREE output OFF 3) Actuates emergency alarm buzzer and monitor central buzzer	1) Rear steering LOCK/FREE switch cannot be operated	EU-56

JUDGEMENT TABLE FOR UPPER MDT, AND HYDRAULIC AND
MECHANICAL SYSTEMS

<div>Location of failure</div> <div>Failure mode</div> <div>Error code</div>			Self-diagnostic display(abnormality display)																					
			MDTU errors																					
			MDT system error																					
			MDT system error	Shut off when low voltage	Shut off when high temperature	Top, bottom don't match (application stopped)	Top, bottom selection warning	Model doesn't match (application stopped)	Model selection warning	Abnormality in C-NET communication between MDTs (output stopped)	Abnormality in S-NET communication between MDT and moment limiter	Swing flasher output short circuited with ground	Power source for outrigger panel short circuited with ground	Outtrigger mode power source short circuited with ground	Crab mode LED short circuited with ground	Front wheel mode LED short circuited with ground	Rear wheel mode LED short circuited with ground	4-wheel mode LED short circuited with ground	Rear steering LOCK LED short circuited with ground	Rear steering FREE LED short circuited with ground	Rear steering CENTER LED short circuited with ground	Reverse steering display lamp short circuited with ground	Winch rotation buzzer (main winch) short circuited with ground	Emergency alarm buzzer short circuited with ground
			E 00	E 10	E 11	E 20	E 21	E 24	E 25	E 28	E 29	E 40	E 41	E 43	E 44	E 45	E 46	E 47	E 48	E 49	E 4A	E 4B	E 4C	E 4D
Work equipment system	1	Boom and winch do not move (including cases where PTO clutch does not engage)																						
	2	Boom cannot be raised or lowered or speed is slow																						
	3	Boom cannot be extended or retracted, or speed is slow																						
	4	Winch cannot be wound in or wound out, or speed is slow																						
	5	Winch moves intermittently (there is hunting)																						
	6	Jib cannot be raised, lowered, or extended, stowed, or rotated																						
	7	Upper structure cannot be swung or swing speed is slow																						
	8	Outriggers cannot be extended or stowed	○	○	○	○		○					○	○										
	9	Excessive hydraulic drift																						
Travel system	11	Machine does not move off																						
	12	Machine does not accelerate or does not decelerate																						
	13	Travel speed is slow or lacks power																						
	14	Torque converter lock-up does not engage or cannot be disengaged (engine stalls when machine is stopped or moves off)																						
	15	Excessive time lag when moving off (shifting gear), or shift up is slow	○			○		○		○														
	16	Torque converter oil temperature becomes high																						
	17	Brake cannot be applied (braking effect is poor) or cannot be released (drags), pulls to one side	○			○		○																
	18	Exhaust brake cannot be applied or cannot be released	○			○		○																
	19	Air pressure does not rise or is too low																						
	20	Cannot switch between 2-wheel drive and 4-wheel drive	○			○		○		○														
	21	Steering mode cannot be switched	○			○		○		○	○													
	22	Wheels do not move when steering wheel is turned (steering does not turn or is difficult to turn)																						
	23	Rear steering is not locked or is not released	○			○		○		○														
	24	Suspension cannot be locked or cannot be set free																						
	25	Suspension lift cannot be used	○	○	○	○		○		○														
Buzzer, lamp, LED gauge does not work, etc.			○	○	○	○		○		○	○	○			○	○	○	○	○	○	○	○	○	○
Troubleshooting code when error code is displayed			EU -1	EU -2	EU -3	EU -4	EU -5	EU -6	EU -7	EU -8	EU -9	EU -10	EU -11	EU -13	EU -14	EU -15	EU -16	EU -17	EU -18	EU -19	EU -20	EU -21	EU -22	EU -23

For upper MDT, turn only output OFF

For details of the failure mode or the problem that appears on the machine, see pages 20-415, 20-432, 433.

Changes to ▲ (emergency stop mode) but works as normal

023S02

- ★ Troubleshooting codes E-107 and 108 are for the free-fall system (does not switch to free-fall or remains in free-fall condition).
- ★ Troubleshooting codes E-2 – 4 are for the engine starting system.

Self-diagnostic display(abnormality display)																																Troubleshooting code when there is no abnormality display
Winch rotation buzzer (auxiliary winch) short circuited with ground	Monitor central buzzer short circuited with ground	Tachometer signal output short circuited	Speedometer signal output short circuited	Fuel level signal output short circuited	Engine water temperature signal output short circuited	Torque converter oil temperature signal output short circuited	Engine oil pressure signal output short circuited	Preheating pilot signal output short circuited	Parking brake lamp output short circuited	Option (Retarder lamp output short circuited)	Hi beam pilot output short circuited with ground	Hourmeter output short circuited with ground	Charge lamp output short circuited with ground	Brake fluid level output short circuited with ground	Right turn pilot output short circuited with ground	Left turn pilot output short circuited with ground	LED dimmer 1 short circuited with ground	LED dimmer 1 short circuited with power source	LED dimmer 2 short circuited with ground	LED dimmer 2 short circuited with power source	Swing flasher output short circuited with power source	Outrigger mode power source short circuited with power source	Disconnection in outrigger mode power source	PTO mode doesn't match	Abnormality in 2WD Hi/4WD Hi/4WD Lo input	Abnormality in service brake input	Abnormality in suspension lift switch	Abnormality in outrigger control switch	Outrigger EXTEND + RETRACT input simultaneously, JACK + SLIDE input simultaneously	Abnormality in steering mode switch input	Rear steering LOCK + FREE command input simultaneously	
MDTU errors																																
E 4E	E 4F	E 50	E 51	E 52	E 53	E 55	E 56	E 57	E 58	E 59	E 5A	E 5B	E 5C	E 5D	E 5E	E 5F	E 72	E 73	E 74	E 75	E 80	E 83	E B3	E E0	E E1	E E3	E E4	E E5	E E6	E EA	E EC	
																																E-1,5,EM-101,102,104,H-1
																																H-2
																																EM-106-1,EM-131, H-3
																																EM106,131, H-4
																																H-5
																																H-6
																																EM-103,109 – 124, H-7
																						○							○	○		EM-201 – 224, H-8
																																H-9
																																H-101
																																H-102
																																E-6, H-103
																																H-104
																																H-105
																																H-106
																																H-107
																																H-108
																									○							H-109
																														○		H-110
																																H-111
																																H-112
																																E-7, H-113
																																E-8, H-114
																											○					H-115
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○					○				○		E9 – 27,EM125 – 128,139 – 140
EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	
-24	-25	-26	-27	-28	-29	-30	-31	-32	-33	-34	-35	-36	-37	-38	-39	-40	-41	-42	-43	-44	-46	-47	-48	-49	-50	-51	-52	-53	-54	-55	-56	

In positions other than Operation 1, it is possible to operate the outriggers using the bottom outrigger panel. Even when the outriggers are extended, the over-rear stability stop is carried out during operations.

Travel possible in 4WD Hi
Possible to carry out travel and operations in Operation 1 (however, the outrigger does not move)

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MACHINE
(FAILURE MODE) WHEN MDTU ERROR
E28 OR MDTL ERROR E28 OCCUR****1. Upper MDT (MDTU)**

- 1) The rear steering LOCK/FREE/CENTER condition is held at the condition in operation before the failure occurred.
- 2) The steering mode is held at the condition in operation before the error occurred.
- 3) The outrigger power source is switched ON to make it possible to operate with the bottom outrigger control panel.
- 4) The machine model, top, and bottom selection are held in the condition in operation before the error occurred.
- 5) The winch rotation buzzer signal (pulse) is output.

2. Lower MDT (MDTL)

- 1) The output to the outrigger related solenoids is stopped.
- 2) The steering mode is held at the condition in operation before the error occurred.
- 3) The side lamp, head lamp, and hazard lamp functions are turned ON (when the engine is started).
- 4) The machine model, top, and bottom selection are held in the condition in operation before the error occurred.
- 5) The other outputs sent by the lower MDT to the solenoids for suspension lift, service (auxiliary) brake, and exhaust brake are stopped.

3. Moment limiter

- 1) Emergency stop mode (▲) display (graphic display) + emergency alarm buzzer.
- 2) All other displays go out.
- 3) Possible to clear outrigger setting and operate motion cut (automatic stop) or over-rear stability stop.

4. Transmission controller

- 1) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).

- 2) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MACHINE
(FAILURE MODE) WHEN MDTU ERROR
E29 OR OSS ERROR E20 OCCUR****1. Upper MDT (MDTU), lower MDT (MDTL)**

- 1) Impossible to switch normal steering to reverse steering.
- 2) Swing flasher does not function.

2. Moment limiter

- 1) Emergency stop mode (▲) display (graphic display) + emergency alarm buzzer.
- 2) Turns the moment limiter panel lamp (night lighting) ON.
- 3) Possible to clear outrigger setting and operate motion cut (automatic stop) or over-rear stability stop.

3. Transmission controller

- 1) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).
- 2) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MACHINE
(FAILURE MODE) WHEN MDTL ERROR
E29 OCCURS****1. Upper MDT (MDTU), lower MDT (MDTL)**

- 1) The steering mode is held at the condition in operation before the error occurred.

2. Moment limiter

- 1) If the PTO mode switch is at Travel or Operation 1, emergency stop mode (▲) display + emergency alarm buzzer.

3. Transmission controller

- 1) The gear shift lever signal is held at the condition in operation before the error occurred.

Gear shifting is carried out by the input signal sent by the interlock signal (2 seconds after the lever position is changed)

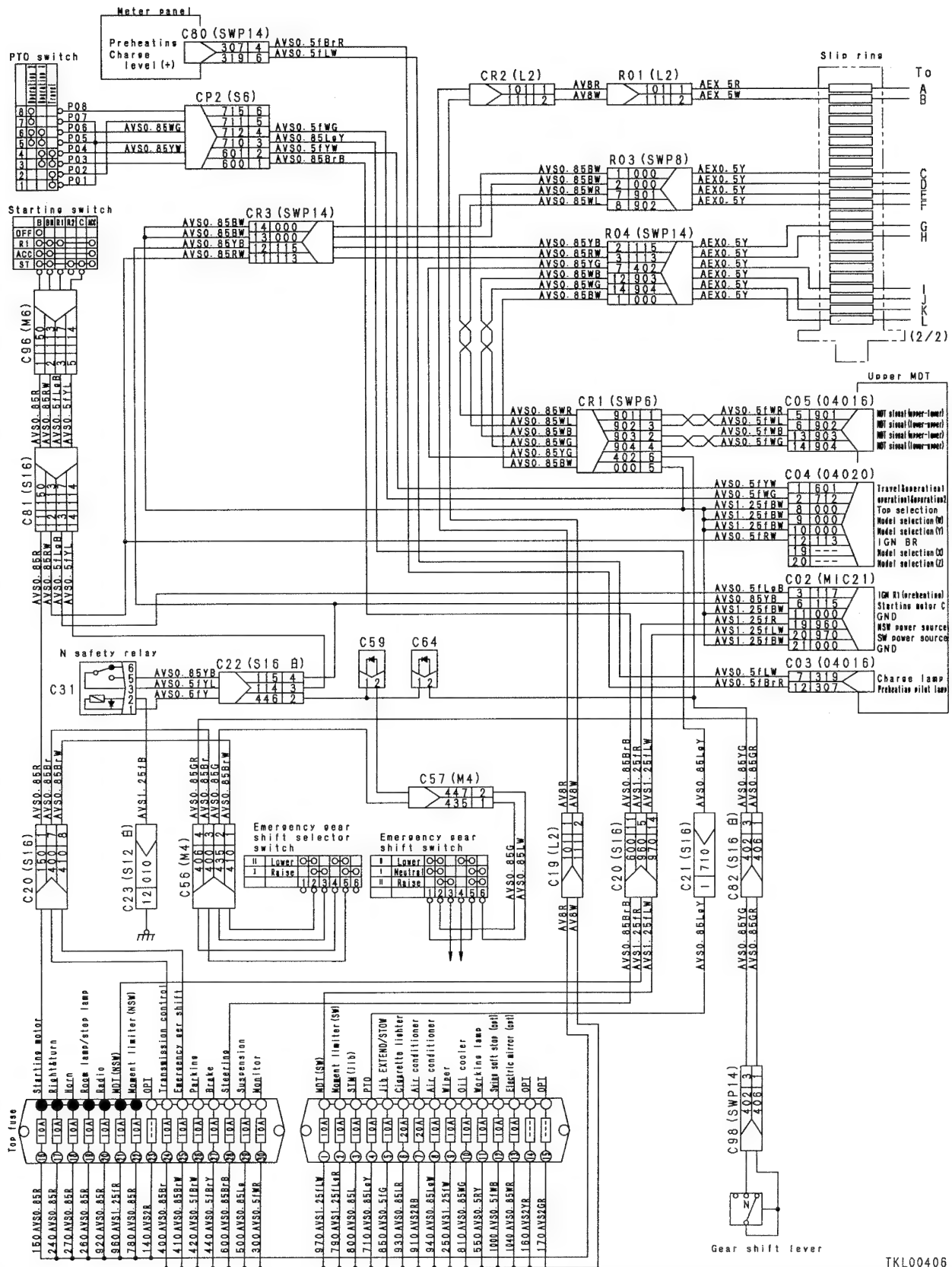
- 2) The travel mode (2WD Hi, 4WD Hi, 4WD Lo) is held at the condition in operation before the error occurred.
- 3) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).
- 4) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)
- 5) The steering mode relay is held at the condition in operation before the error occurred.
- 6) After the starting switch is turned OFF, the PTO mode is set to Travel and the travel mode is set to 2WD Hi.

ACTION TAKEN BY CONTROLLER AND PROBLEM THAT APPEARS ON MACHINE (FAILURE MODE) WHEN OSS ERROR E30 OCCURS

1. Upper MDT (MDTU), lower MDT (MDTL), transmission controller.
 - No response (ignores condition)
2. Moment limiter
 - 1) If the problem occurs during jib operations, the following are carried out: motion cut, error code display + emergency alarm buzzer.

ACTION TAKEN BY CONTROLLER AND PROBLEM THAT APPEARS ON MACHINE (FAILURE MODE) WHEN OSS ERROR E00 OCCURS

1. Upper MDT (MDTU), lower MDT (MDTL), transmission controller
 - No response (ignores condition)
2. Moment limiter
 - 1) The condition in operation before the error occurred is held until the starting switch is turned OFF (the overload automatic stop also functions), but after the starting switch is turned OFF, it cannot be reset.
 - 2) The moment limiter panel lamp (night lighting) is lighted up.
 - 3) Emergency stop mode (▲) display + emergency alarm buzzer.

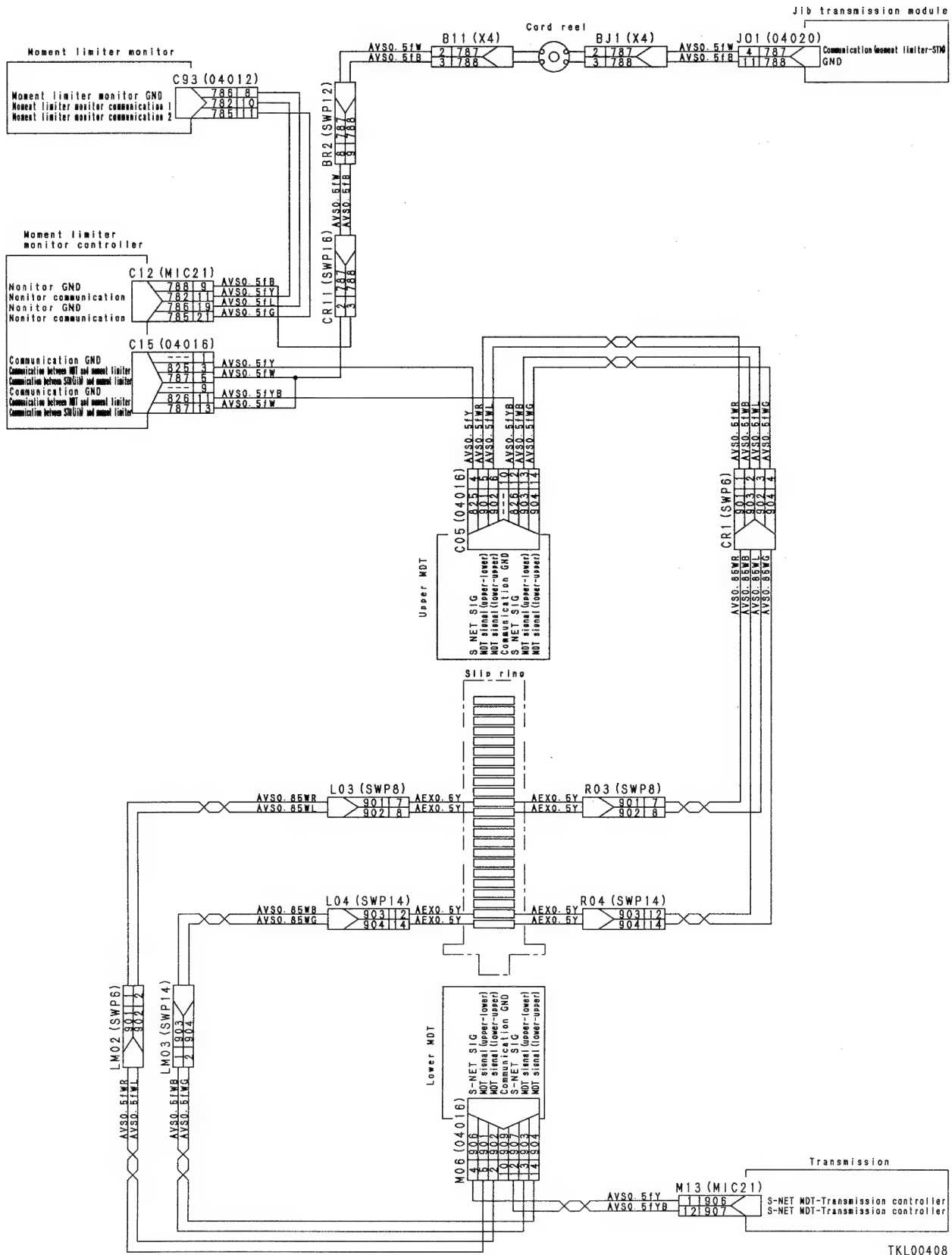
ELECTRICAL CIRCUIT DIAGRAM OF POWER SOURCE, START-
ING, CHARGING, AND PREHEATING SYSTEMS

023S02

TKL00406

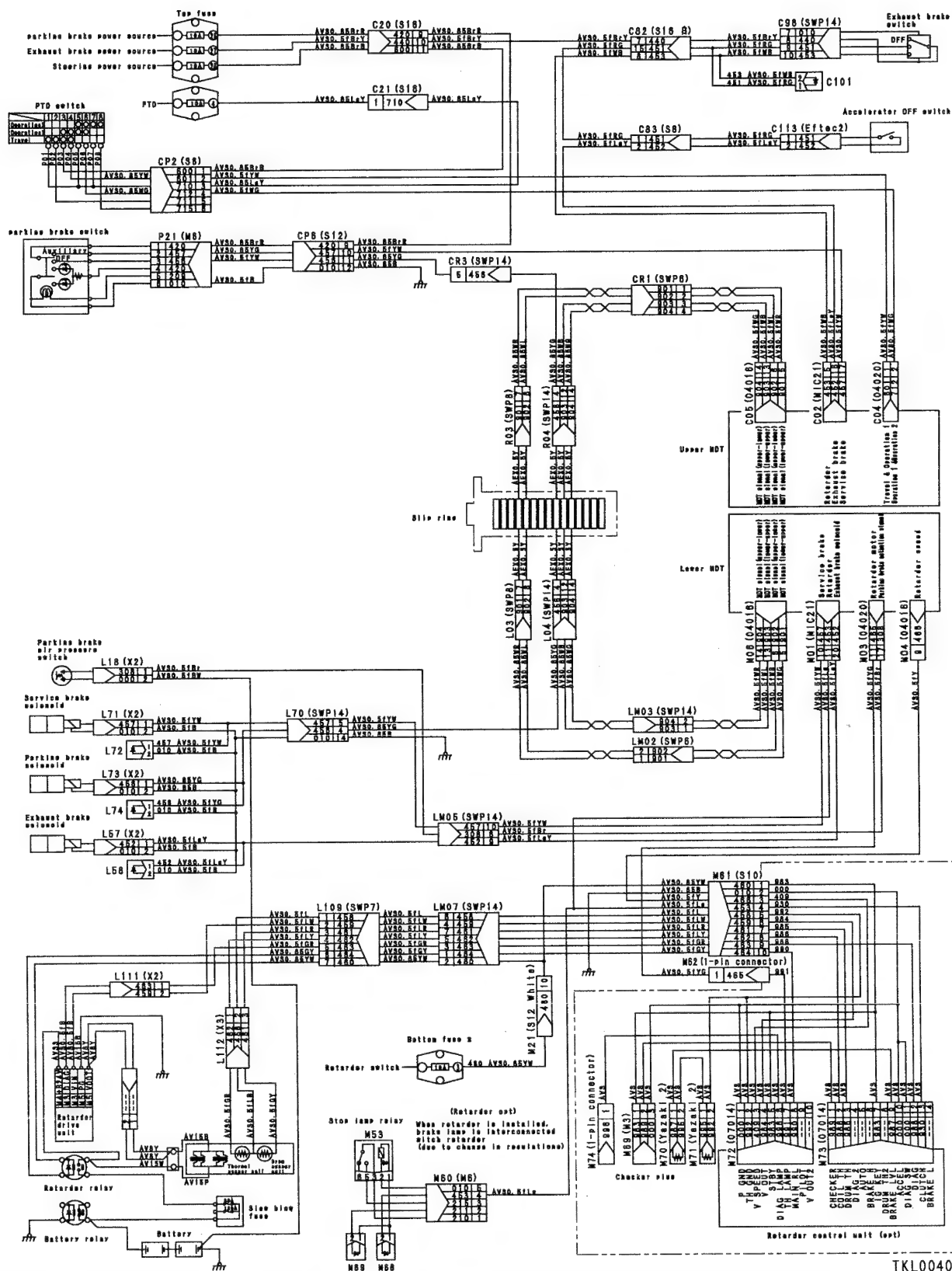


ELECTRICAL CIRCUIT DIAGRAM OF NETWORK SYSTEM



023S02

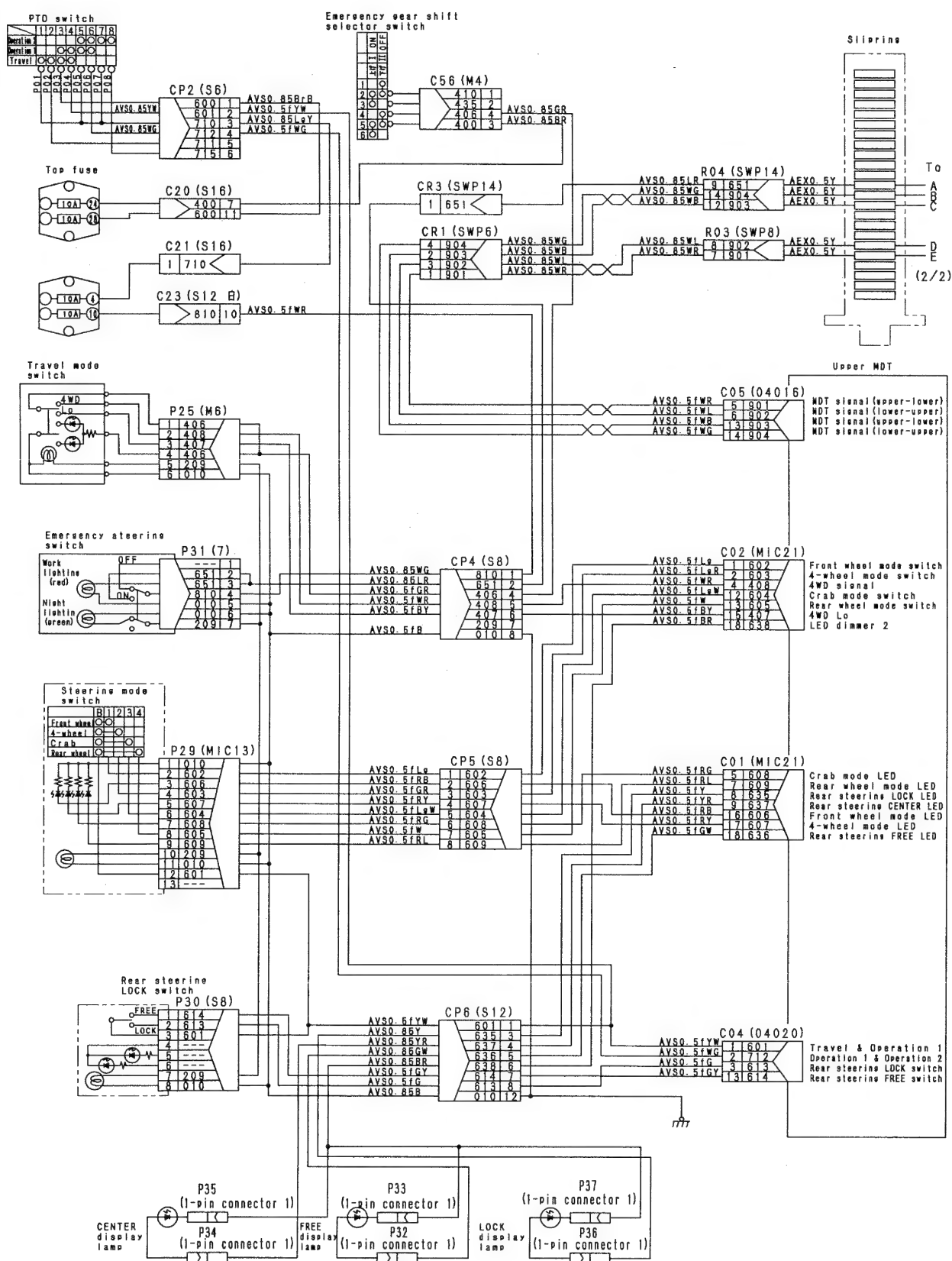
ELECTRICAL CIRCUIT DIAGRAM OF BRAKE SYSTEM



TKL00409

023S02

ELECTRICAL CIRCUIT DIAGRAM OF STEERING SYSTEM

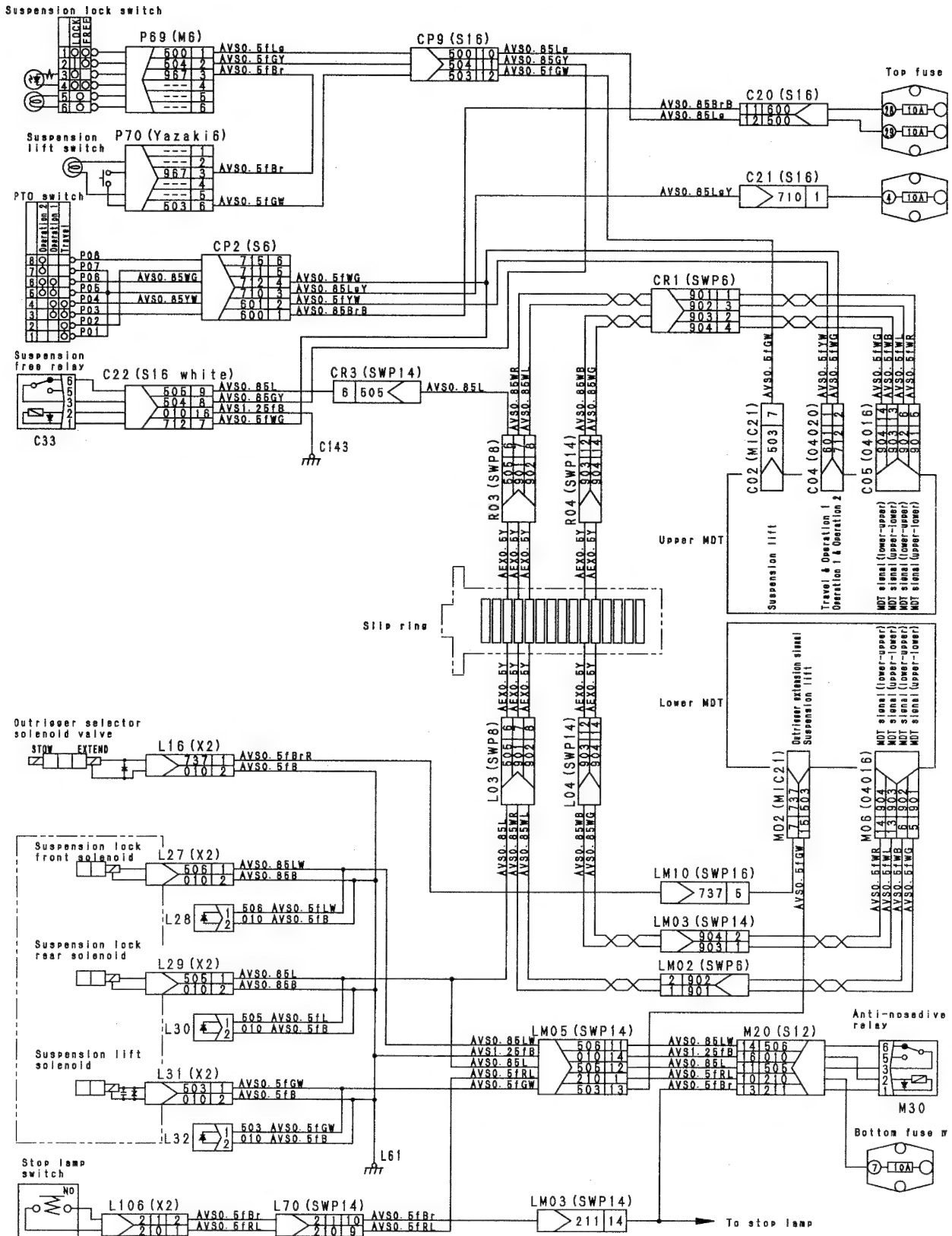


023S02

TKL00410



ELECTRICAL CIRCUIT DIAGRAM OF SUSPENSION SYSTEM



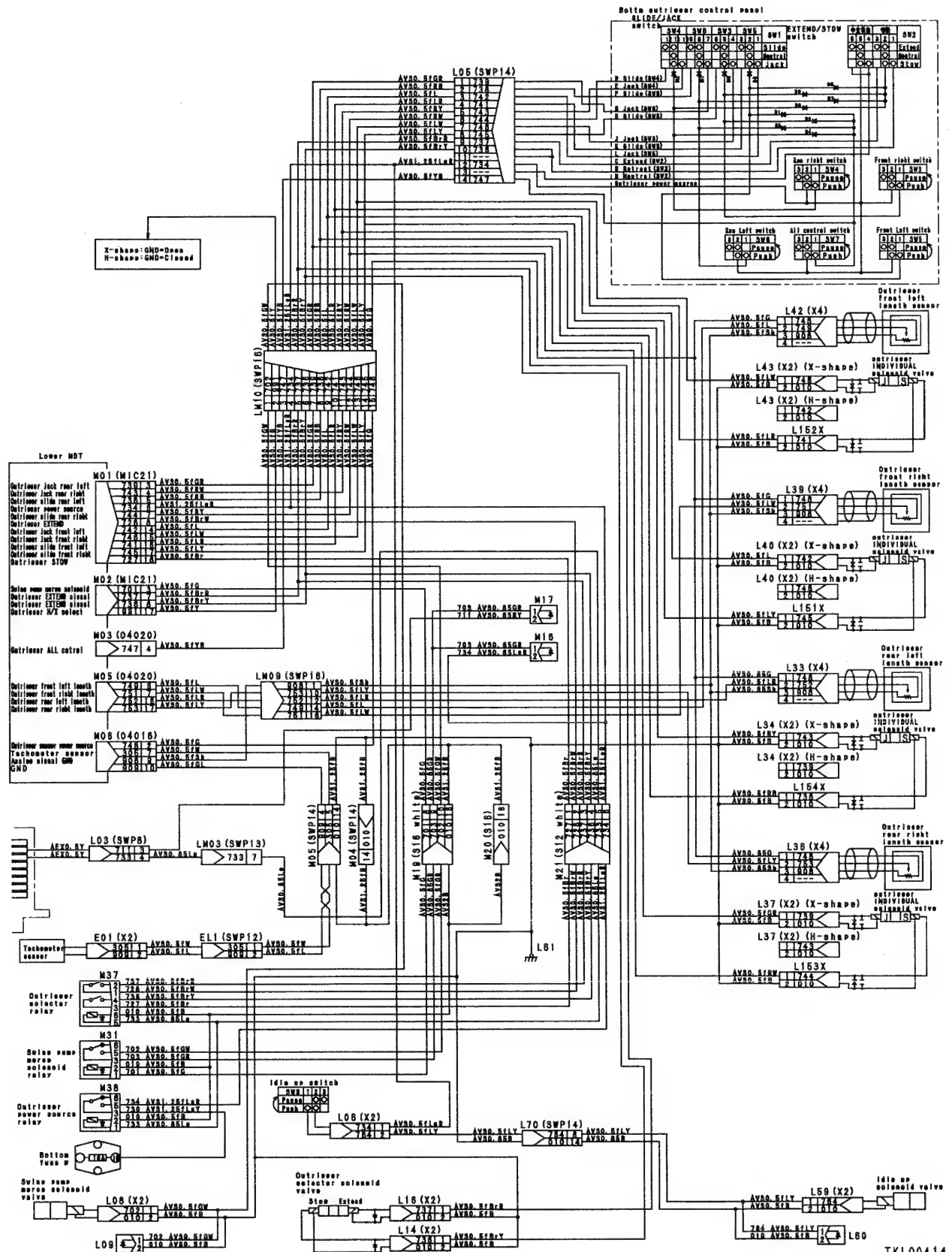
023S02

TKL00412

20-392

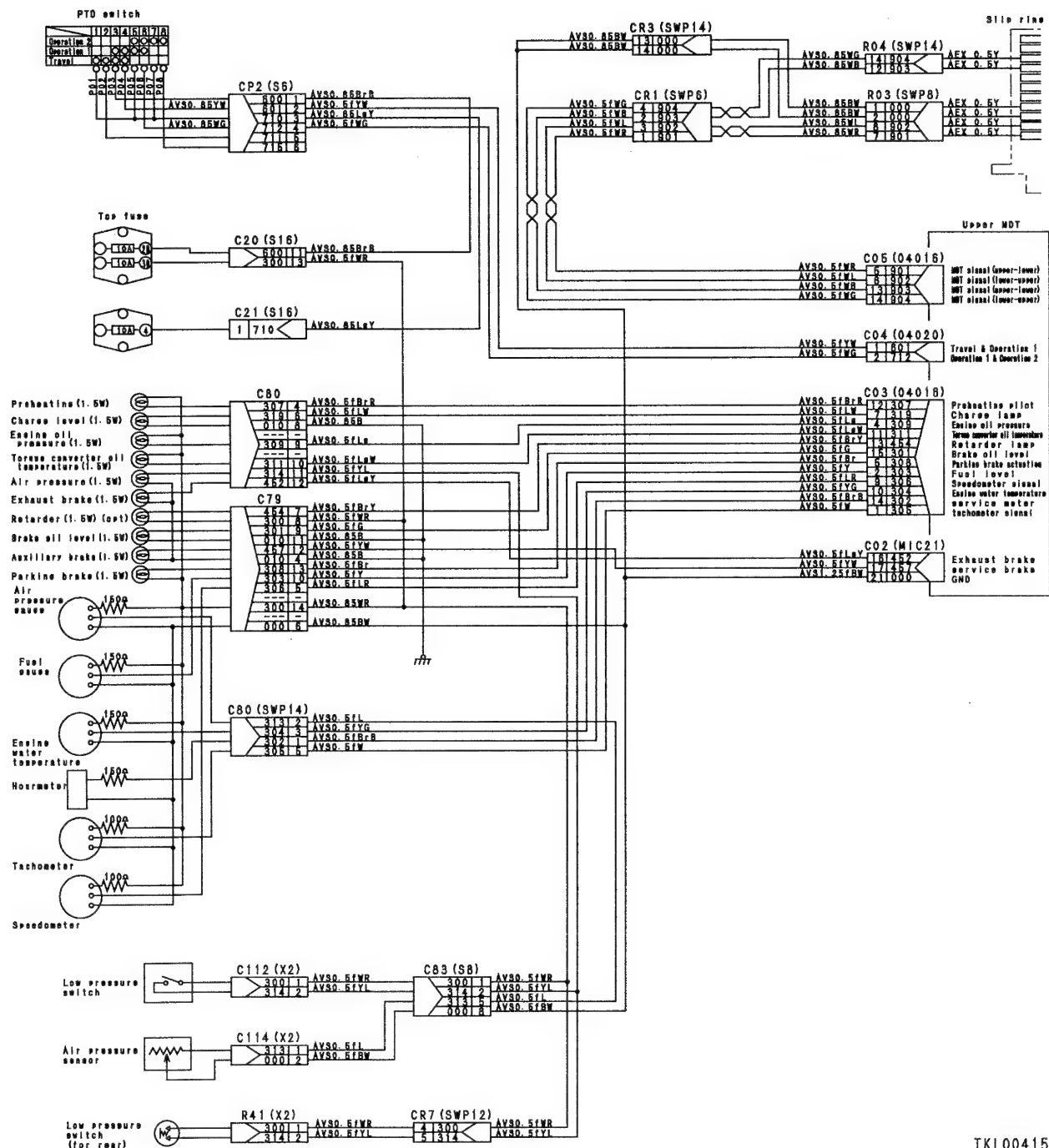


023S02



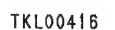
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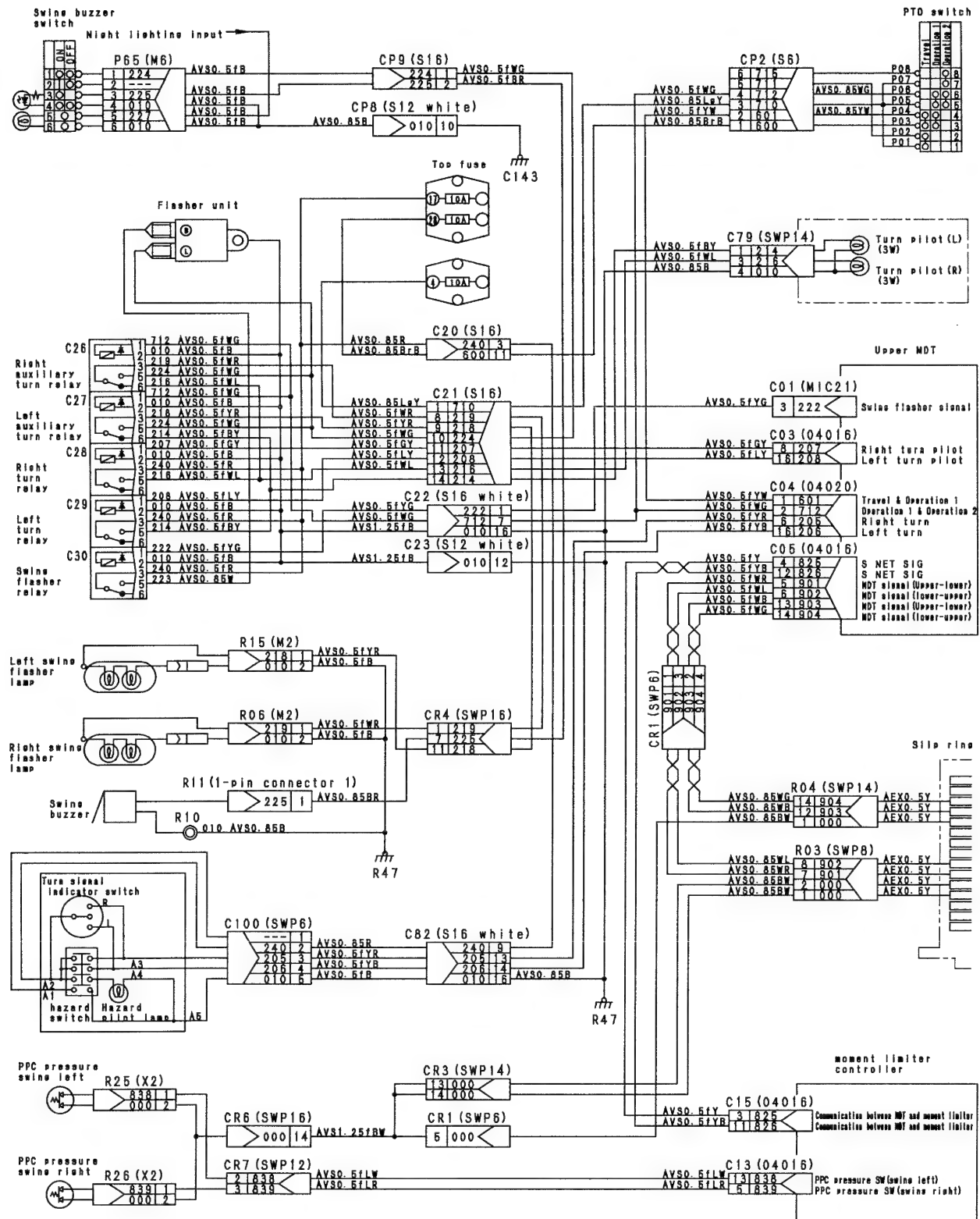
ELECTRICAL CIRCUIT DIAGRAM OF MACHINE MONITOR SYSTEM



023S02

TKL00415

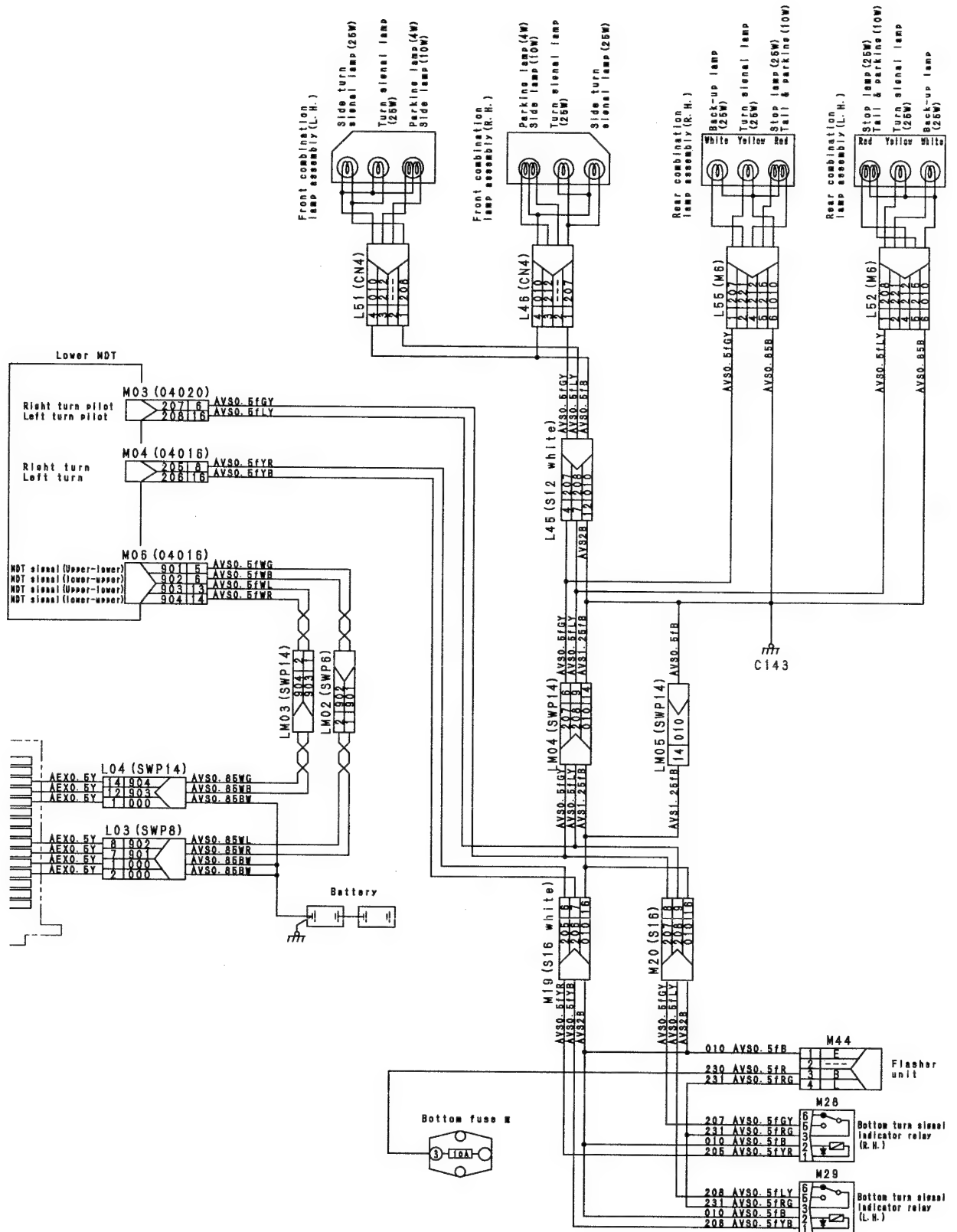


ELECTRICAL CIRCUIT DIAGRAM OF TURN SIGNAL AND SWING
FLASHER SYSTEMS

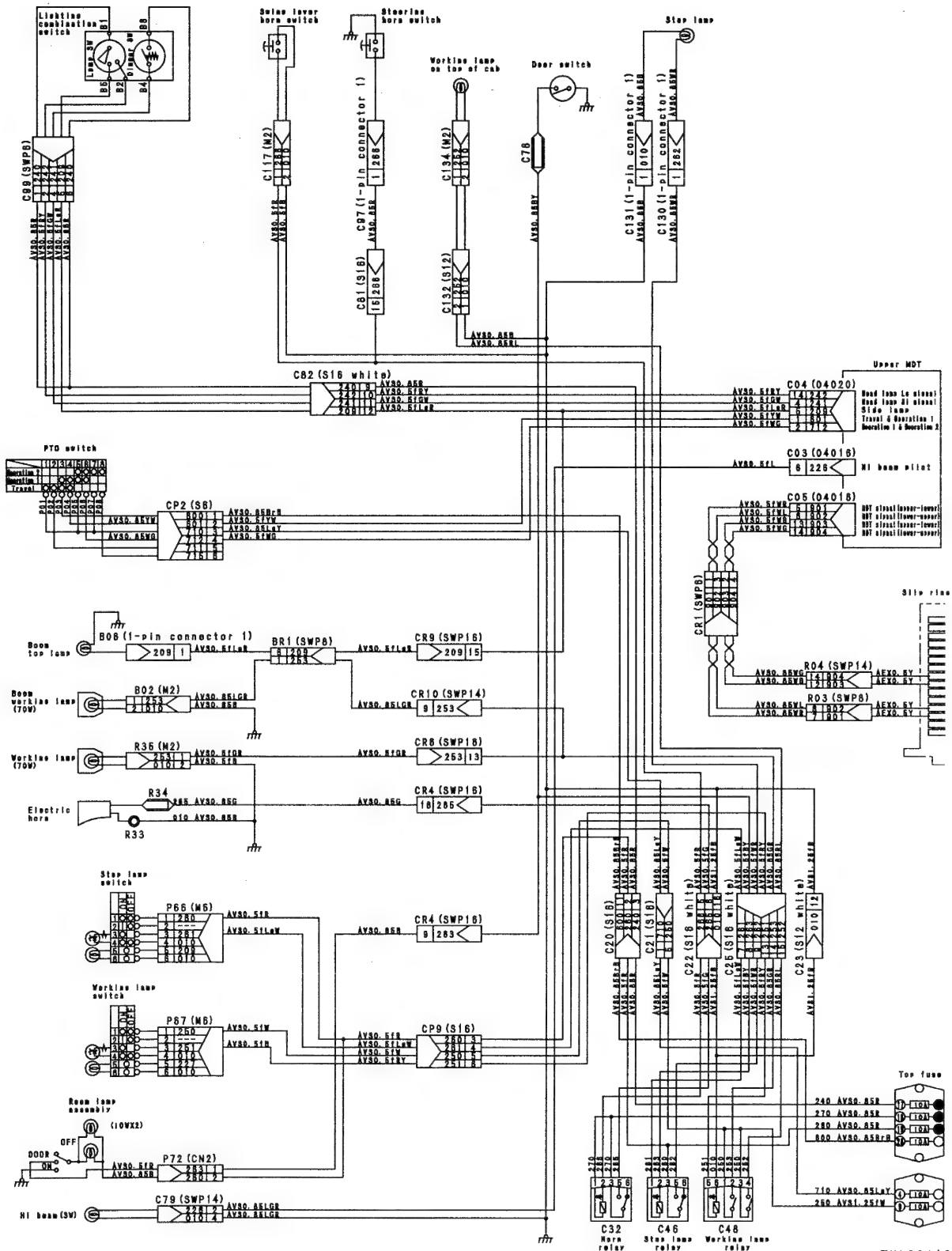
023S02

TKL00417

023S02

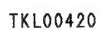


ELECTRICAL CIRCUIT DIAGRAM OF LAMP, HORN, AND GREASE SYSTEMS



TKL00419

023S02



EU-1 MDTU error E00 (MDT system error) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
		Defective upper MDT	Repair or replace

EU-2 MDTU error E10 (Shut off when low voltage) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
		Drop in battery voltage (Max. 18 V)	Repair or replace

023S02

EU-3 MDTU error E11 (Shut off when high temperature) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
		Overheat inside upper MDT	Stop operations (wait for temperature inside lower MDT to go down)

EU-4 MDTU error E20 (Top, bottom don't match (application stopped)) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error is also detected as OSS error E20.

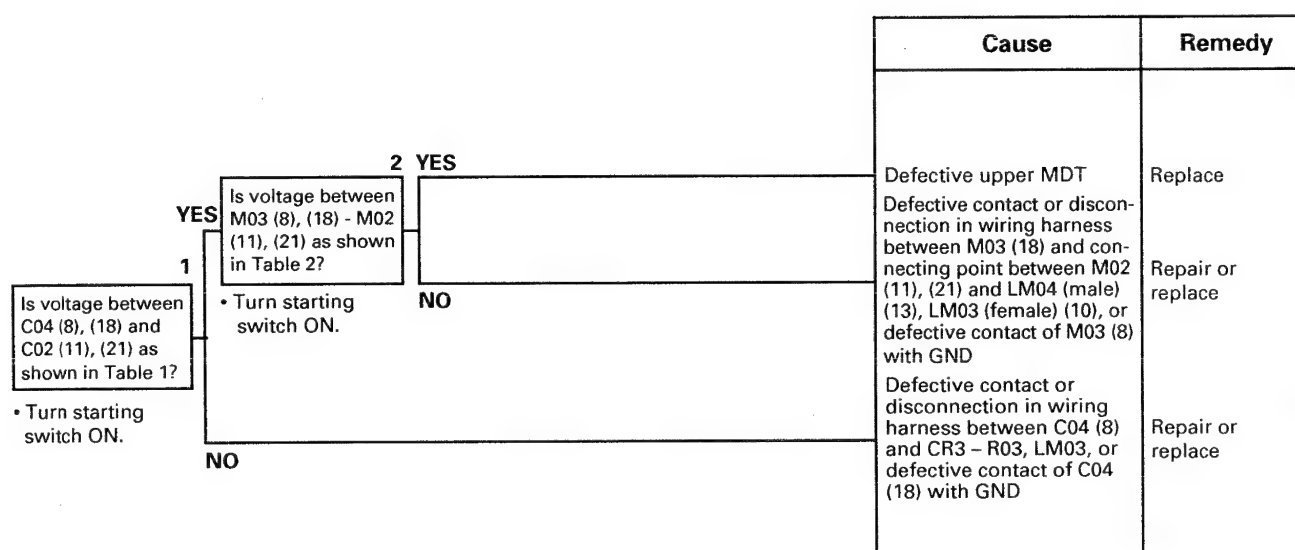


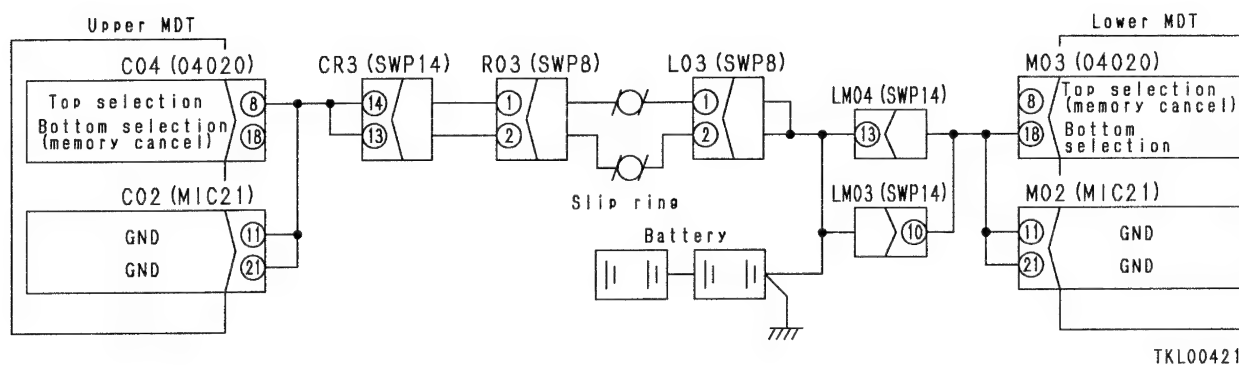
Table 1

Connector	Voltage (V)
Between C04 (8) and C02 (11), (21)	Max. 1 V
Between C04 (18) and C02 (11), (21)	15 – 30 V

Table 2

Connector	Voltage (V)
Between M03 (8) and M02 (11), (21)	15 - 30 V
Between M03 (18) and M02 (11), (21)	Max. 1 V

EU-4 Related electric circuit diagram



EU-5 MDTU error E21 (Top, bottom selection warning) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Is voltage between C04 (8), (18) and C02 (11), (21) as shown in Table 1?

• Turn starting switch ON.

2 YES

Is voltage between M03 (8), (18) and M02 (11), (21) as shown in Table 2?

• Turn starting switch ON.

NO

Cause	Remedy
Defective upper MDT	Replace
Defective contact or disconnection in wiring harness between M03 (18) and connecting point between M02 (11), (21) and LM04 (male) (13), LM03 (female) (10)	Repair or replace
Defective contact or disconnection in wiring harness between C04 (8) - CR3 (14) - R03 (1), contact of C04 (18) with GND	Repair or replace

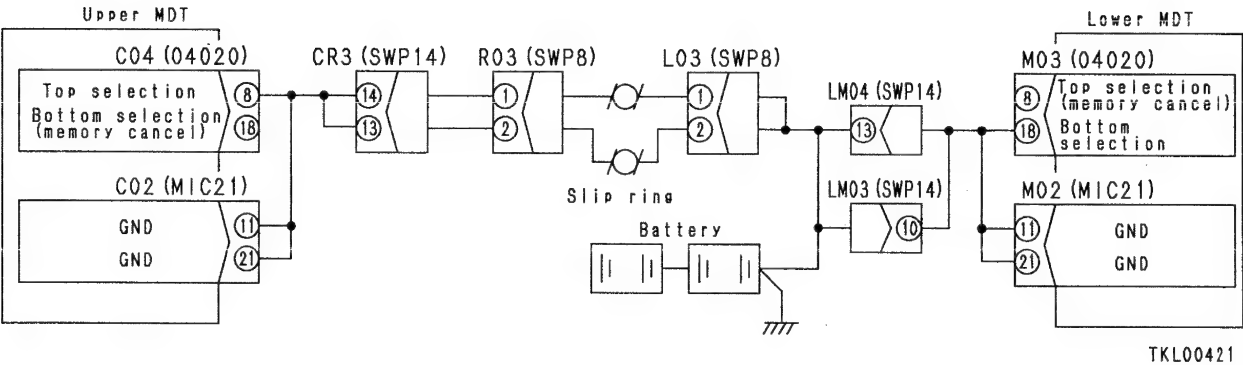
Table 1

Connector	Voltage (V)
Between C04 (8) and C02 (11), (21)	Max. 1 V
Between C04 (18) and C02 (11), (21)	15 – 30 V

Table 2

Connector	Voltage (V)
Between M03 (8) and M02 (11), (21)	15 – 30 V
Between M03 (18) and M02 (11), (21)	Max. 1 V

EU-5 Related electric circuit diagram



EU-6 MDTU error E24 (Model doesn't match (application stopped)) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error is also detected as OSS error E20.

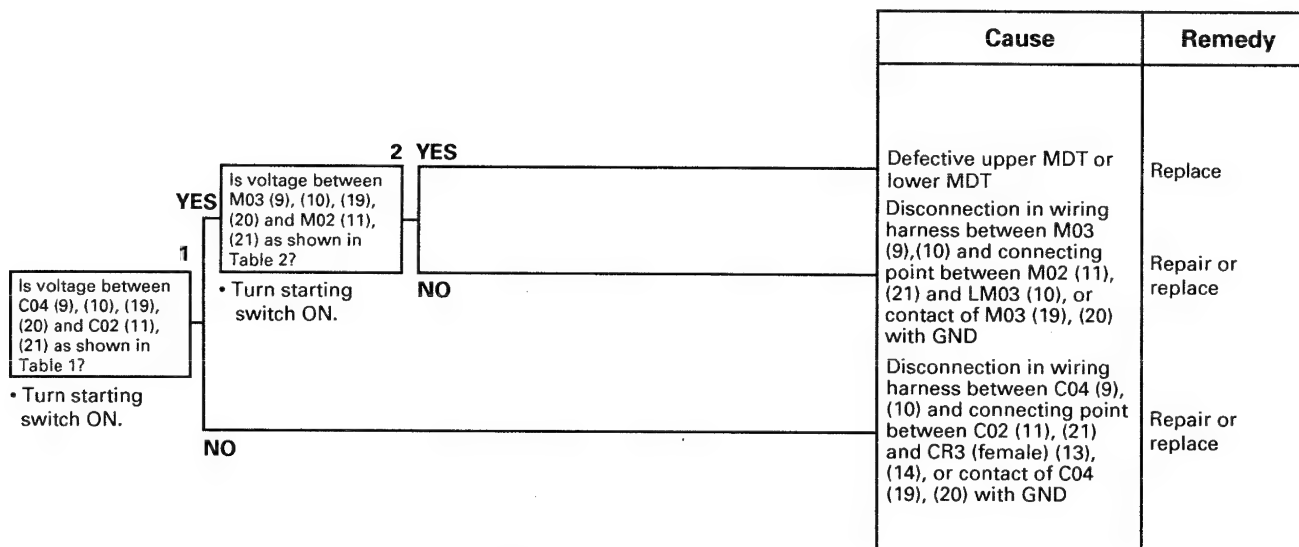


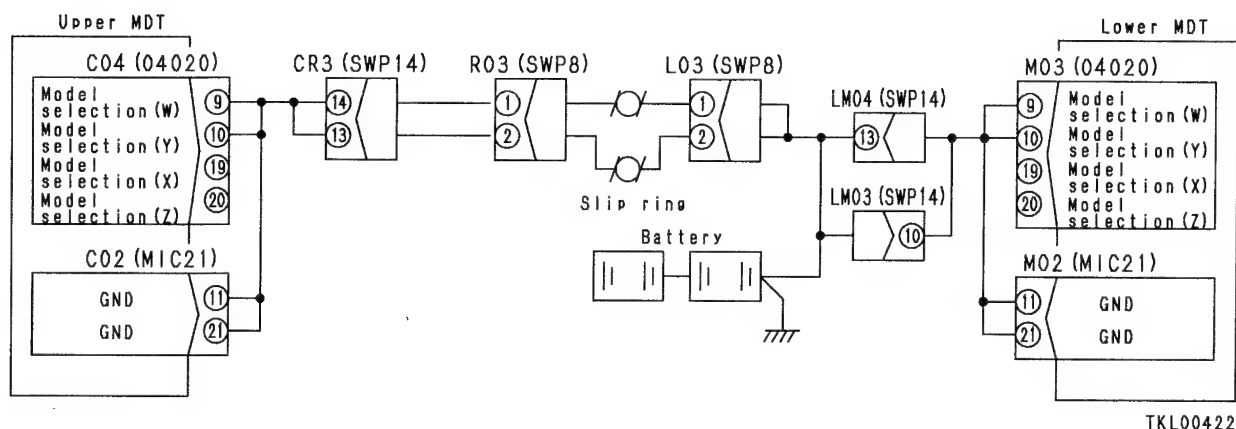
Table 1

Connector	Voltage (V)
Between C04 (9) and C02 (11), (21)	Max. 1 V
Between C04 (10) and C02 (11), (21)	Max. 1 V
Between C04 (19) and C02 (11), (21)	15 – 30 V
Between C04 (20) and C02 (11), (21)	15 – 30 V

Table 2

Connector	Voltage (V)
Between M03 (9) and M02 (11),(21)	Max. 1 V
Between M03 (10) and M02 (11),(21)	Max. 1 V
Between M03 (19) and M02 (11),(21)	15 – 30 V
Between M03 (20) and M02 (11),(21)	15 – 30 V

EU-6 Related electric circuit diagram



EU-7 MDTU error E25 (Model selection warning) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1</p> <p>Is voltage between C04 (9), (10), (19), (20) and C02 (11), (21) as shown in Table 1?</p> <p>• Turn starting switch ON.</p> <p>YES</p> <p>2</p> <p>Is voltage between M03 (9), (10), (19), (20) and M02 (11), (21) as shown in Table 2?</p> <p>• Turn starting switch ON.</p> <p>NO</p>	YES	Defective upper MDT or lower MDT	Replace
	NO	Disconnection in wiring harness between M03 (9),(10) and connecting point between M02 (11), (21) and LM03 (10), LM04 (male) (13), or contact of M03 (19), (20) with GND	Repair or replace
	NO	Disconnection in wiring harness between C04 (9), (10) and connecting point between C02 (11), (21) and CR3 (female) (13), (14), or contact of	Repair or replace

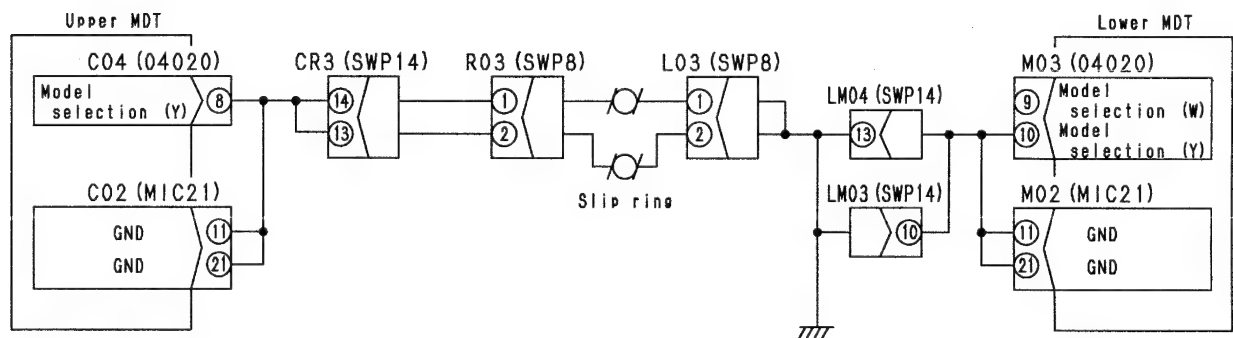
Table 1

Connector	Voltage (V)
Between C04 (9) and C02 (11), (21)	Max. 1 V
Between C04 (10) and C02 (11), (21)	Max. 1 V
Between C04 (19) and C02 (11), (21)	15 - 30 V
Between C04 (20) and C02 (11), (21)	15 - 30 V

Table 2

Connector	Voltage (V)
Between M03 (9) and M02 (11),(21)	Max. 1 V
Between M03 (10) and M02 (11),(21)	Max. 1 V
Between M03 (19) and M02 (11),(21)	15 - 30 V
Between M03 (20) and M02 (11),(21)	15 - 30 V

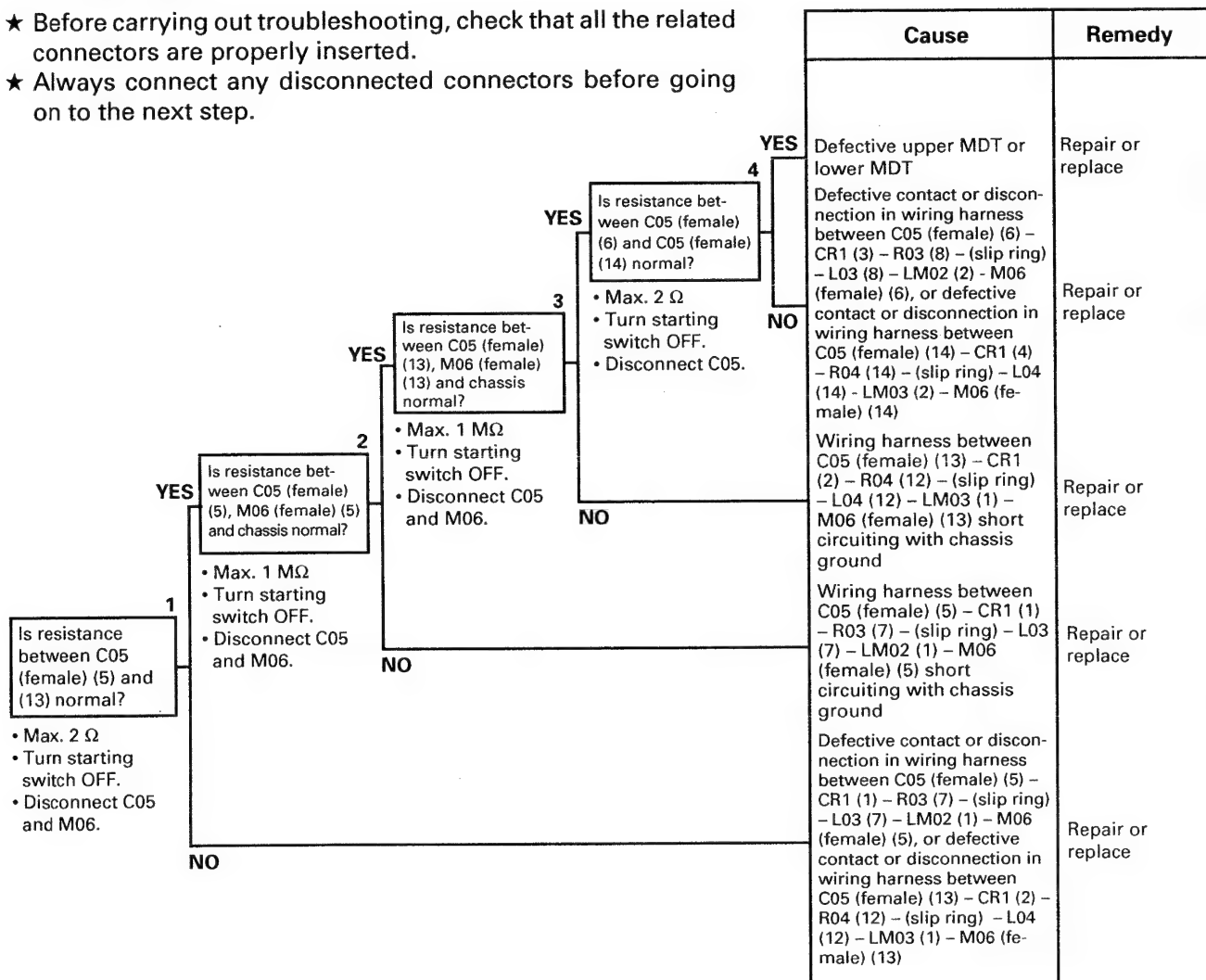
EU-7 Related electric circuit diagram



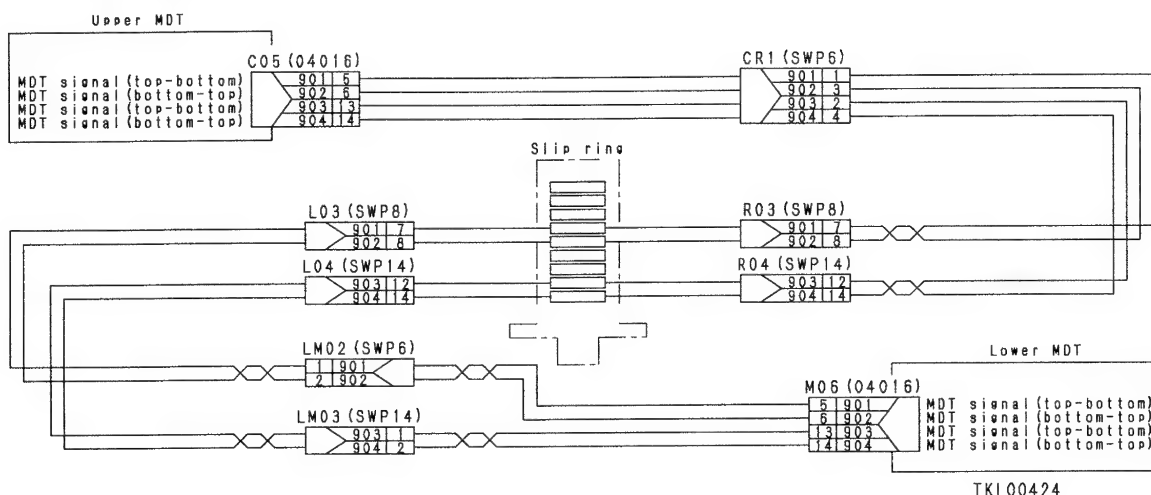
TKL00423

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Cause	Remedy



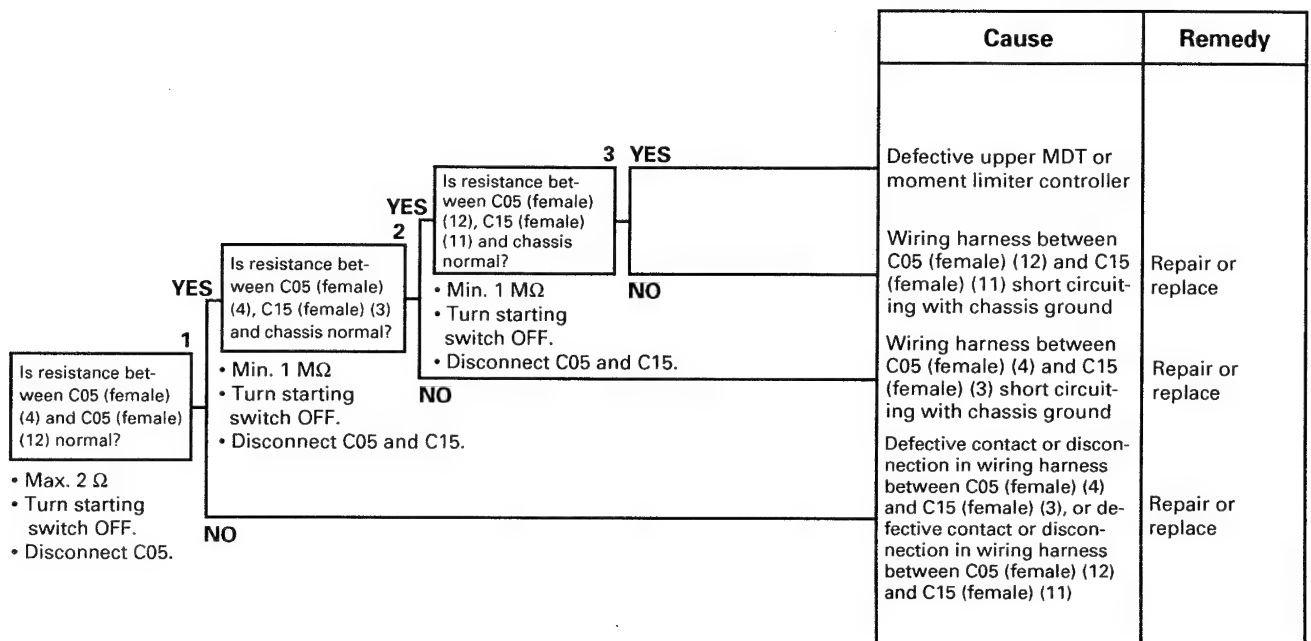
EU-8 Related electric circuit diagram



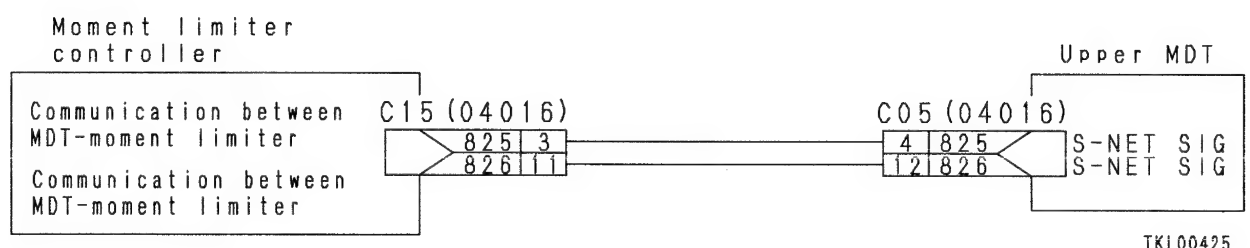
023S02

EU-9 MDTU error E29 (Abnormality in S-NET communication between MDT and moment limiter) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error is also detected as OSS error E20.

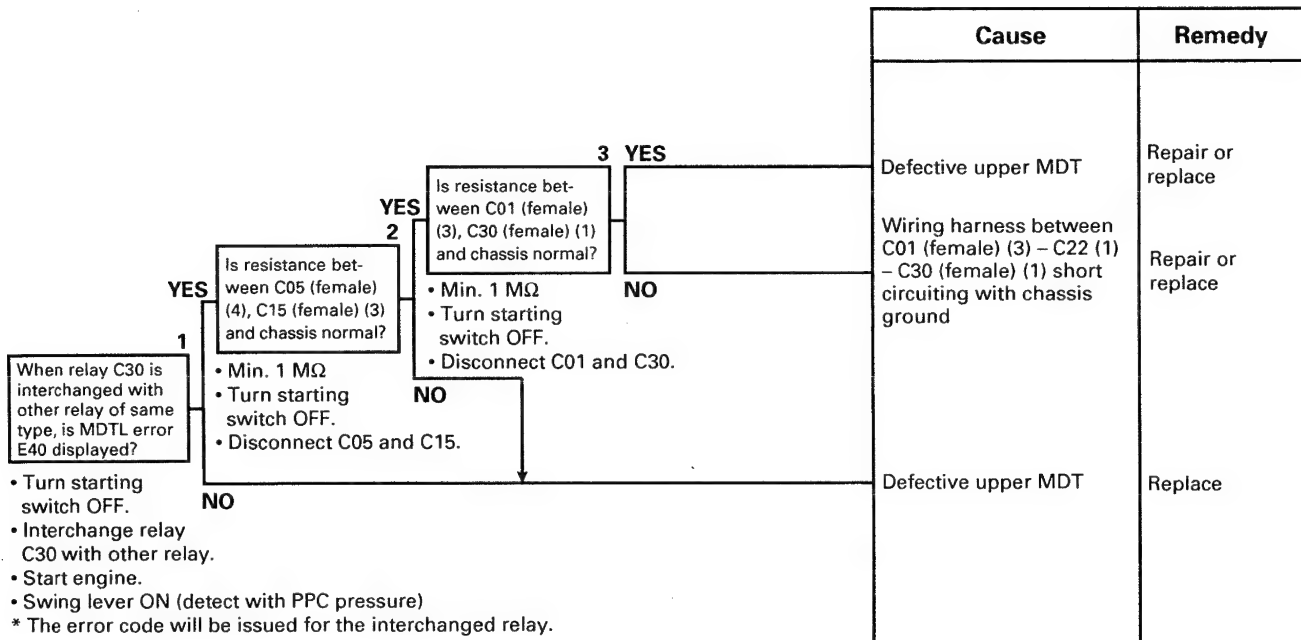


EU-9 Related electric circuit diagram

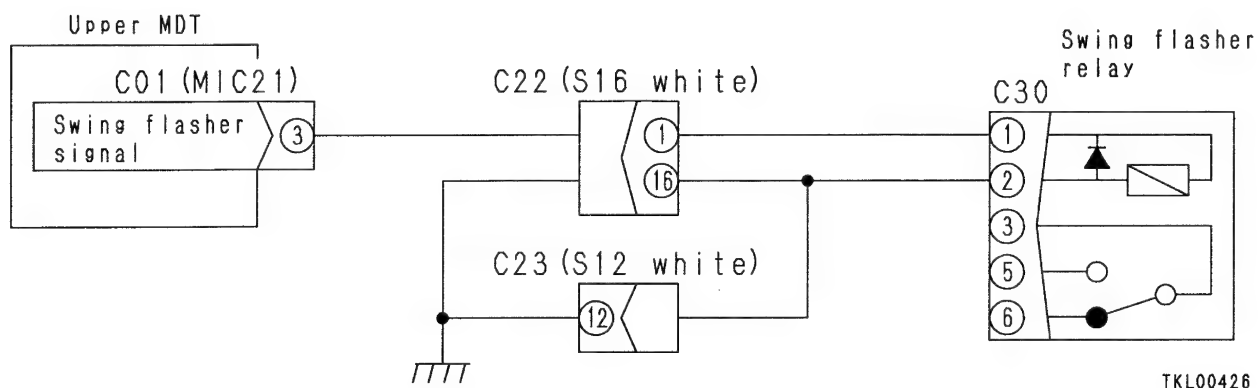


EU-10 MDTU error E40 (Swing flasher output short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

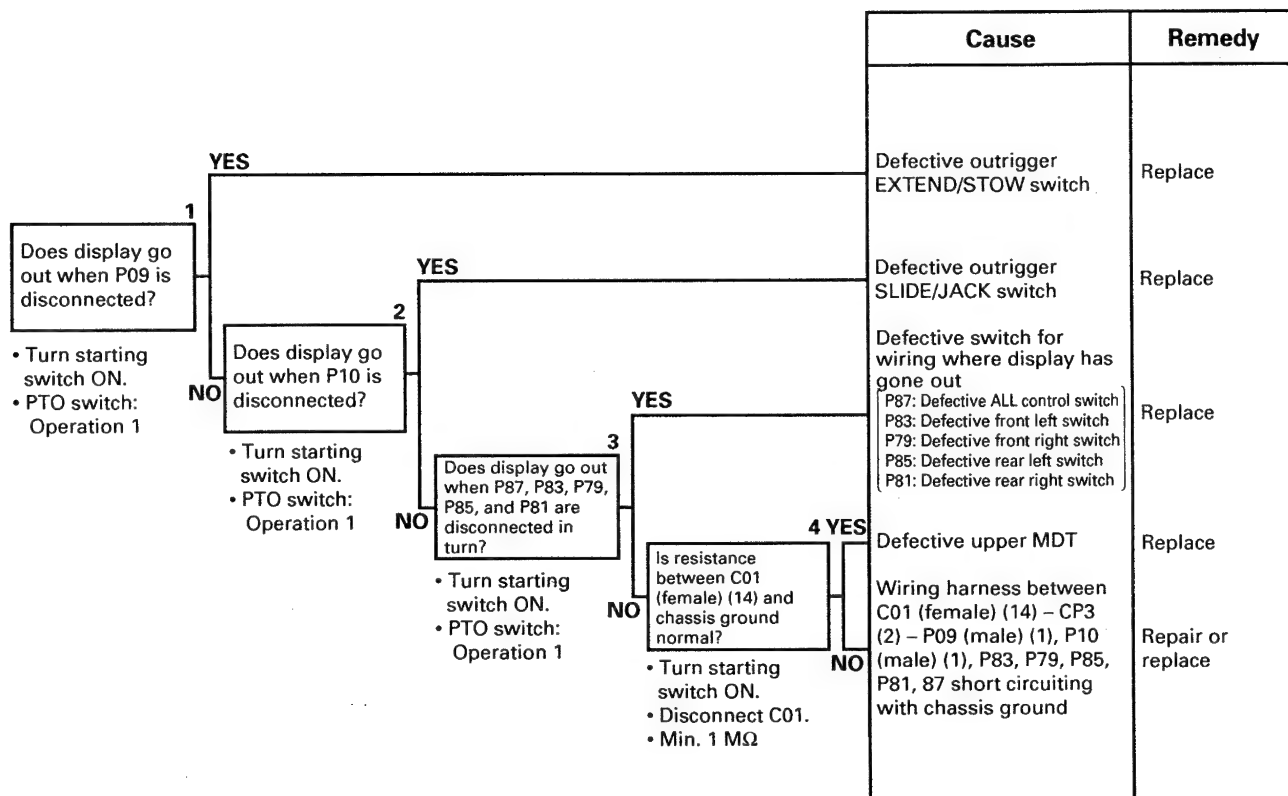


EU-10 Related electric circuit diagram

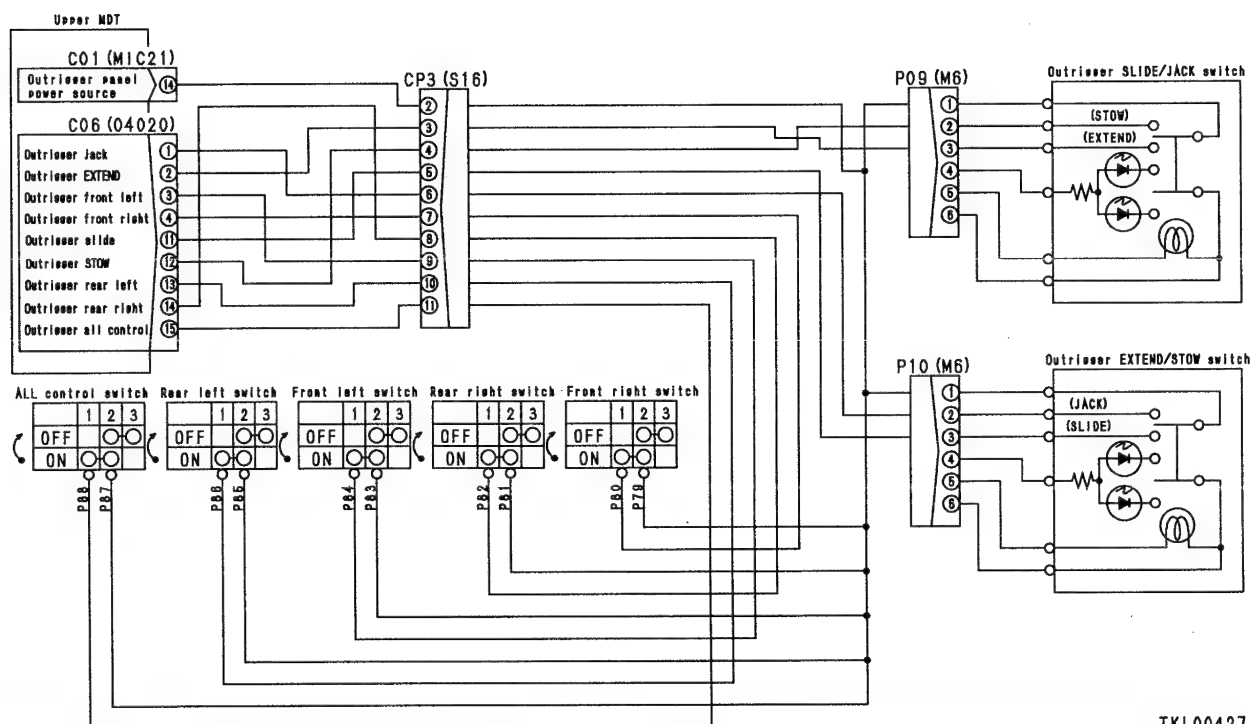


EU-11 MDTU error E41 (Power source for outrigger panel short circuited with ground) is displayed

- ★ Carry out troubleshooting in the outrigger mode (PTO switch: Operation 1).
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



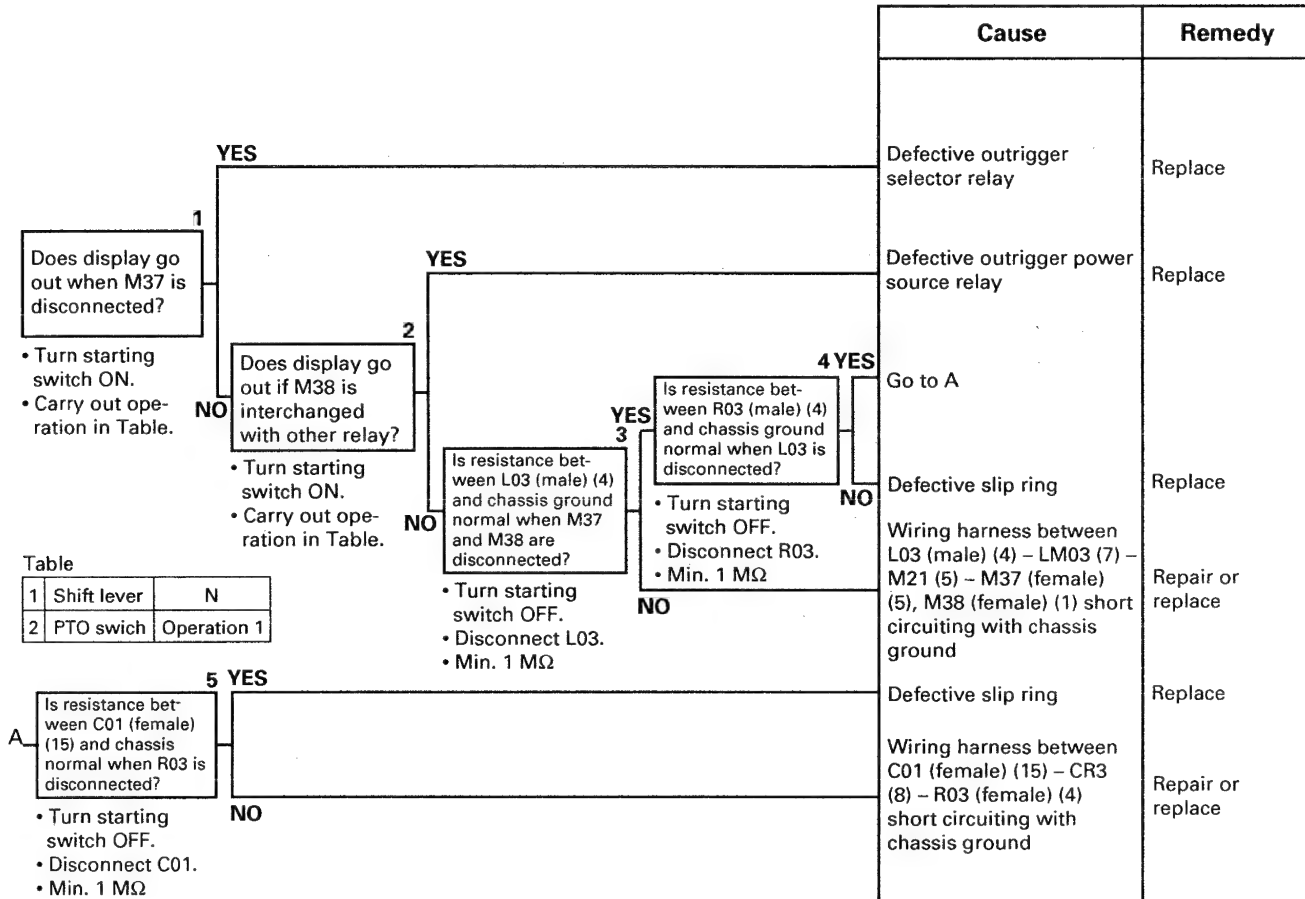
EU-11 Related electric circuit diagram



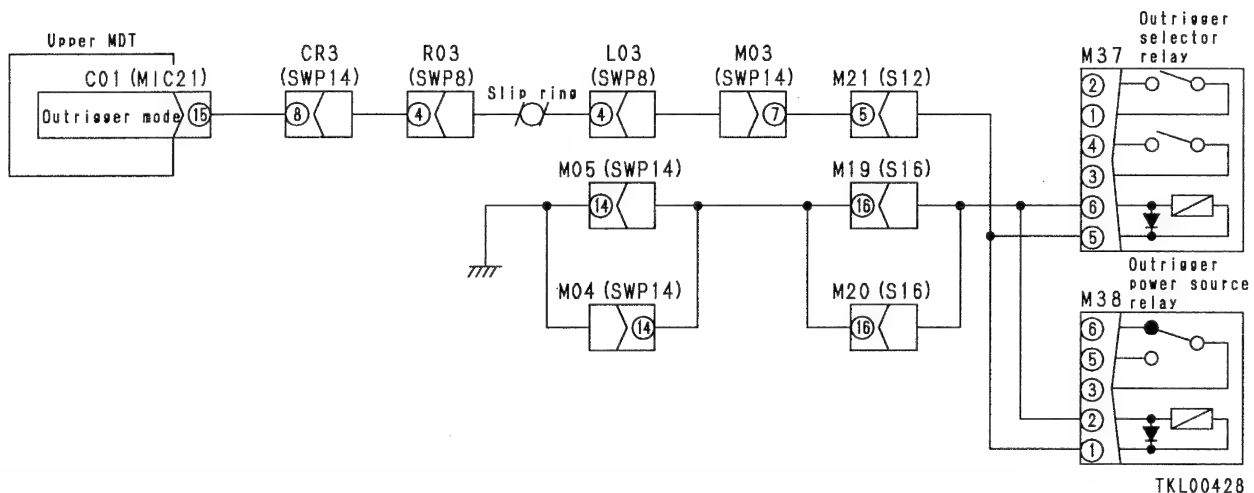
TKL00427

EU-13 MDTU error E43 (Outrigger mode power source short circuited with ground) is displayed

- ★ Carry out troubleshooting in the outrigger mode (PTO switch: Operation 1).
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EU-13 Related electric circuit diagram



EU-14

MDTU error E44 (Crab mode display LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

Is resistance between C01 (female) (5) and GND normal?

• Min. 1 MΩ

• Turn starting switch OFF.

• Disconnect C01 and P29.

NO

Cause

Defective steering mode switch or defective upper MDT

Wiring harness between C01 (female) (5) – CP5 (6) – P29 (male) (7) short circuiting with chassis ground

Remedy

Repair or replace

Repair or replace

EU-15

MDTU error E45 (Front wheel mode display LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

Is resistance between C01 (female) (16) and GND normal?

• Min. 1 MΩ

• Turn starting switch OFF.

• Disconnect C01 and P29.

NO

Cause

Defective steering mode switch or defective upper MDT

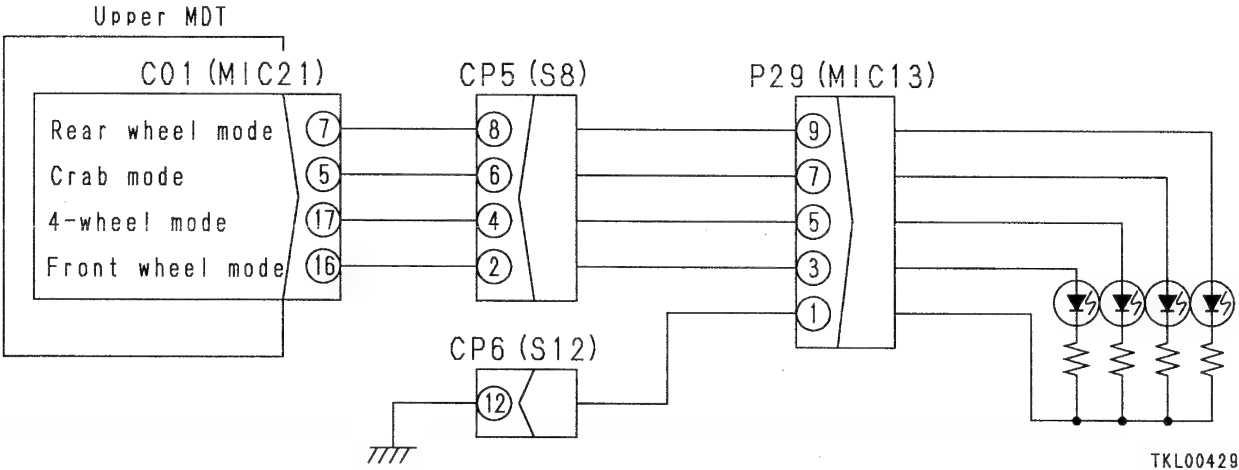
Wiring harness between C01 (female) (5) – CP5 (2) – P29 (male) (3) short circuiting with chassis ground

Remedy

Replace

Repair or replace

EU-14, 15 Related electric circuit diagram



EU-16 MDTU error E46 (Rear wheel mode display LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

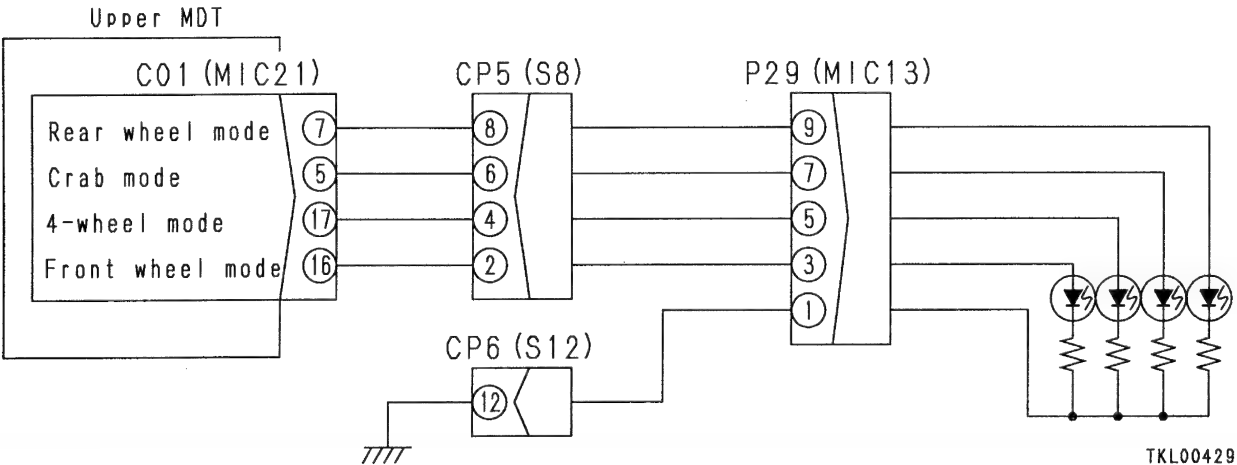
		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between C01 (female) (7) and GND normal?</div> <div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C01 and P29.</div> </div> </div>		Defective steering mode switch or defective upper MDT	Replace
		Wiring harness between C01 (female) (7) – CP5 (8) – P29 (male) (9) short circuiting with chassis ground	Repair or replace

EU-17 MDTU error E47 (4-wheel mode display LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

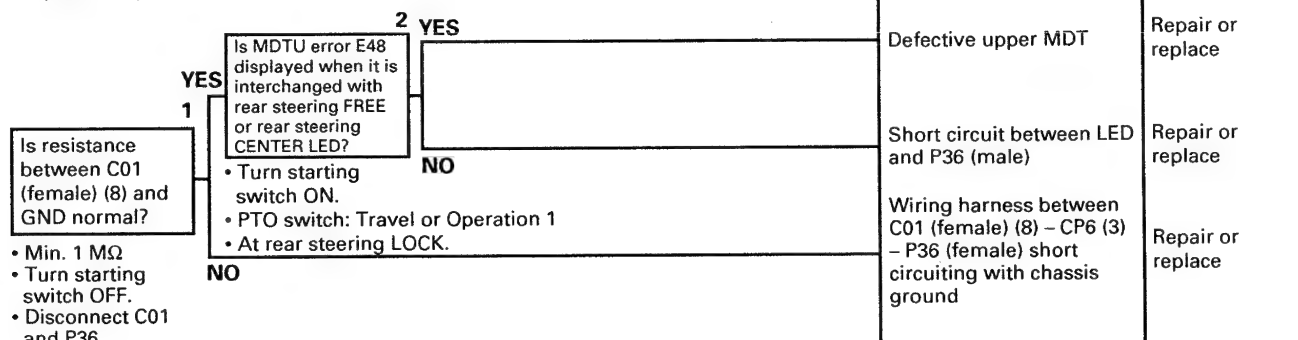
		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between C01 (female) (17) and GND normal?</div> <div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C01 and P29.</div> </div> </div>		Defective steering mode switch or defective upper MDT	Replace
		Wiring harness between C01 (female) (17) – CP5 (4) – P29 (male) (5) short circuiting with chassis ground	Repair or replace

EU-16, 17 Related electric circuit diagram



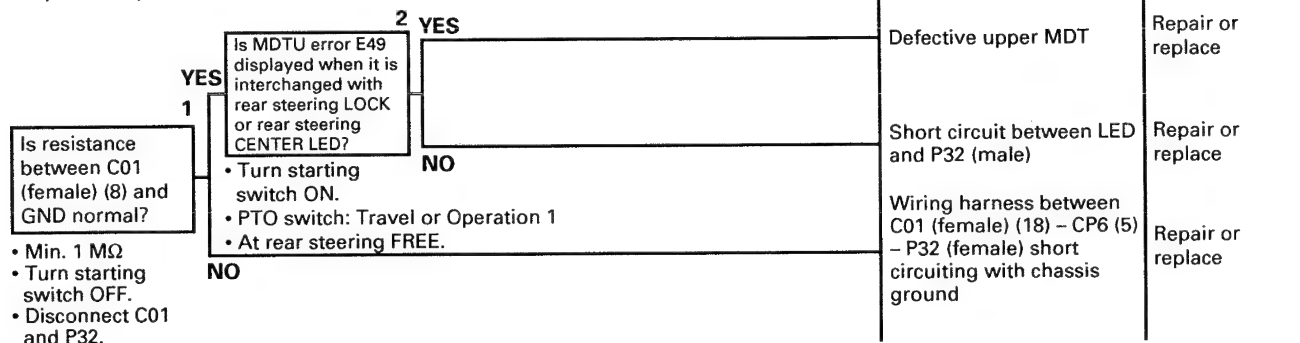
EU-18 MDTU error E48 (Rear steering [wheel] LOCK LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
 - ★ The error code is not displayed for the system where there is a disconnection, so check for defective contact or disconnection in the wiring harness between C01 (female) (8) - CP6 (3) - P36 (female).
- | Cause | Remedy |
|-------|--------|
| | |

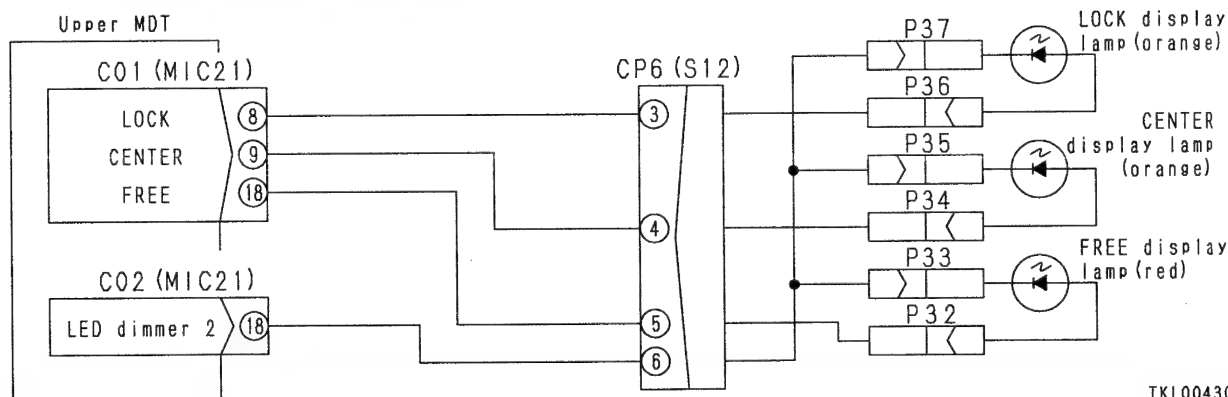


EU-19 MDTU error E49 (Rear steering [wheel] FREE LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
 - ★ The error code is not displayed for the system where there is a disconnection, so check for defective contact or disconnection in the wiring harness between C01 (female) (18) - CP6 (5) - P32 (female).
- | Cause | Remedy |
|-------|--------|
| | |



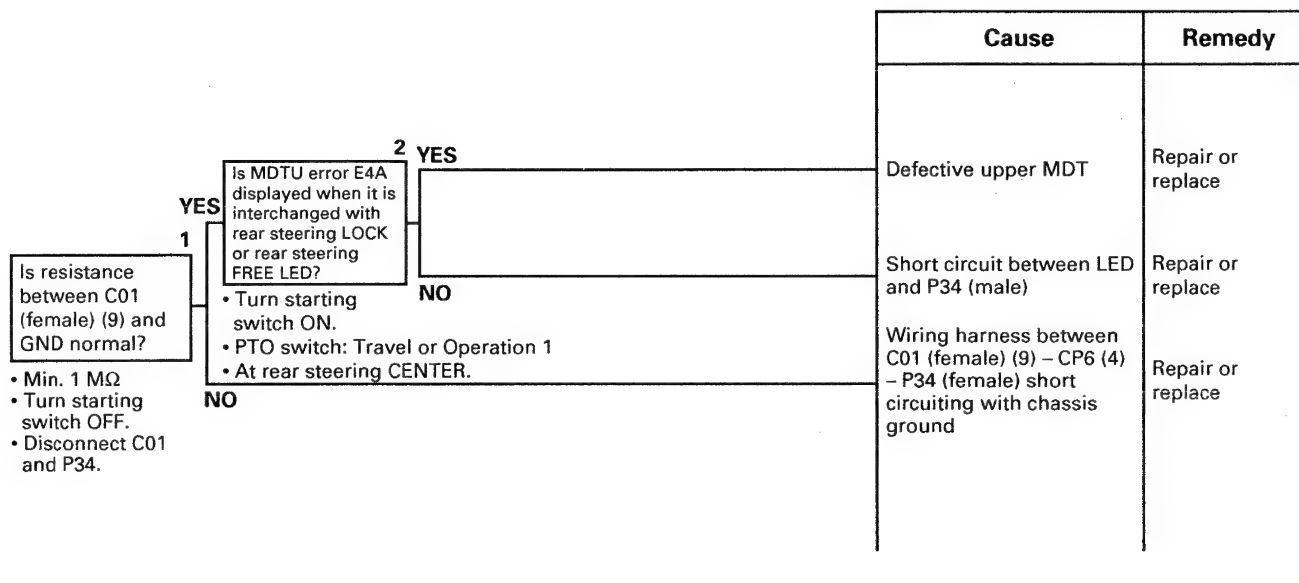
EU-18, 19 **Related electric circuit diagram**



TKL00430

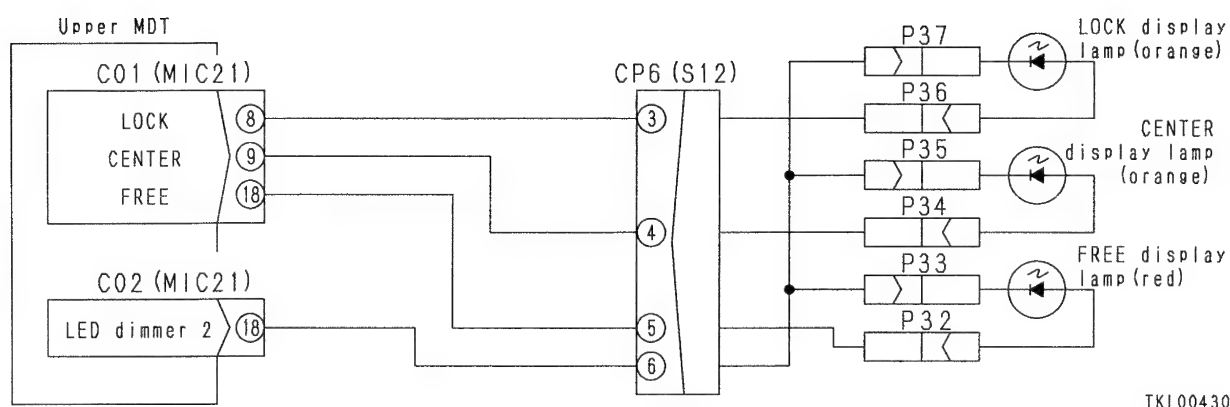
EU-20 MDTU error E4A (Rear steering [wheel] CENTER LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ The error code is not displayed for the system where there is a disconnection, so check for defective contact or disconnection in the wiring harness between C01 (female) (9) - CP6 (4) - P34 (female).



023S02

EU-20 Related electric circuit diagram

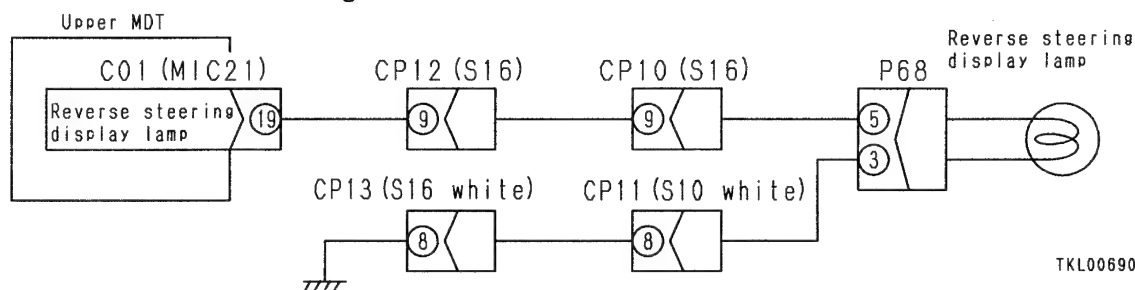


EU-21 MDTU error E4B (Reverse steering display LED short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ The error code is not displayed for the system where there is a disconnection, so check for defective contact or disconnection in the wiring harness between C01 (female) (19) - CP10 (9) - P68 (female) (5).

		Cause	Remedy
<p>1 YES</p> <p>Is resistance between C01 (female) (19) and GND normal?</p> <ul style="list-style-type: none"> • Min. 1 MΩ • Turn starting switch OFF. • Disconnect C01 and P68. 	<p>2 YES</p> <p>Does MDTU error E4B go out when P68 is disconnected?</p> <p>NO</p> <ul style="list-style-type: none"> • Disconnect P68. • Turn starting switch ON. • PTO switch: Travel or Operation 1 • In reverse steering. 	Defective upper MDT	Repair or replace
		Short circuit between P68 (male) (3) and (5) (defective reverse steering display lamp)	Repair or replace
		Wiring harness between C01 (female) (19) - CP12 (9) - C010 (9) - P68 (female) (5) short circuiting with chassis ground	Repair or replace

EU-21 Related electric circuit diagram

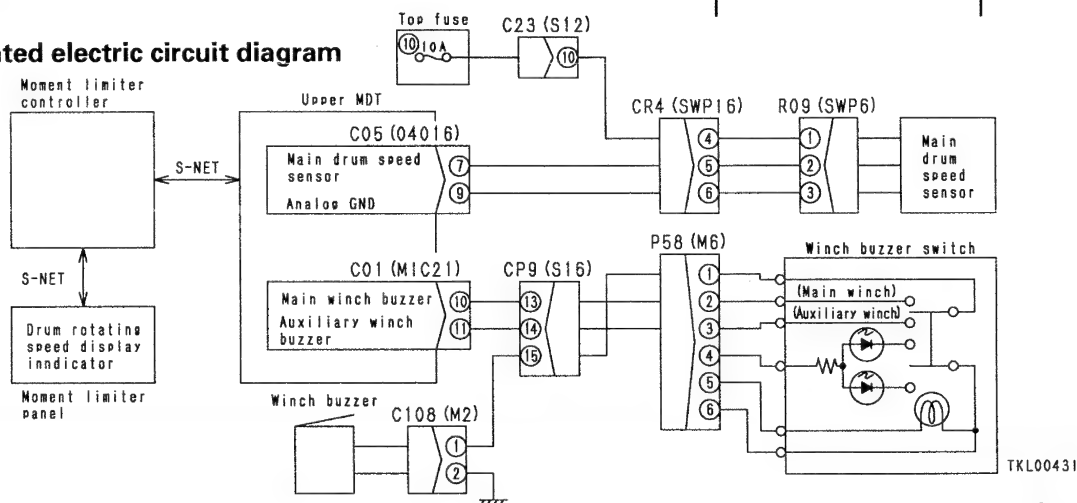


EU-22 MDTU error E4C (Winch rotation buzzer (main winch) short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

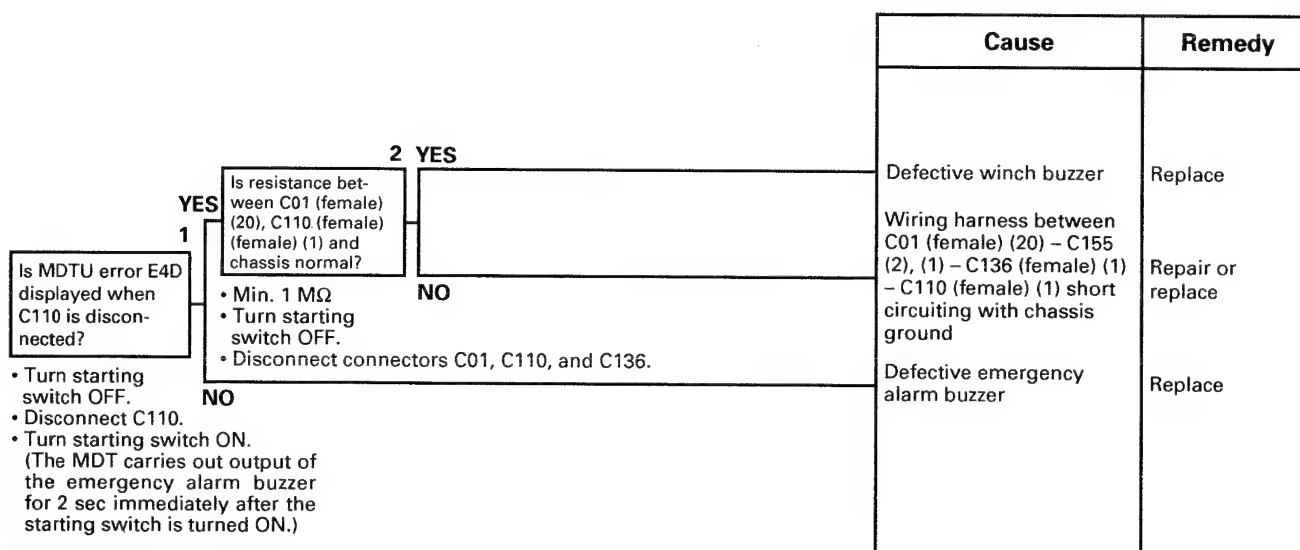
		Cause	Remedy
<p>1 YES</p> <p>Is resistance between C01 (female) (10) and chassis ground normal?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Winch buzzer switch: Main • Disconnect C01 and C108. • Min. 1 MΩ 	<p>2 YES</p> <p>Does MDTU error E4C go off when winch buzzer is disconnected?</p> <p>NO</p> <ul style="list-style-type: none"> • Disconnect C108. • Engine at low idling • Carry out fine control of main winch. 	Defective winch buzzer	Replace
		Defective upper MDT	Replace
		Wiring harness between C01 (female) (19) - CP12 (9) - C010 (9) - P68 (female) (5) short circuiting with chassis ground	Repair or replace

EU-22 Related electric circuit diagram



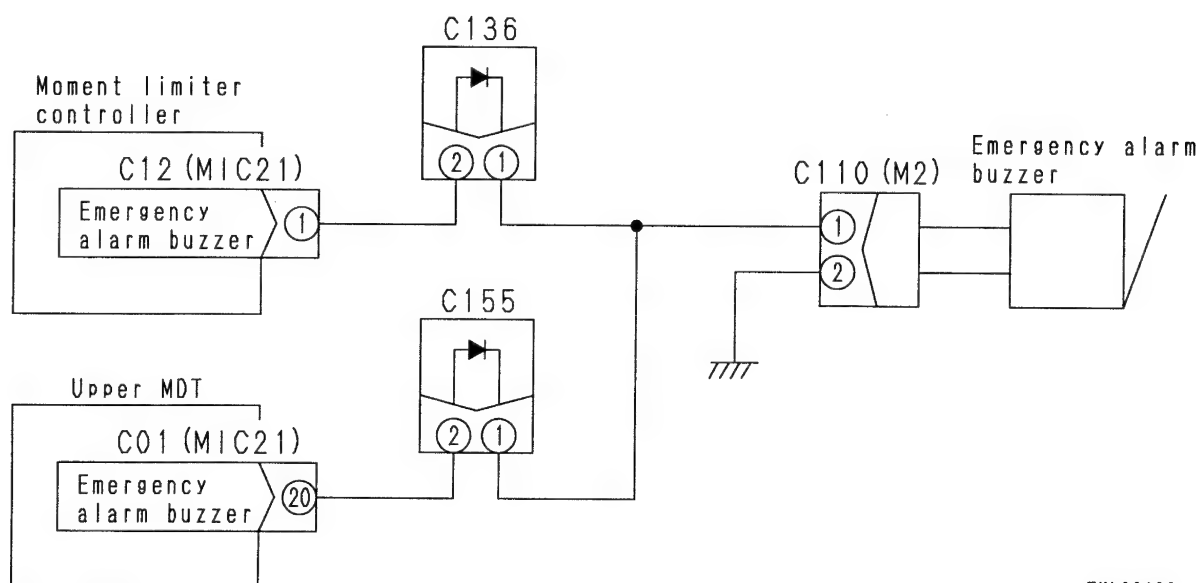
EU-23 MDTU error E4D (Emergency alarm buzzer short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

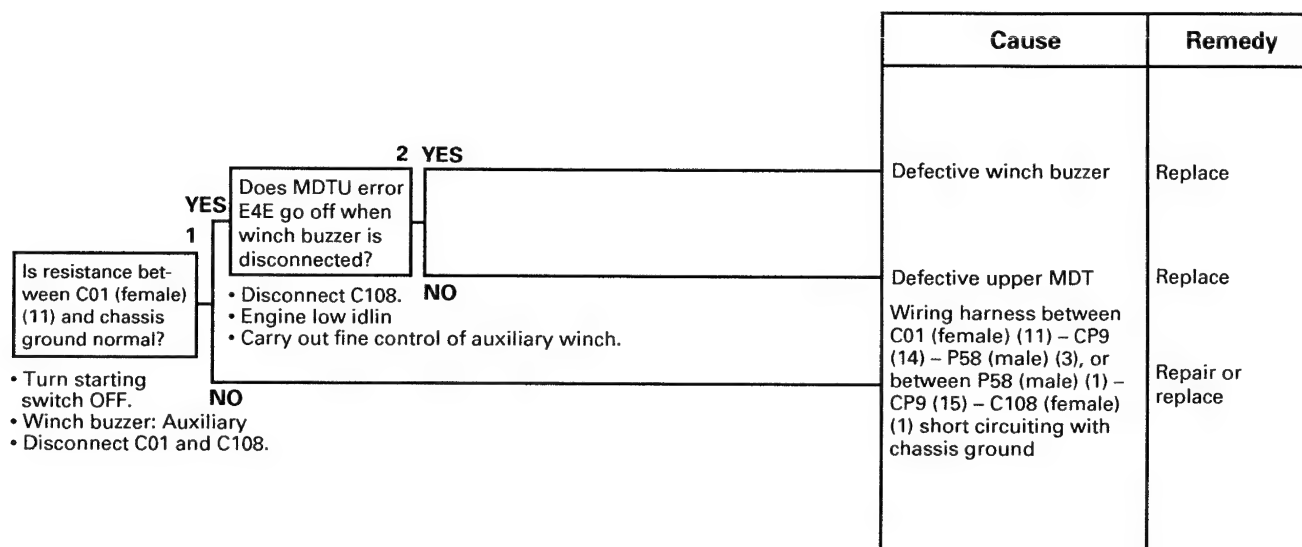
EU-23 Related electric circuit diagram



TKL00432

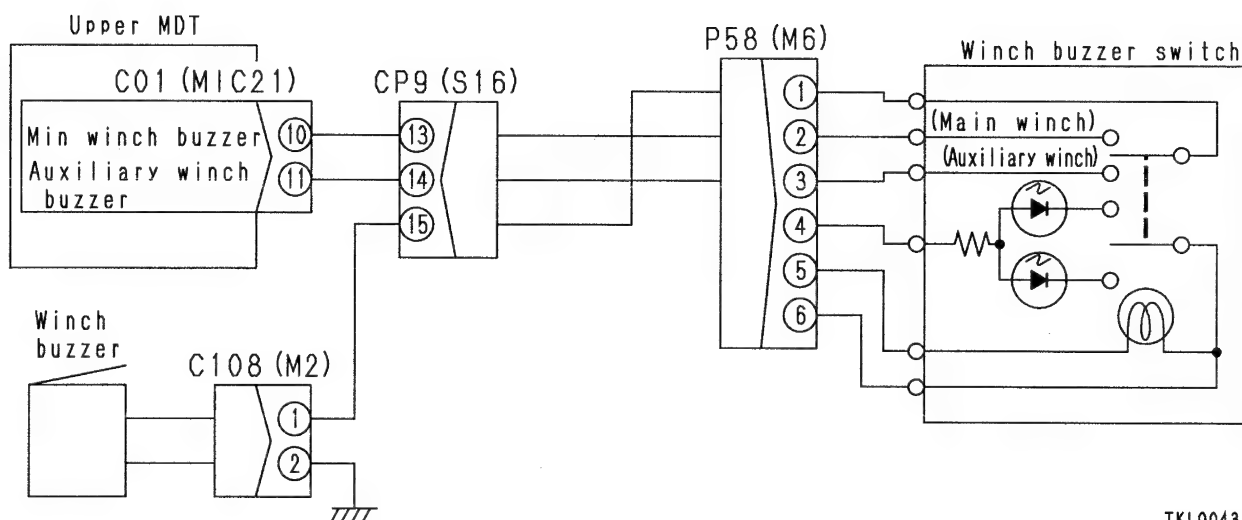
EU-24 MDTU error E4E (Winch rotation buzzer (auxiliary winch) short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EU-24 Related electric circuit diagram



TKL00433

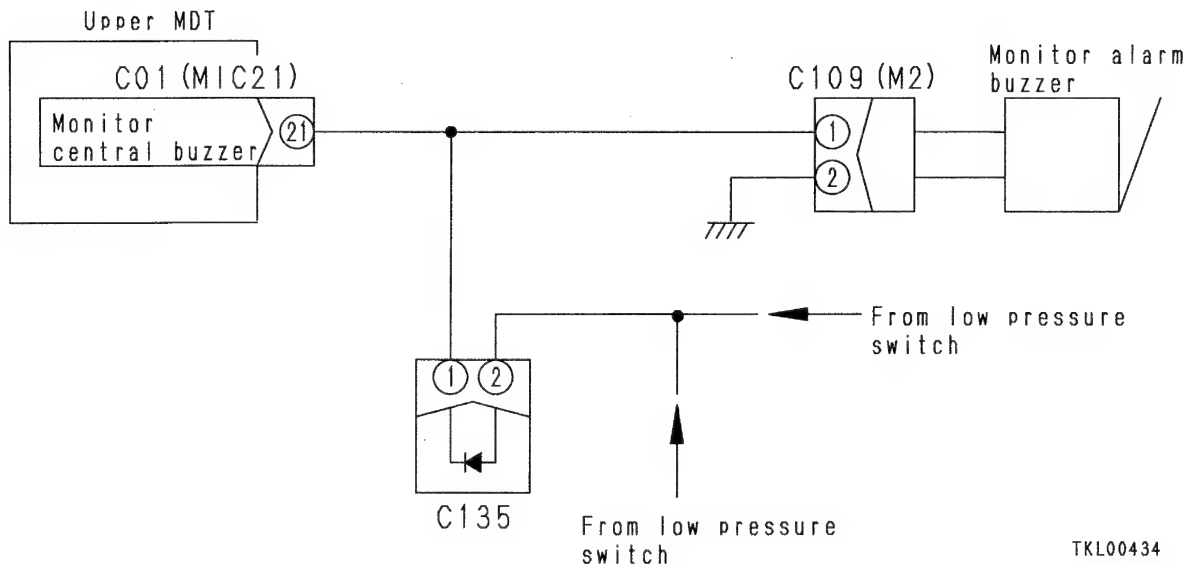
EU-25 MDTU error E4F (Monitor central buzzer short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Check that the fuse is normal before carrying out troubleshooting.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div><div>Is MDTU error E4F displayed when C109 is disconnected?</div><div>1</div><div>YES</div><div><div>Is resistance between C01 (female) (21), C109 (female) (1) and chassis normal?</div><div>2 YES</div><div></div><div>NO</div></div><div><div>• Min. 1 MΩ</div><div>• Turn starting switch OFF.</div><div>• Disconnect connectors C109, C01, and C135.</div></div><div>NO</div><div><div>• Turn starting switch OFF.</div><div>• Disconnect C109.</div><div>• Turn starting switch ON.</div><div>(The MDT carries out output of the monitor central buzzer for 1 sec immediately after the starting switch is turned ON.)</div></div></div>	Defective winch buzzer	Replace	
	Wiring harness between C01 (female) (21) – C135 (1) – C109 (female) (1) short circuiting with chassis ground	Repair or replace	
	Defective monitor central buzzer	Replace	

023S02

EU-25 Related electric circuit diagram

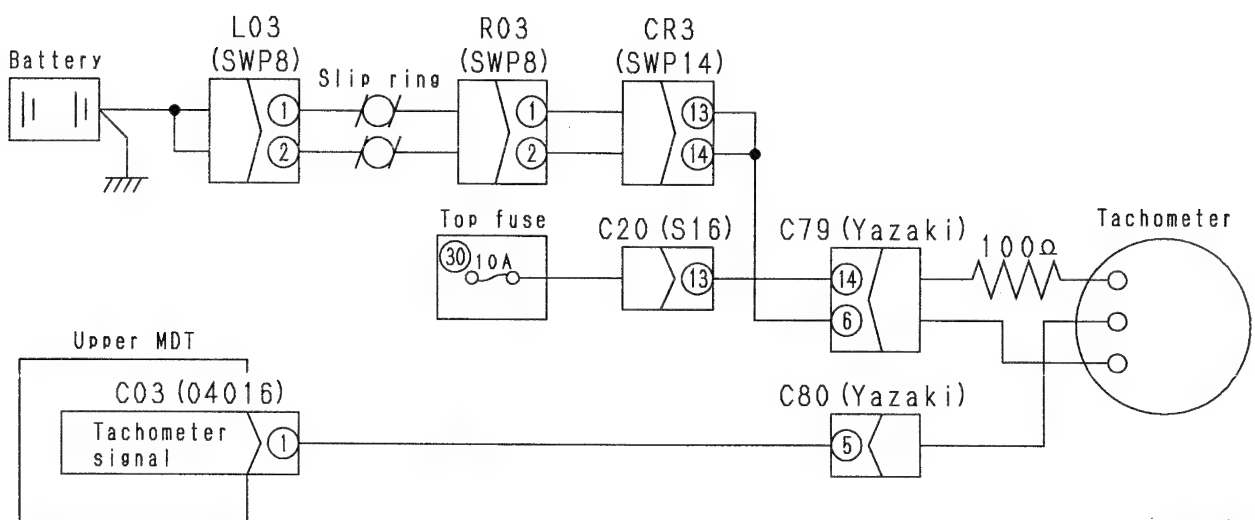


EU-26 MDTU error E50 (Tachometer signal output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<p>1</p> <p>Does display go out when C80 is disconnected?</p> <p>• Start engine.</p> <p>YES</p>	Defective tachometer	Replace
<p>NO</p> <p>2</p> <p>Is voltage between C80 (female) (5), C03 (female) (1) and chassis normal?</p> <p>YES</p>	Defective upper MDT	Replace
<p>NO</p> <p>• Max. 1 V</p> <p>• Disconnect C80 and C03.</p> <p>• Turn starting switch ON.</p>	Wiring harness between C03 (female) (1) and C80 (female) (5) short circuiting with power source	Repair or replace

EU-26 Related electric circuit diagram



TKL00435

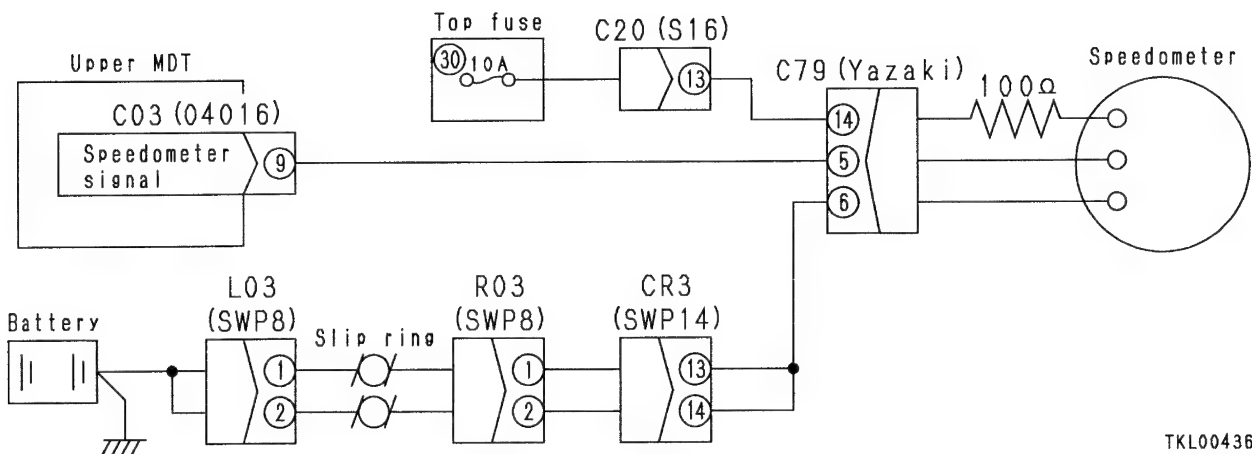
EU-27 MDTU error E51 (Speedometer signal output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1</div> <div>Does display go out when C79 is disconnected?</div> <div> <div>YES</div> <div> <div>Defective speedometer</div> <div>Replace</div> </div> </div> <div> <div>NO</div> <div> <div> <div>2</div> <div>Is voltage between C79 (female) (5), C03 (female) (9) and chassis normal?</div> <div> <div>YES</div> <div> <div>Defective upper MDT</div> <div>Replace</div> </div> </div> <div> <div>NO</div> <div> <div>Wiring harness between C03 (female) (9) and C79 (female) (5) short circuiting with power source</div> <div>Repair or replace</div> </div> </div> </div> </div> </div></div>	<div> <div> <div>• Raise the chassis from the ground with the outriggers and then operate the travel system.</div> <div> <div>• Max. 1 V</div> <div>• Disconnect C79 and C03.</div> <div>• Turn starting switch ON.</div> </div> </div> </div>		

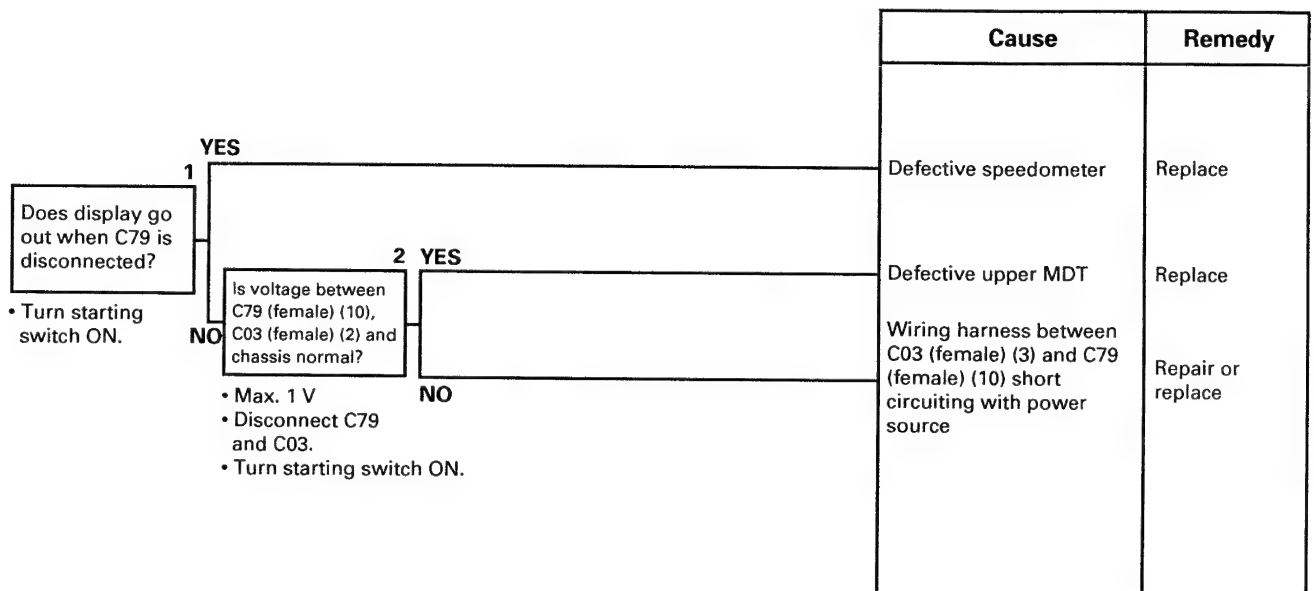
023S02

EU-27 Related electric circuit diagram



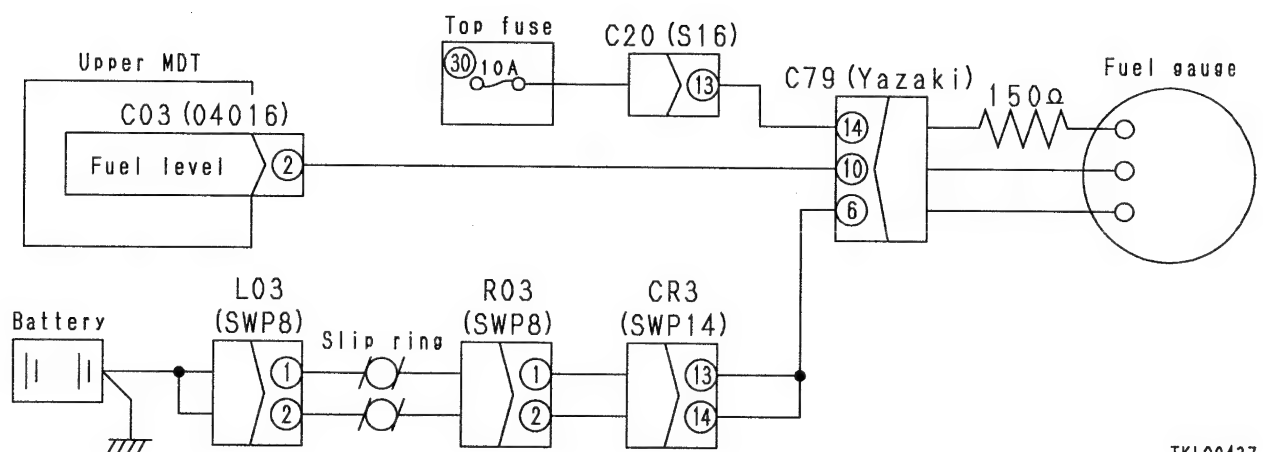
EU-28 MDTU error E52 (Fuel level signal output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

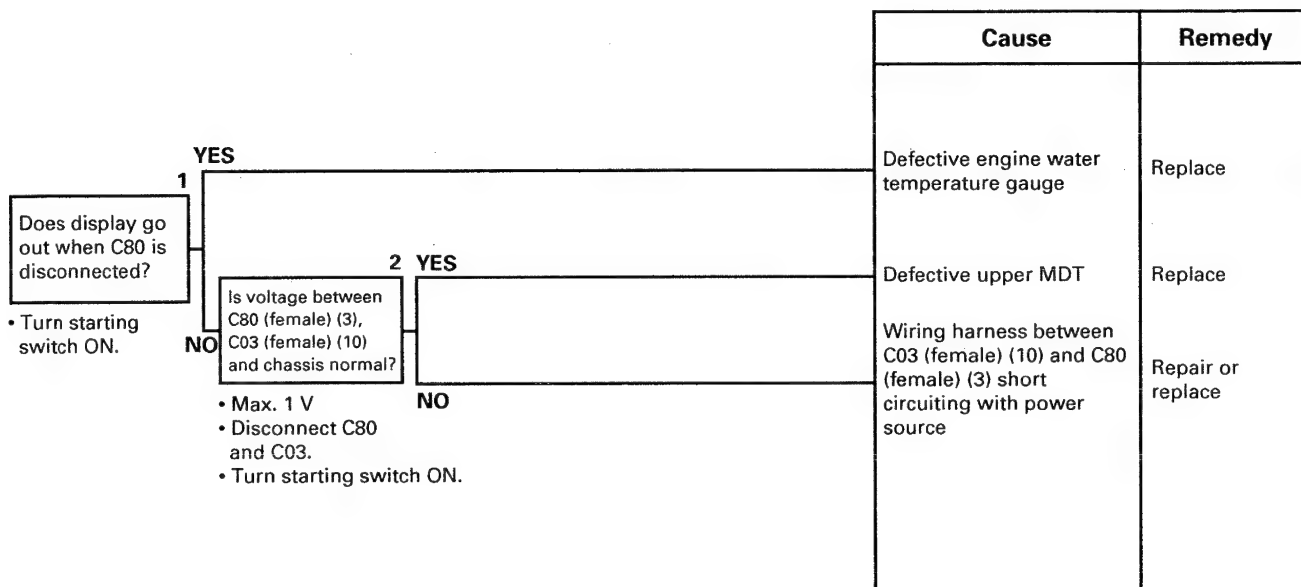
EU-28 Related electric circuit diagram



TKL00437

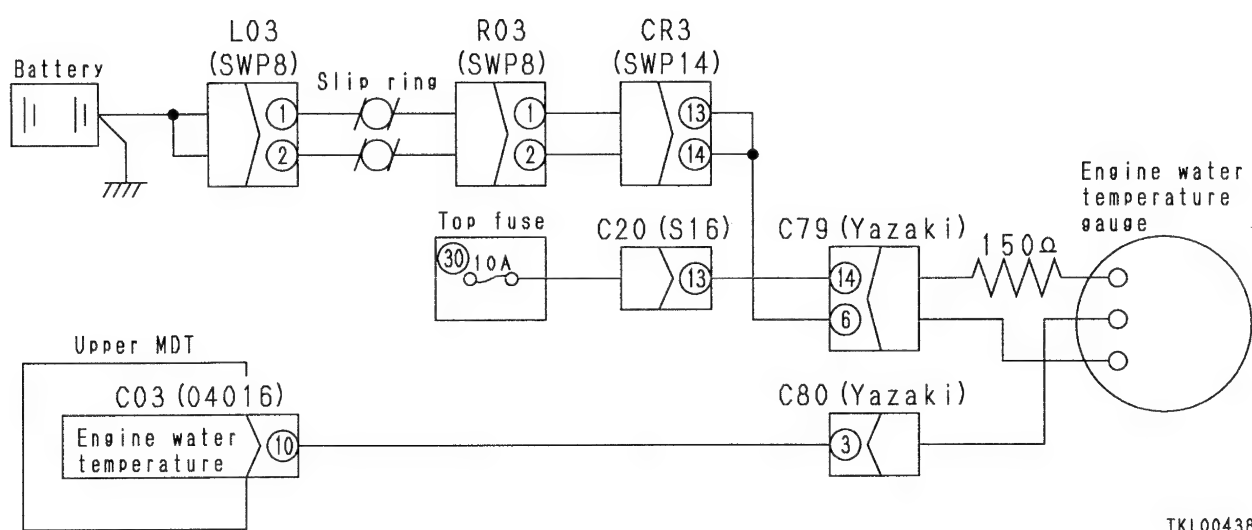
EU-29 MDTU error E53 (Engine water temperature signal output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



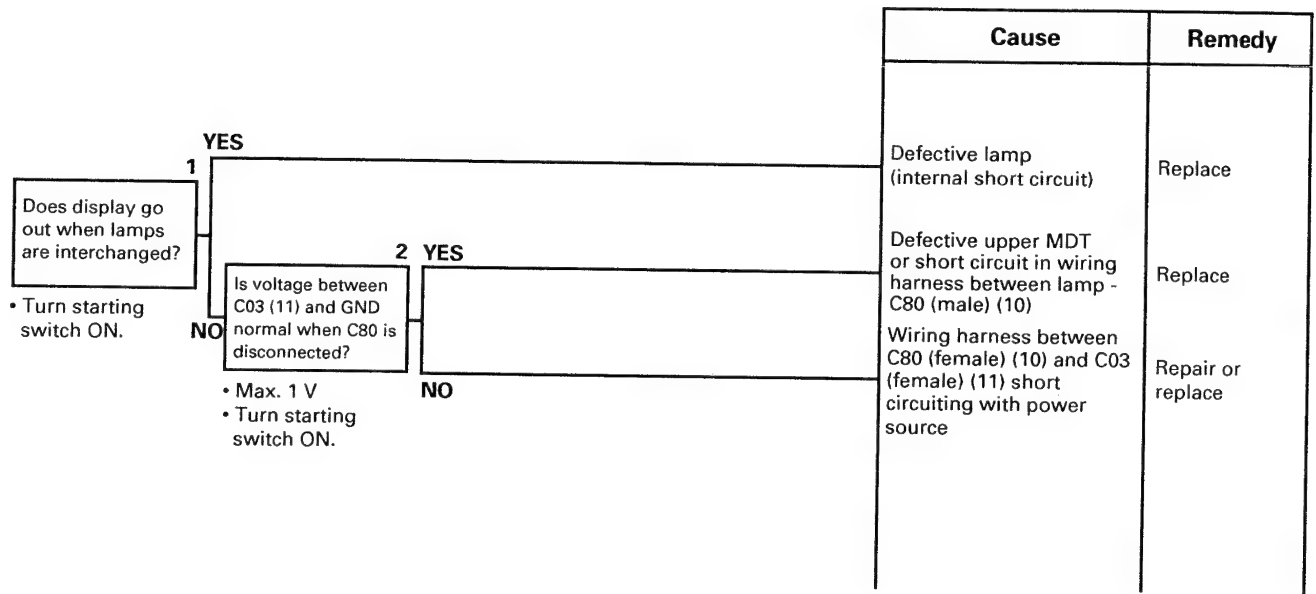
023S02

EU-29 Related electric circuit diagram



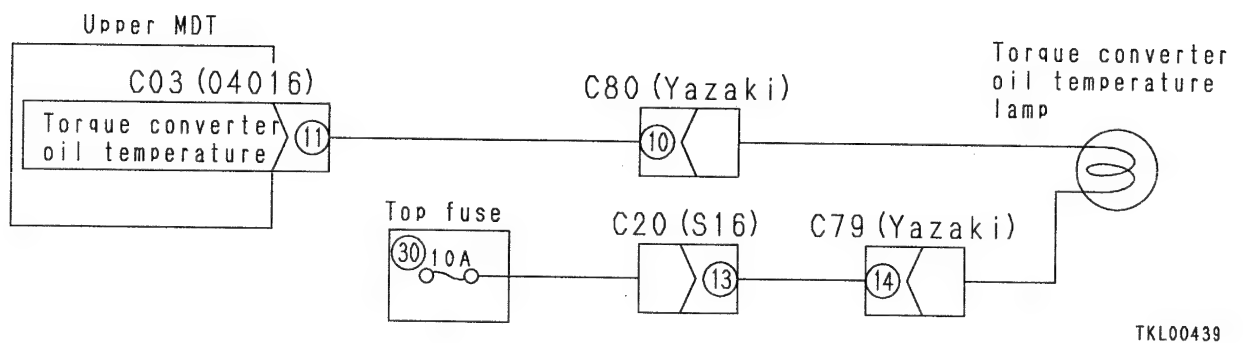
EU-30 MDTU error E55 (Torque converter oil temperature signal output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



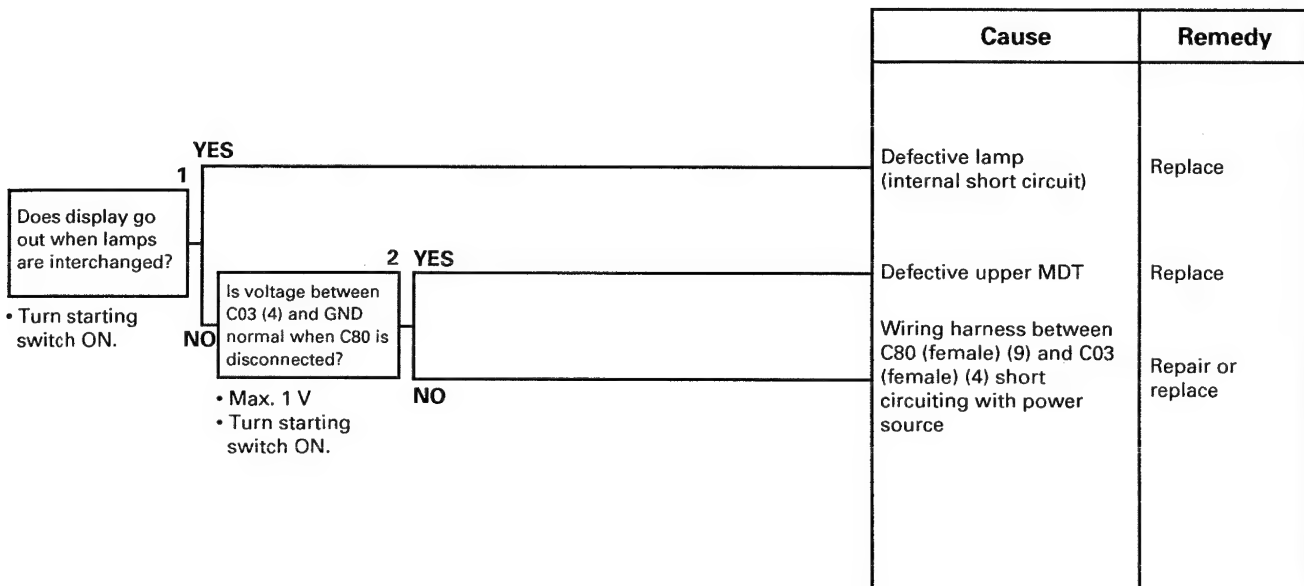
023S02

EU-30 Related electric circuit diagram



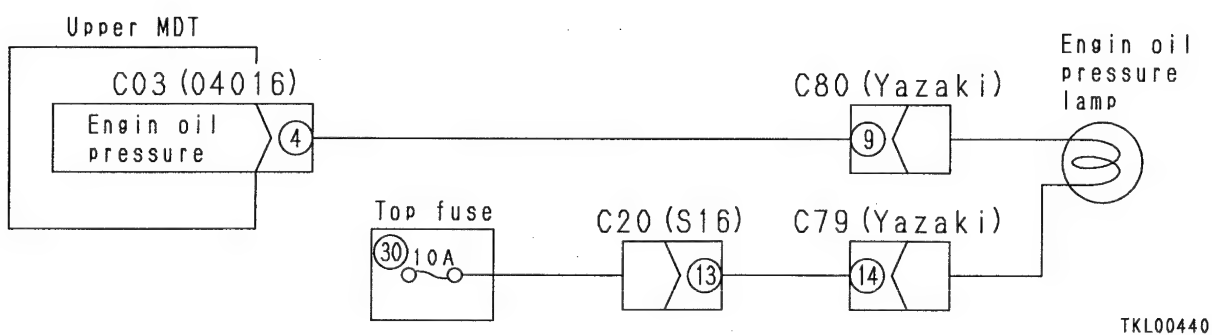
EU-31 MDTU error E56 (Engine oil pressure signal output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EU-31 Related electric circuit diagram



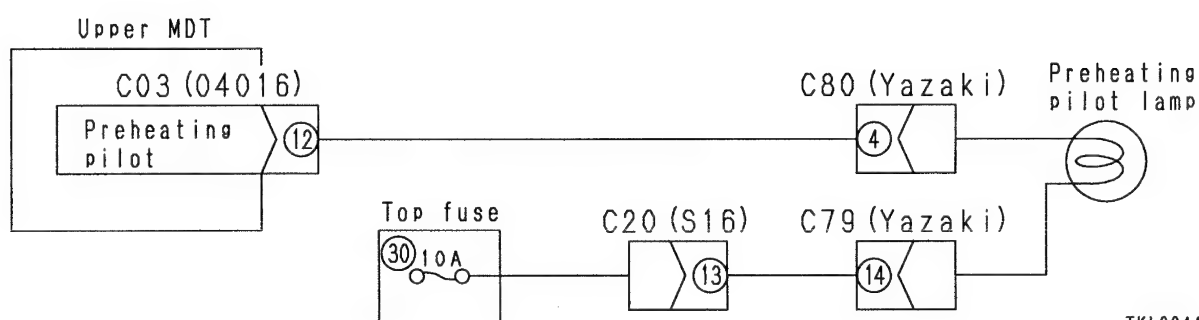
EU-32 MDTU error E57 (Preheating pilot signal output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Does display go out when lamps are interchanged?</p> <p>• Turn starting switch to HEAT.</p> <p>NO</p> <p>2 YES</p> <p>Is voltage between C03 (12) AND GND normal when C80 is disconnected?</p> <p>• Max. 1 V</p> <p>• Turn starting switch to HEAT.</p> <p>NO</p>	YES	Defective lamp (internal short circuit)	Replace
	YES	Defective upper MDT	Replace
	NO	Wiring harness between C80 (female) (4) and C03 (female) (12) short circuiting with power source	Repair or replace

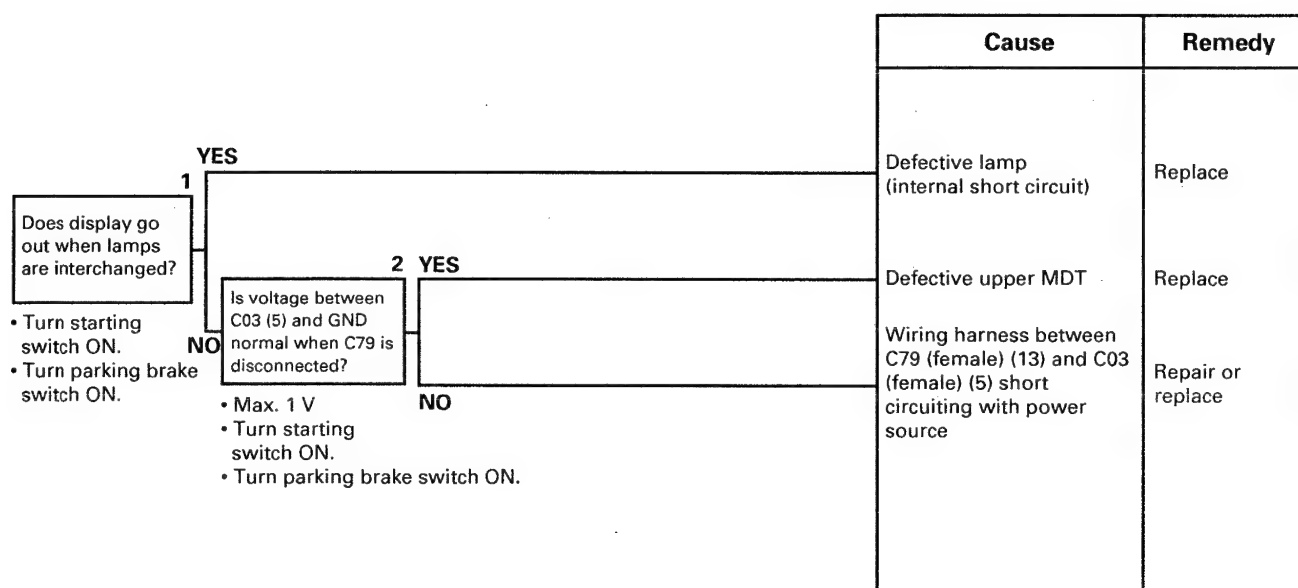
023S02

EU-32 Related electric circuit diagram



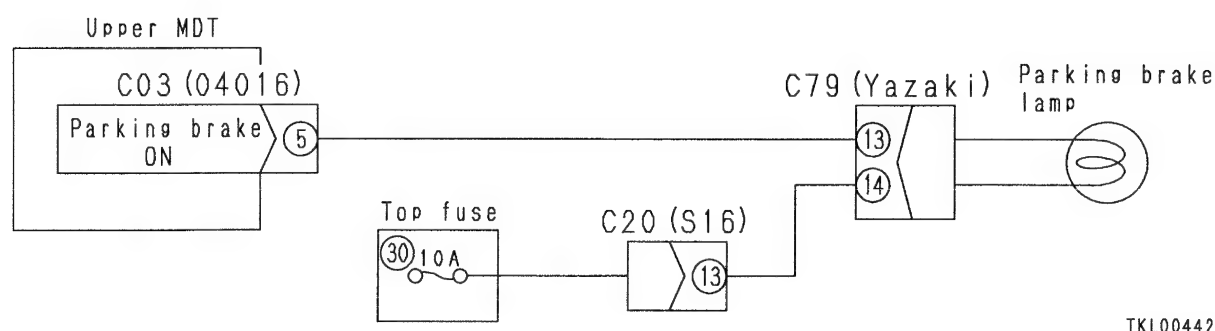
EU-33 MDTU error E58 (Parking brake actuation lamp output system short circuited) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EU-33 Related electric circuit diagram



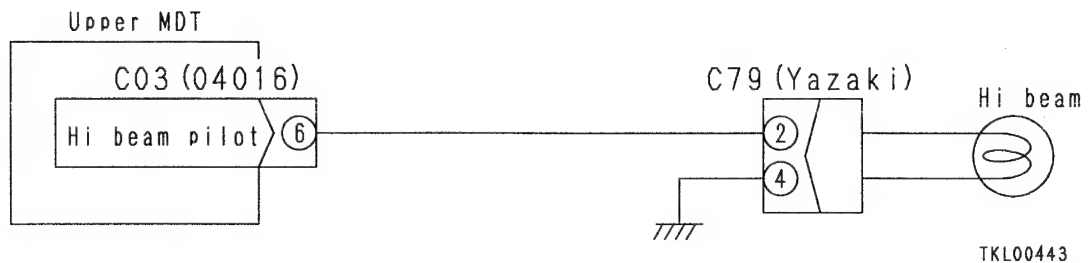
TKL00442

EU-35 MDTU error E5A (Hi beam pilot output system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ If the starting switch is turned OFF after the abnormality occurs, and the error code is not displayed on the monitor when the starting switch is turned ON again, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

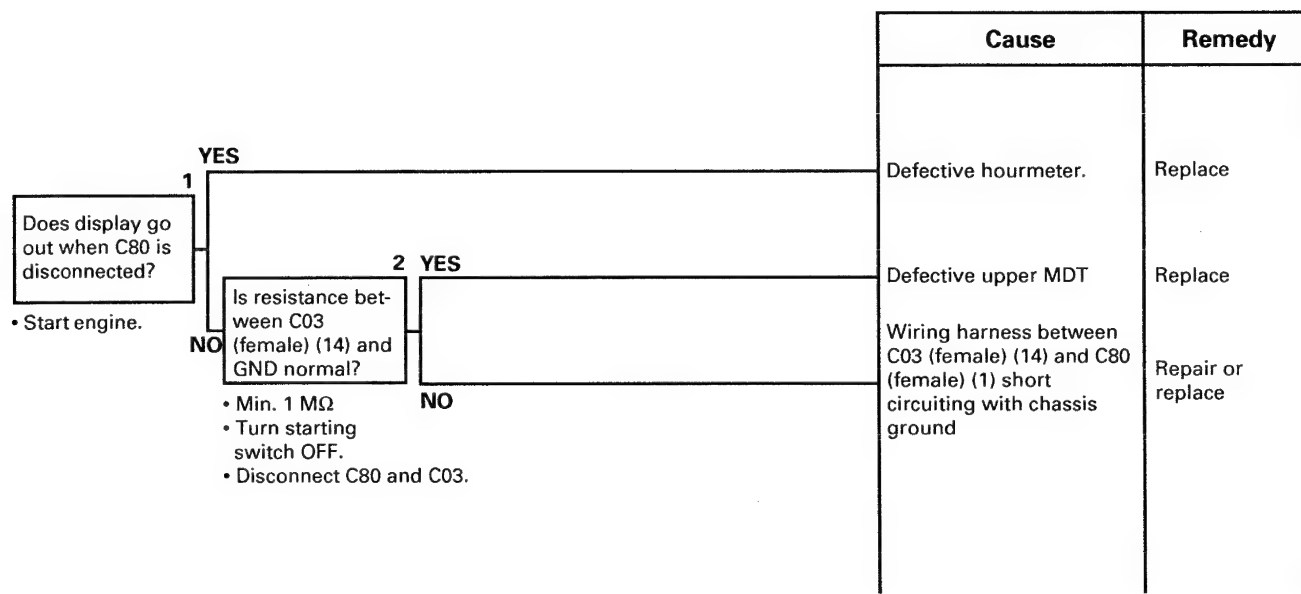
		Cause	Remedy
<div>Is MDTL error E5A displayed when C79 is disconnected?</div> <div>1</div> <div>YES</div> <div>NO</div> <div>2</div> <div>YES</div> <div>NO</div> <div>Is resistance between C03 (female) (6), C79 (female) (2) and chassis normal?</div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C03 and C79.</div> <div>• Turn starting switch OFF, then ON again.</div> <div>• Lamp switch stage 2: ON</div> <div>Dimmer switch pressed odd number of times (head lamp Hi)</div>	Defective upper MDT	Repair or replace	
	Wiring harness between C03 (female) (6) and C79 (female) (2) short circuiting with chassis ground	Repair or replace	
	Defective Hi beam pilot lamp	Replace	

EU-35 Related electric circuit diagram



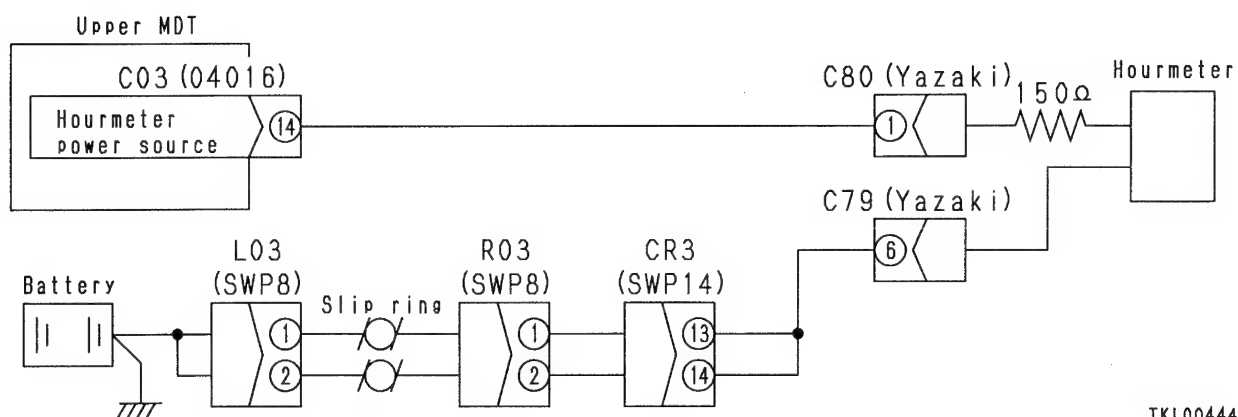
EU-36 MDTU error E5B (Hourmeter output system short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

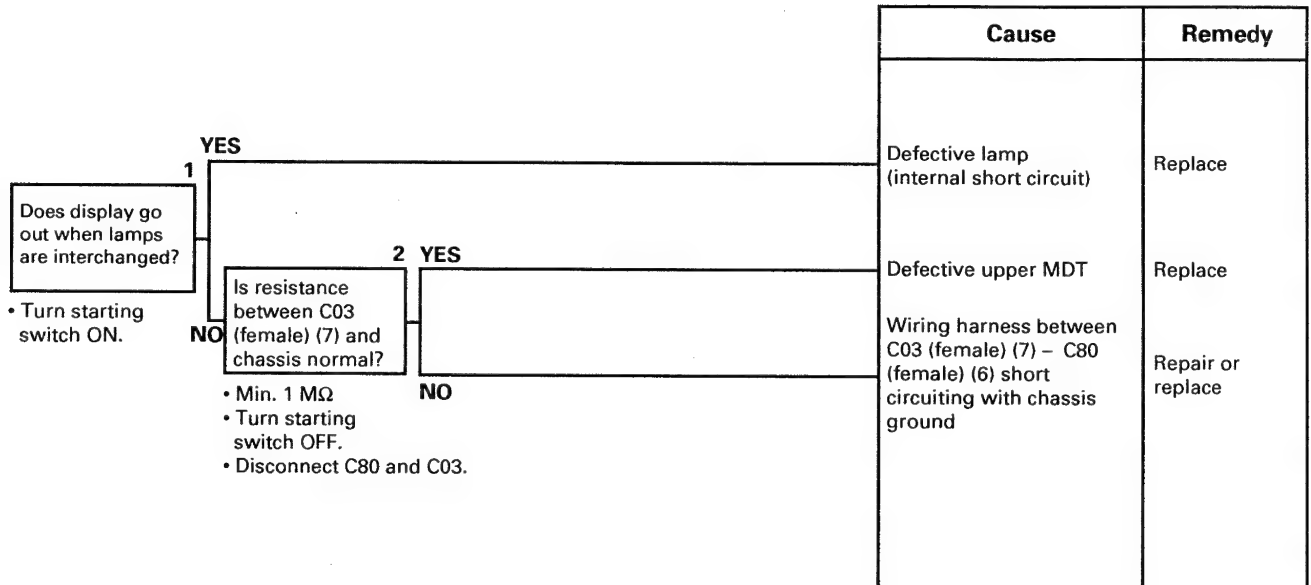
EU-36 Related electric circuit diagram



TKL00444

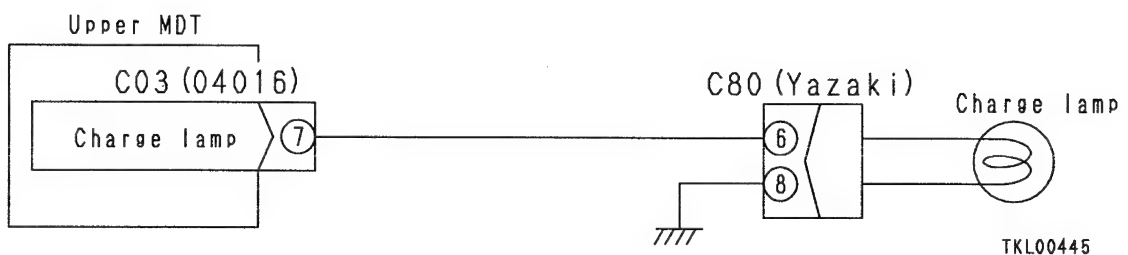
EU-37 MDTU error E5C (Charge lamp output system short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



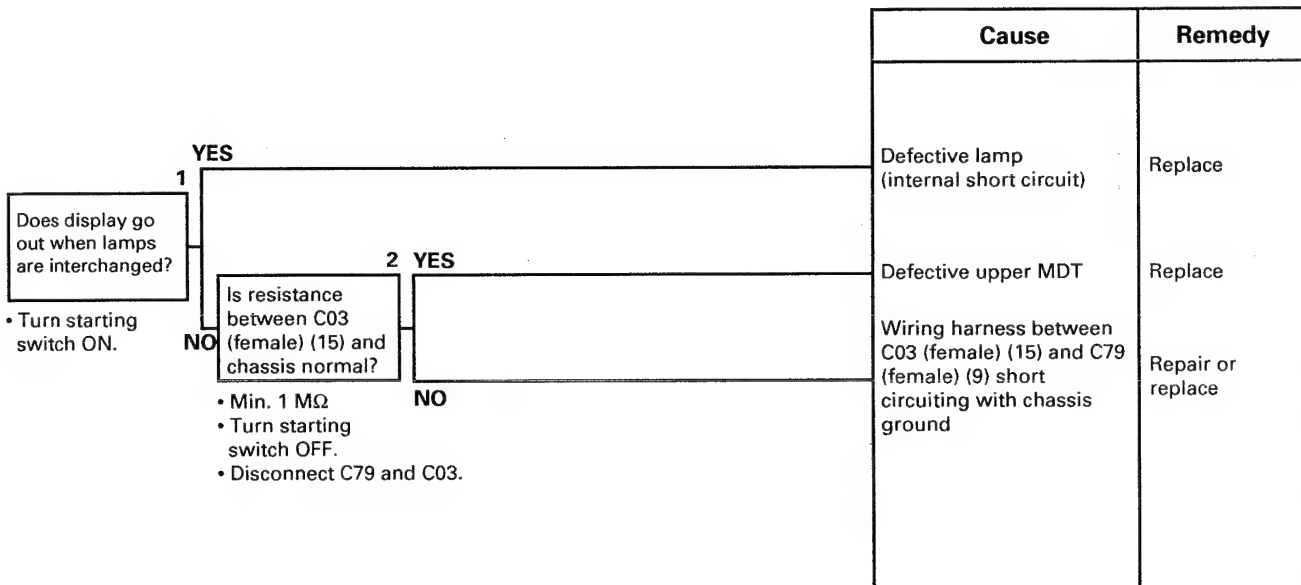
023S02

EU-37 Related electric circuit diagram

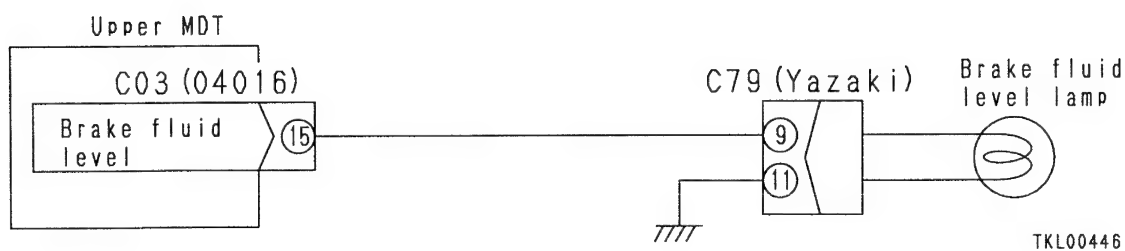


EU-38 MDTU error E5D (Brake fluid level [oil] level output system short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EU-38 Related electric circuit diagram

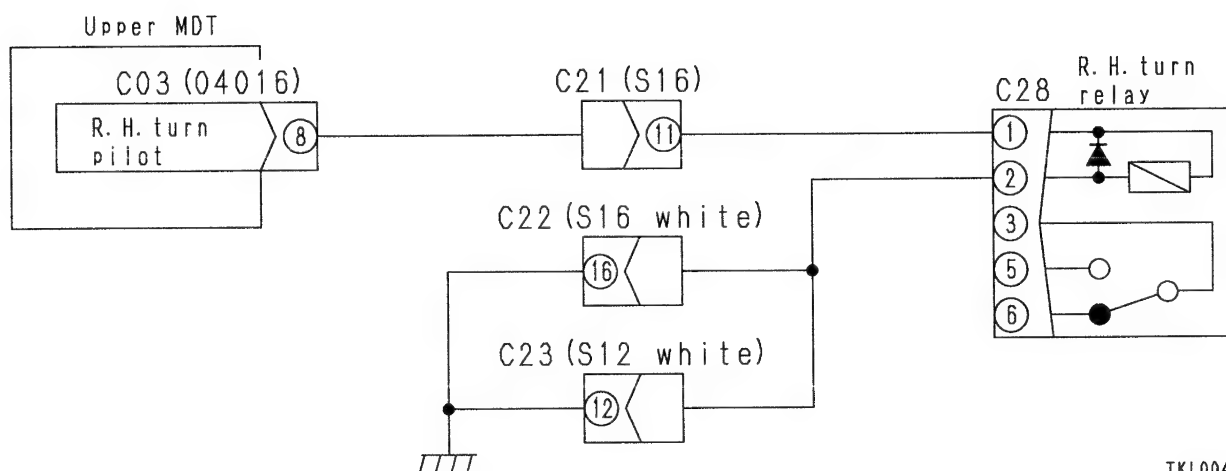


EU-39 MDTU error E5E (Right turn pilot short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

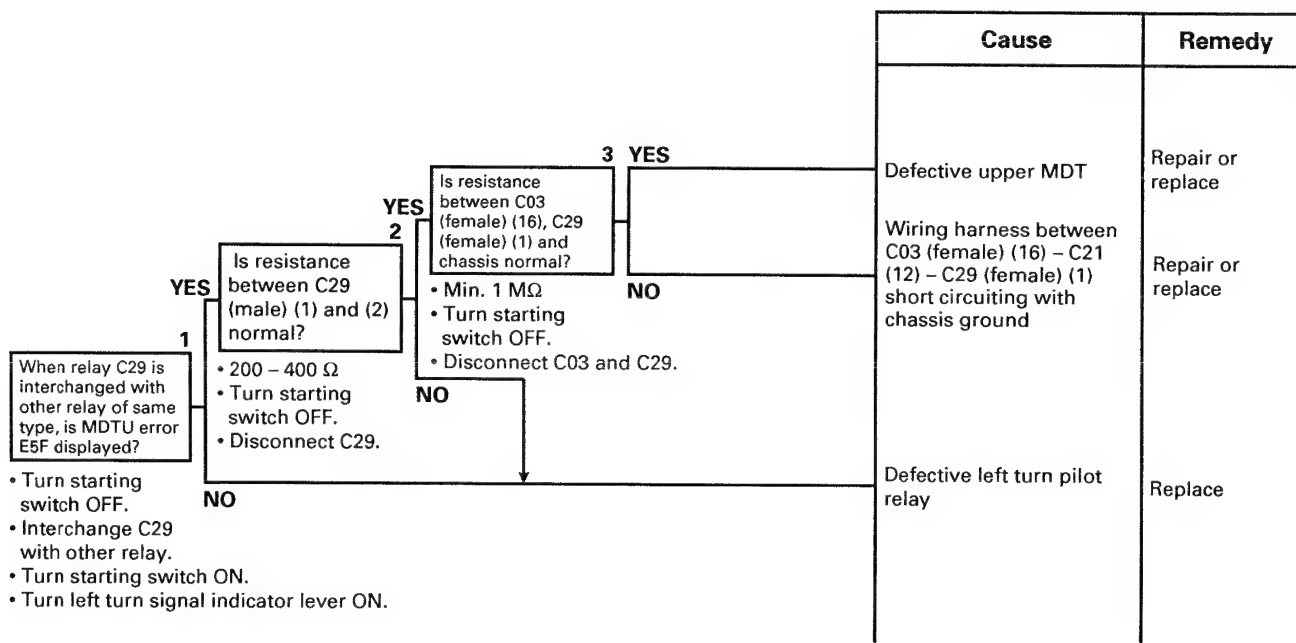
	Cause	Remedy
<p>023S02</p> <p>1 When relay C28 is interchanged with other relay of same type, is MDTU error E5E displayed?</p> <p>YES</p> <p>2 Is resistance between C28 (male) (1) and (2) normal?</p> <p>• 200 – 400 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect C28.</p> <p>NO</p> <p>3 YES</p> <p>Is resistance between C03 (female) (8), C28 (female) (1) and chassis normal?</p> <p>• Min. 1 MΩ</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect C03 and C28.</p> <p>NO</p> <p>• Turn starting switch OFF.</p> <p>• Interchange C28 with other relay.</p> <p>• Turn starting switch ON.</p> <p>• Turn right turn signal indicator lever ON.</p>	<p>Defective upper MDT</p> <p>Wiring harness between C03 (female) (8) – C21 (11) – C28 (female) (1) short circuiting with chassis ground</p> <p>Defective right turn pilot relay</p>	<p>Repair or replace</p> <p>Repair or replace</p> <p>Replace</p>

EU-39 Related electric circuit diagram



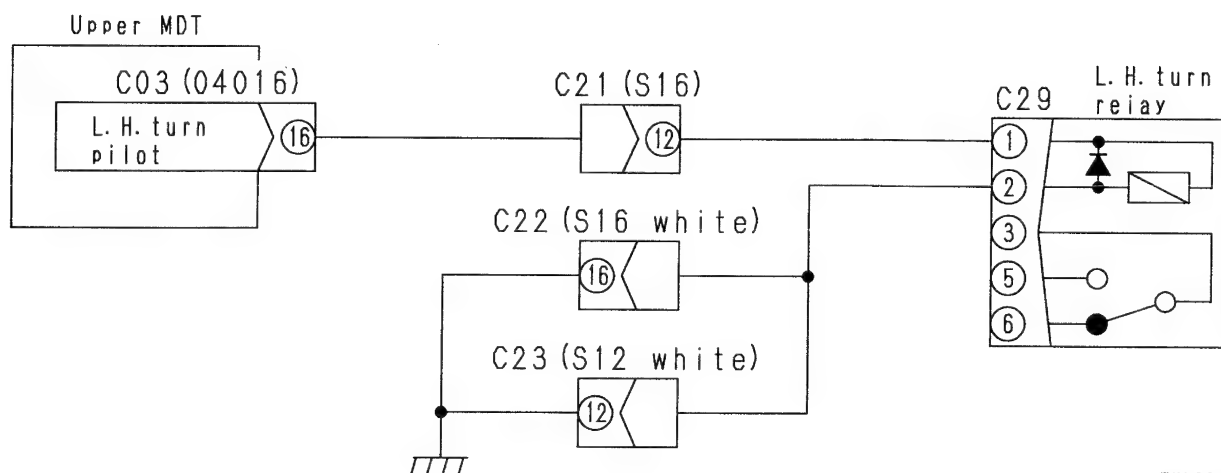
EU-40 MDTU error E5F (Left turn pilot output short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EU-40 Related electric circuit diagram



TKL00448

EU-41 MDTU error E72/E1E (LED dimmer 1 [shift position display LED system] short circuited with ground) is displayed

- ★ If MDTU error E72 occurs, it may be saved in the error memory together with MDTU error E1E, but both of these errors are the same type.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

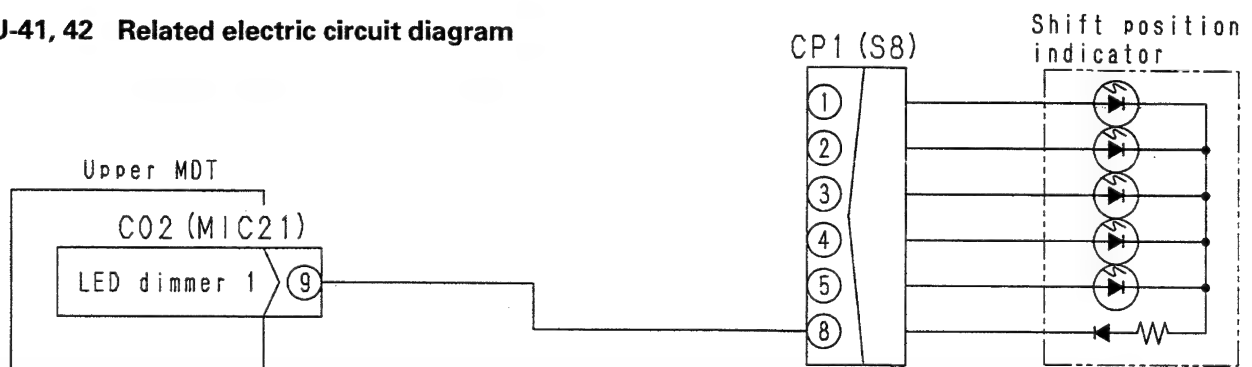
		Cause	Remedy
<p>1</p> <p>Is resistance between C02 (female) (9) and chassis ground normal?</p> <p>• Min. 1 MΩ • Turn starting switch OFF. • Disconnect C02.</p> <p>YES</p> <p>NO</p>	2 YES	Defective upper MDT	Replace
	2 YES	Short circuit with ground between LED and CP1 (female) (8)	Repair or replace
	NO	Wiring harness between C02 (female) (9) and CP1 (male) (8) short circuiting with chassis ground	Repair or replace

EU-42 MDTU error E73/E1E (LED dimmer 2 [shift position display LED system] short circuited with power source) is displayed

- ★ If MDTU error E73 occurs, it may be saved in the error memory together with MDTU error E1E, but both of these errors are the same type.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1</p> <p>Is MDT error E73 occurring?</p> <p>• Turn starting switch ON. • Disconnect CP1.</p> <p>YES</p> <p>NO</p>	2 YES	Defective upper MDT	Replace
	2 YES	Short circuit with ground between LED and CP1 (female) (8)	Repair or replace
	NO	Wiring harness between LED and CP1 (female) (8) short circuiting with power source, or short circuit between CP1 (female) (1) – (5) – LED – CP1 (female) (8)	Repair or replace

EU-41, 42 Related electric circuit diagram



TKL00449

EU-43 MDTU error E74/E1F (LED dimmer 2 [rear wheel LOCK LED system] short circuited with ground) is displayed

- ★ If MDTU error E74 occurs, it may be saved in the error memory together with MDTU error E1F, but both of these errors are the same type.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

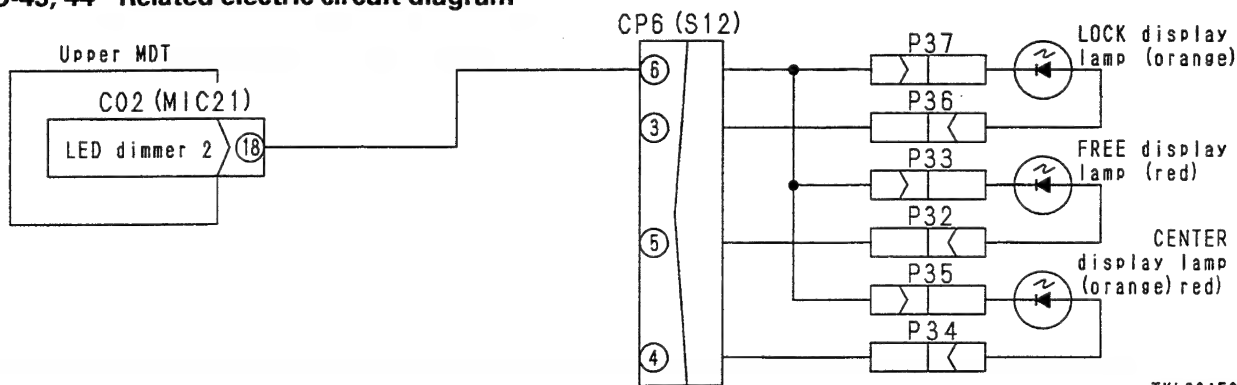
		Cause	Remedy
<div> <div>1</div> <div>Is resistance between C02 (female) (18) and chassis ground normal?</div> <div> <div>YES</div> <div> <div>2</div> <div>Is resistance between C02 (female) (18) and chassis ground normal?</div> <div> <div>YES</div> <div></div> </div> </div> <div>NO</div> <div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C02.</div> </div> </div> </div>	YES	Defective upper MDT	Replace
	NO	Short circuit with ground between LED and CP6 (female) (6)	Repair or replace
	NO	Wiring harness between C02 (female) (18) and CP6 (male) (6) short circuiting with chassis ground	Repair or replace

EU-44 MDTU error E75/E1F (LED dimmer 2 [rear wheel LOCK LED system] short circuited with power source) is displayed

- ★ If MDTU error E75 occurs, it may be saved in the error memory together with MDTU error E1F, but both of these errors are the same type.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1</div> <div>Is MDT error E75 occurring?</div> <div> <div>YES</div> <div> <div>2</div> <div>Is voltage between C02 (female) (18) and chassis ground normal?</div> <div> <div>YES</div> <div></div> </div> </div> <div>NO</div> <div> <div>• Max. 1 V</div> <div>• Turn starting switch ON.</div> <div>• Disconnect C02 and CP6.</div> </div> </div> </div>	YES	Defective upper MDT	Replace
	NO	Wiring harness between C02 (female) (18) and CP6 (male) (6) short circuiting with power source	Repair or replace
	NO	Wiring harness between LED and CP6 (female) (6) short circuiting with power source, or short circuit between CP6 (female) (3),(4),(5) – LED – CP6 (female) (6)	Repair or replace

EU-43, 44 Related electric circuit diagram



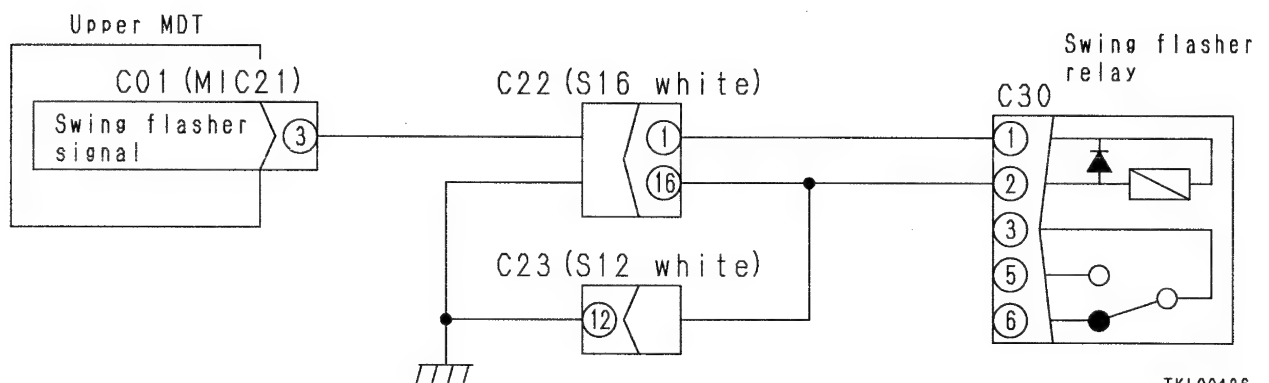
TKL00450

EU-46 MDTU error E80 (Swing flasher output short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Is voltage between C01 (female) (3), C30 (female) (1) and chassis normal?</p> <p>• Max. 1 V</p> <p>• Disconnect C01 and C30.</p> <p>• Turn starting switch ON.</p>	YES	Defective upper MDT	Repair or replace
	NO	Wiring harness between C01 (female) (3) – C22 (1) – C30 (female) (1) short circuiting with power source	Repair or replace

EU-46 Related electric circuit diagram

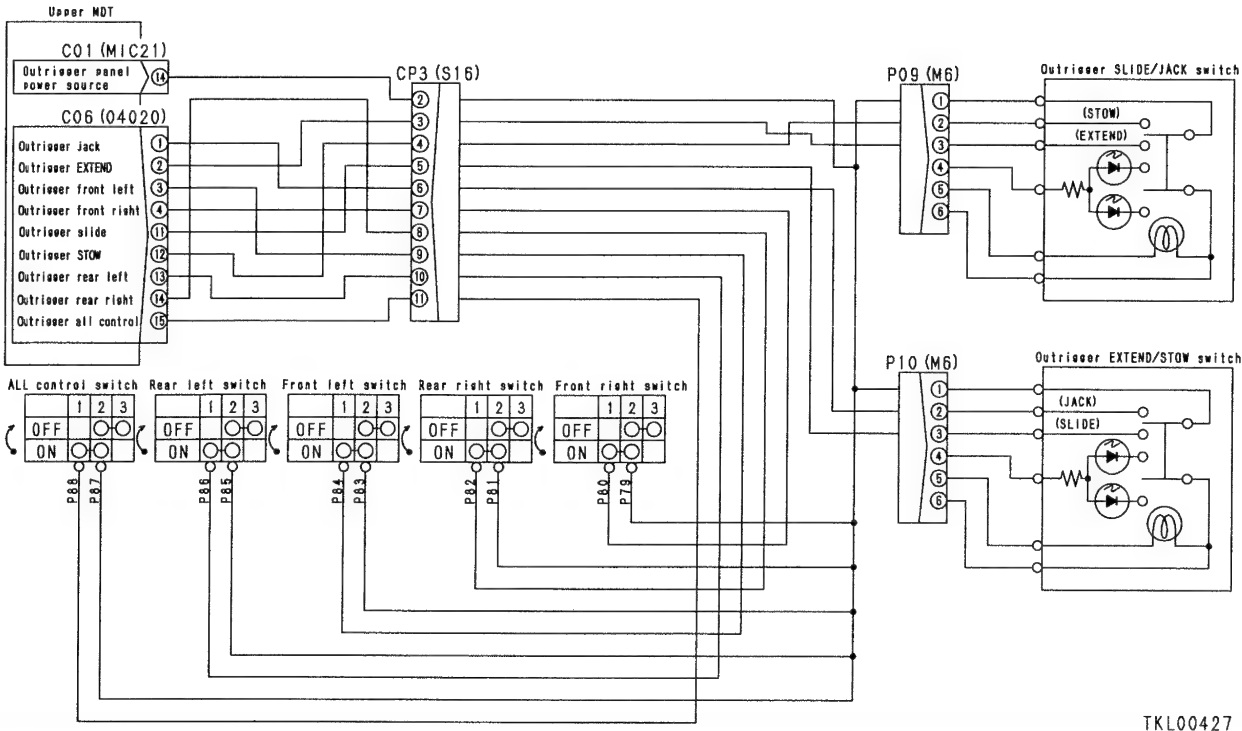


EU-47 MDTU error E83 (Outrigger mode power source short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

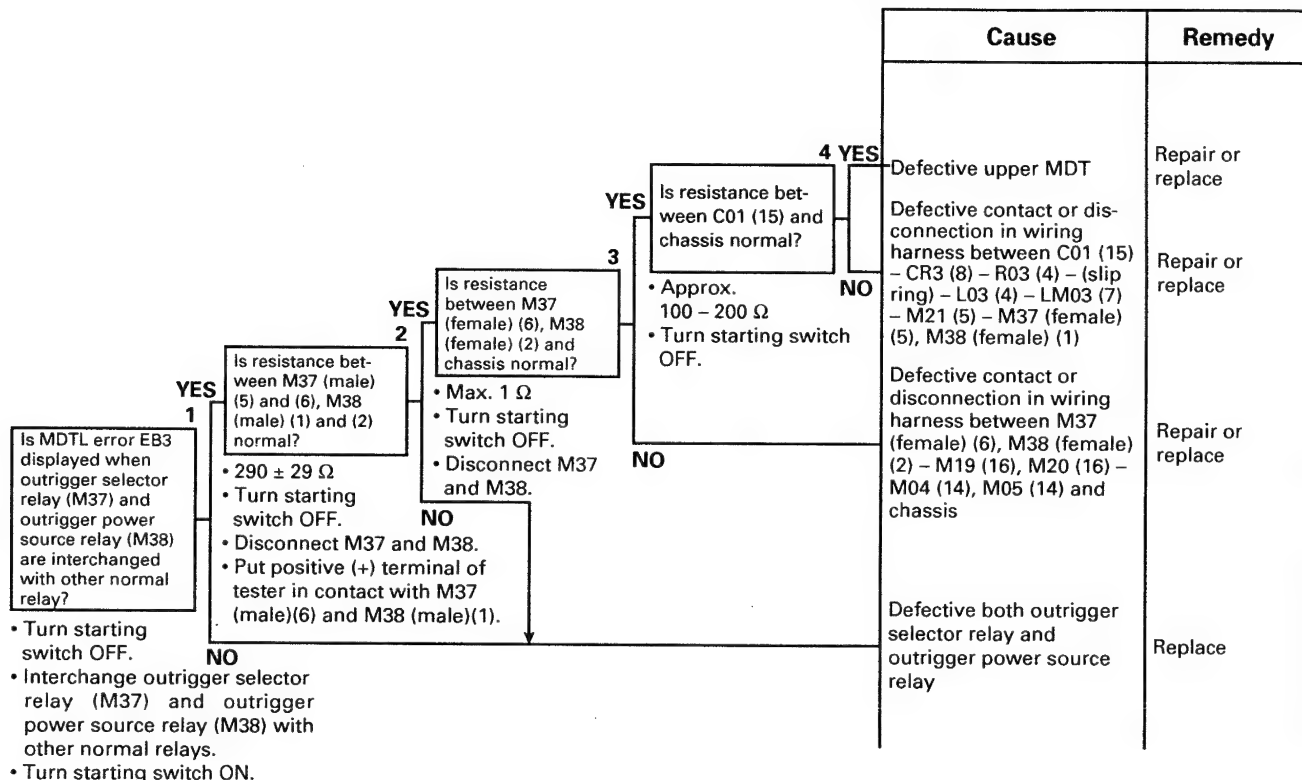
		Cause	Remedy
<div> <div>1</div> <div>Is voltage between C01 (female) (15) and chassis normal?</div> <div> <div>• Max. 1 V</div> <div>• Disconnect C01.</div> <div>• Turn starting switch ON.</div> </div> </div> <div> <div>2</div> <div>Is voltage between R03 (male) (4) and chassis normal?</div> <div> <div>• Max. 1 V</div> <div>• Disconnect R03.</div> <div>• Turn starting switch ON.</div> </div> </div> <div> <div>3</div> <div>Is voltage between L03 (female) (4) and chassis normal?</div> <div> <div>• Max. 1 V</div> <div>• Disconnect L03.</div> <div>• Turn starting switch ON.</div> </div> </div>	YES	Defective upper MDT	Replace
	NO	Wiring harness between C01 (female) (15) – CR3 (8) – R03 (female) (4) short circuiting with power source	Repair or replace
	YES	Defective slip ring	Replace
	NO	Wiring harness between L03 (female) (4) – LM03 (7) – M21 (5) – M37 (female) (5), M38 (female) (1) short circuiting with power source	Repair or replace

EU-47 Related electric circuit diagram

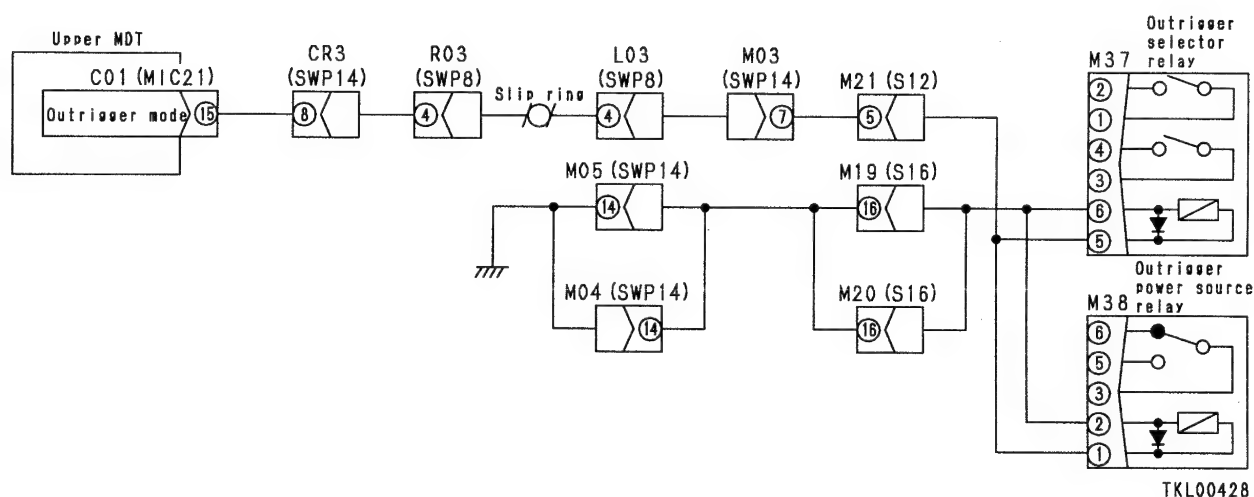


EU-48 MDTU error EB3 (Disconnection in outrigger mode power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EU-48 Related electric circuit diagram



EU-49 MDTU error EE0 (PTO mode doesn't match) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

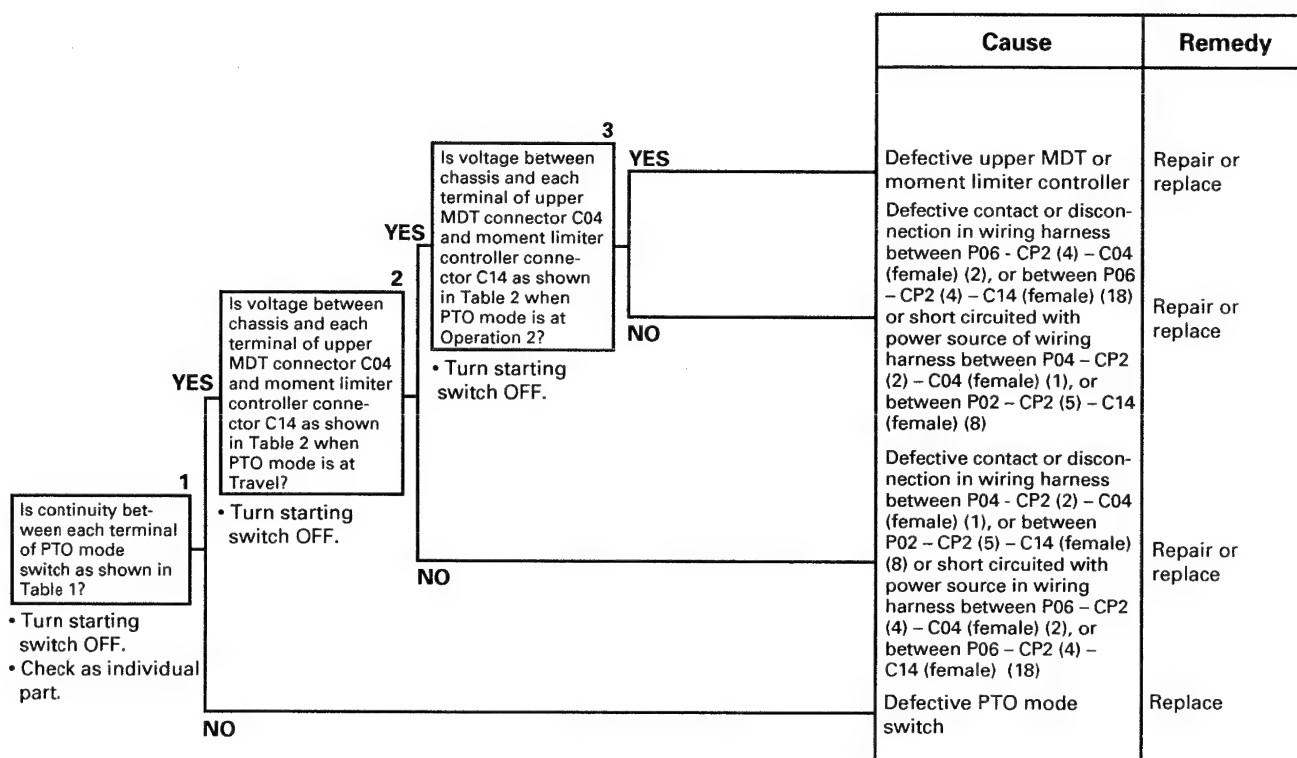


Table 1 (Resistance value between each terminal of PTO mode switch)

Terminal	P01	P02	P03	P04	P05	P06	P07	P08
PTO mode								
Operation 2					○	○	○	○
Operation 1			○	○	○	○		
Travel	○	○	○	○				
Switch terminal	①	②	③	④	⑤	⑥	⑦	⑧

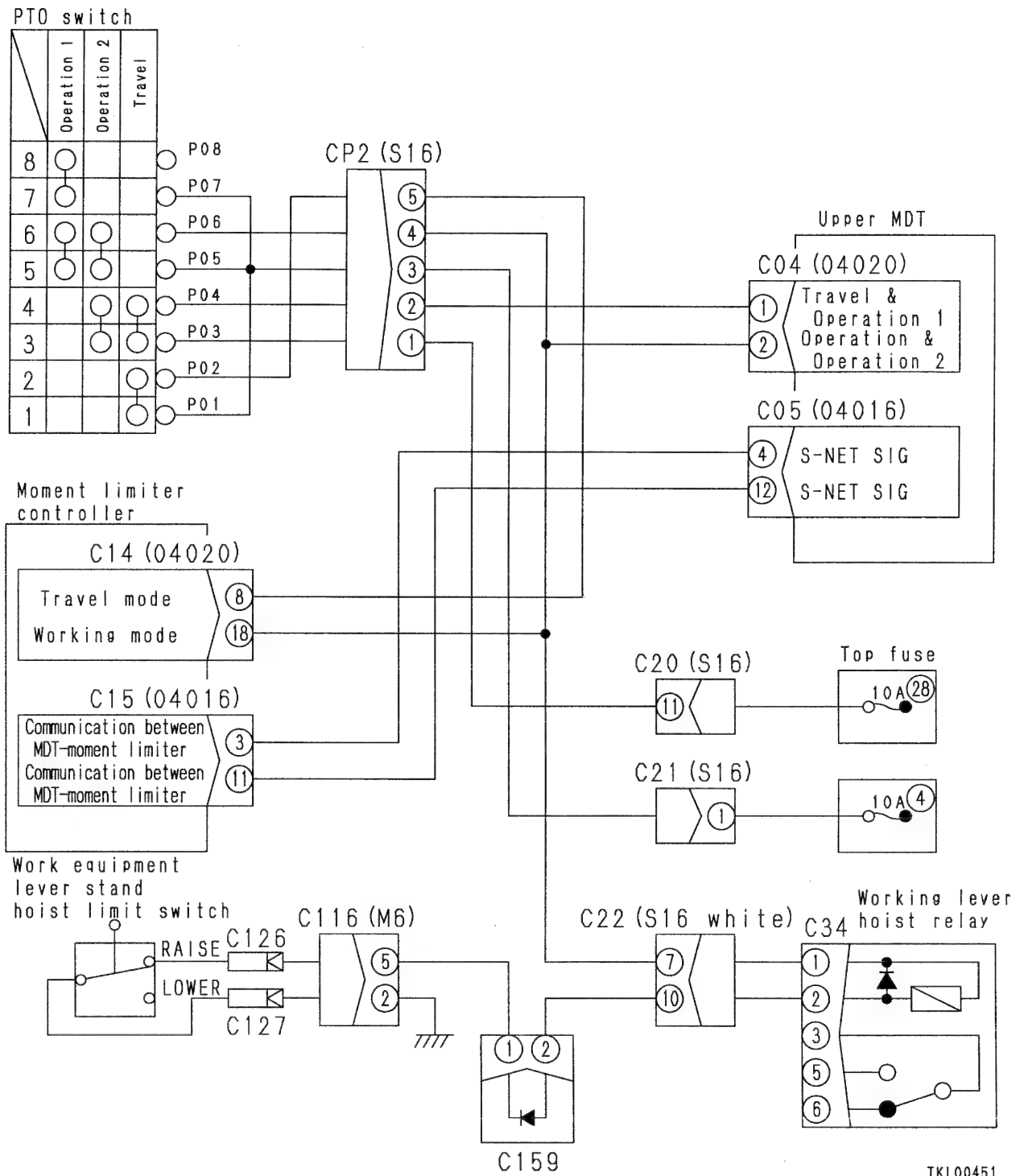
Table 2 (Voltage between PTO mode switch and each terminal of upper MDT connector C04 and moment limiter controller connector C14)

Upper MDT connector C04	Moment limiter controller connector C14	Travel	Operation 1	Operation 2
Between (1) - chassis	—————	20 - 30V	20 - 30V	Max. 1 V
Between (2) - chassis	—————	20 - 30V	20 - 30V	Max. 1 V
—————	Between (8) -chassis	20 - 30V	20 - 30V	Max. 1 V
—————	Between (18) -chassis	20 - 30V	20 - 30V	Max. 1 V

023S02

EU-49 Related electric circuit diagram

023S02



EU-50 MDTU error EE1 (Abnormality in 2WD Hi/4WD Hi/4WD Lo input) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

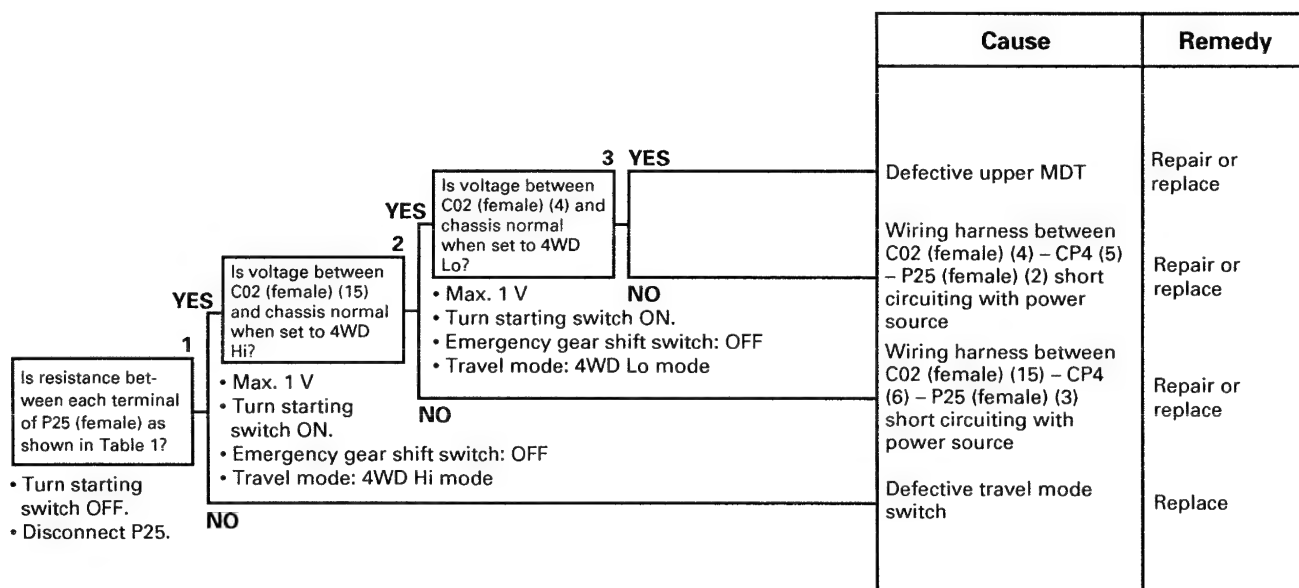
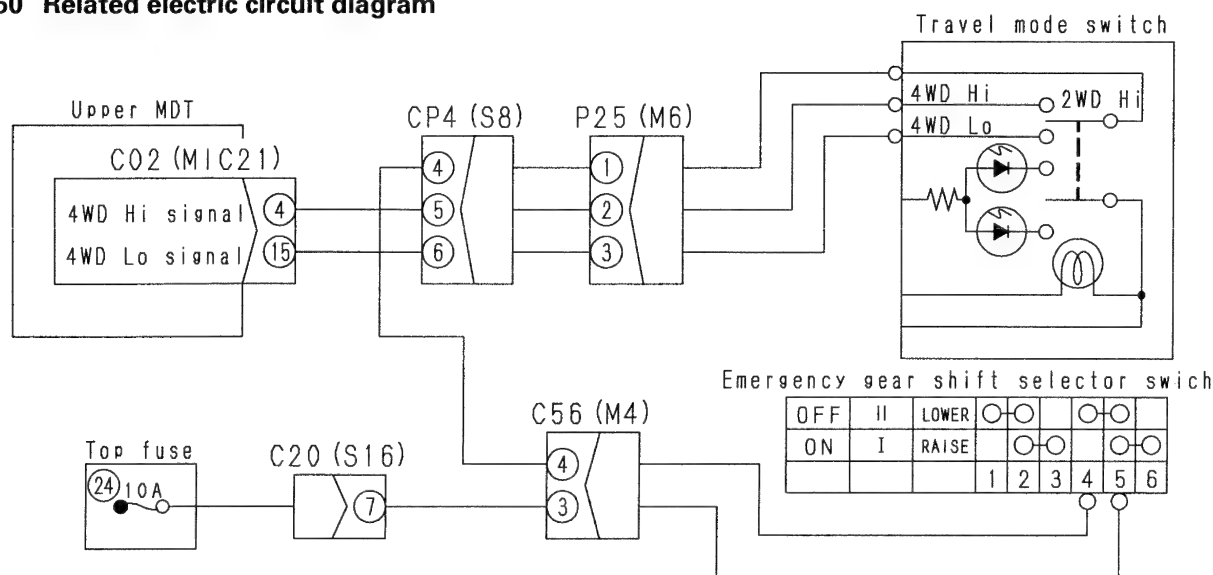


Table 1 [Travel mode and resistance value between terminals of P25 (female)]

P25 (female) terminal	2WD Hi mode	4WD Hi mode	4WD Lo mode
Between (1) – (2)	Min. 1 M Ω	Max. 1 Ω	Min. 1 M Ω
Between (1) – (3)	Min. 1 M Ω	Min. 1 M Ω	Max. 1 Ω
Between (2) – (3)	Min. 1 M Ω	Min. 1 M Ω	Min. 1 M Ω

EU-50 Related electric circuit diagram



TKL00452

EU-51 MDTU error EE3 (Abnormality in service brake input) is displayed

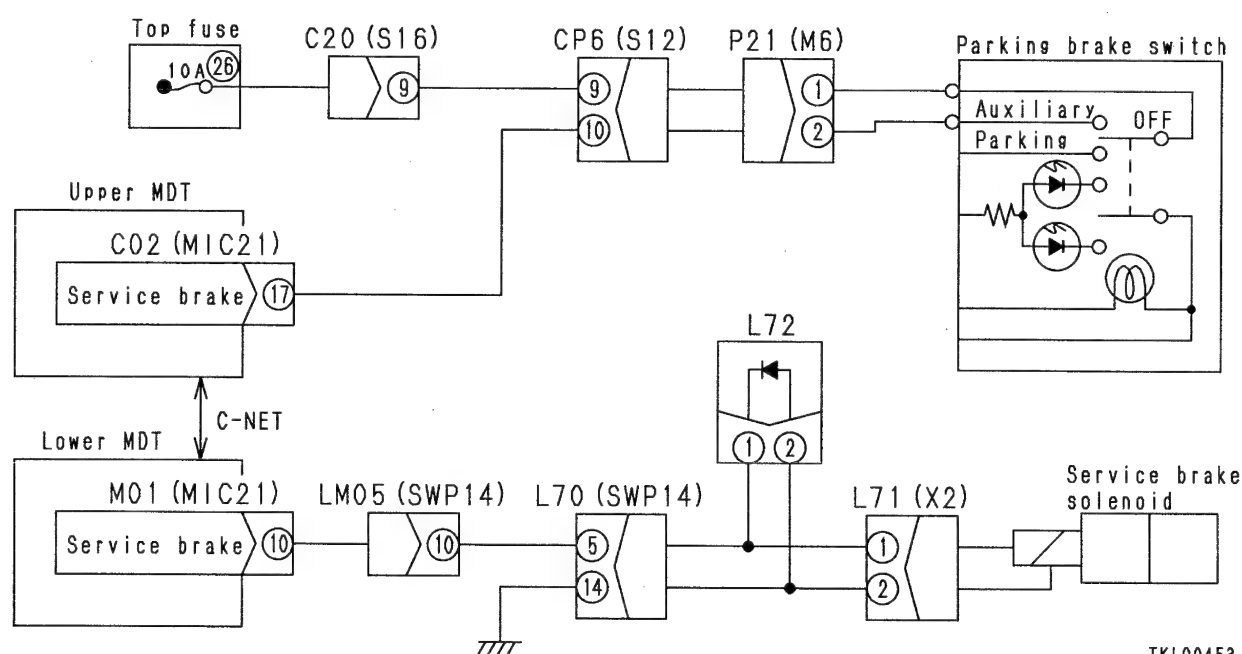
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Is resistance between each terminal of P21 (female) as shown in Table 1?</p> <p>• Turn starting switch ON.</p> <p>• Disconnect P21.</p>	<p>2 YES</p> <p>Is voltage between C02 (17) and chassis normal when parking brake is OFF?</p> <p>• Max. 1 V</p> <p>• Turn starting switch ON.</p> <p>• Parking brake switch: OFF (Parking brake air pressure switch: OFF)</p>	Defective upper MDT	Repair or replace
	NO	Wiring harness between C02 (female) (17) – CP6 (10) – P21 (male) (2) short circuiting with power source	Repair or replace
	NO	Defective parking brake switch	Replace

Table 1 (Resistance value between terminals of parking brake switch P21 (female))

P21 (female) terminal	Auxiliary	Parking	OFF
Between (1) – (2)	Max. 1 Ω	Min. 1 MΩ	Min. 1 MΩ

EU-51 Related electric circuit diagram



TKL00453

EU-52 MDTU error EE4 (Abnormality in suspension lift switch) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

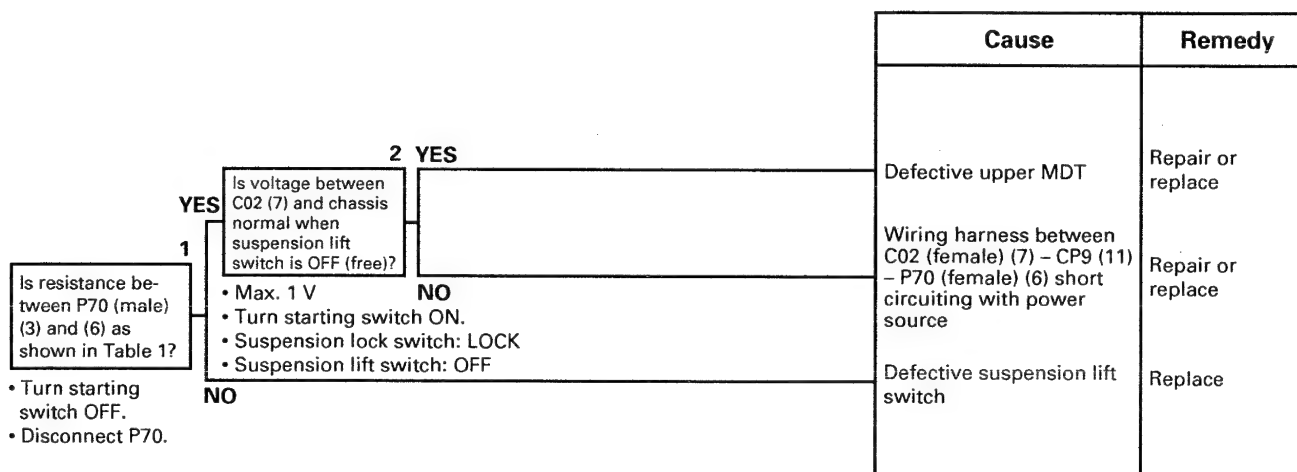
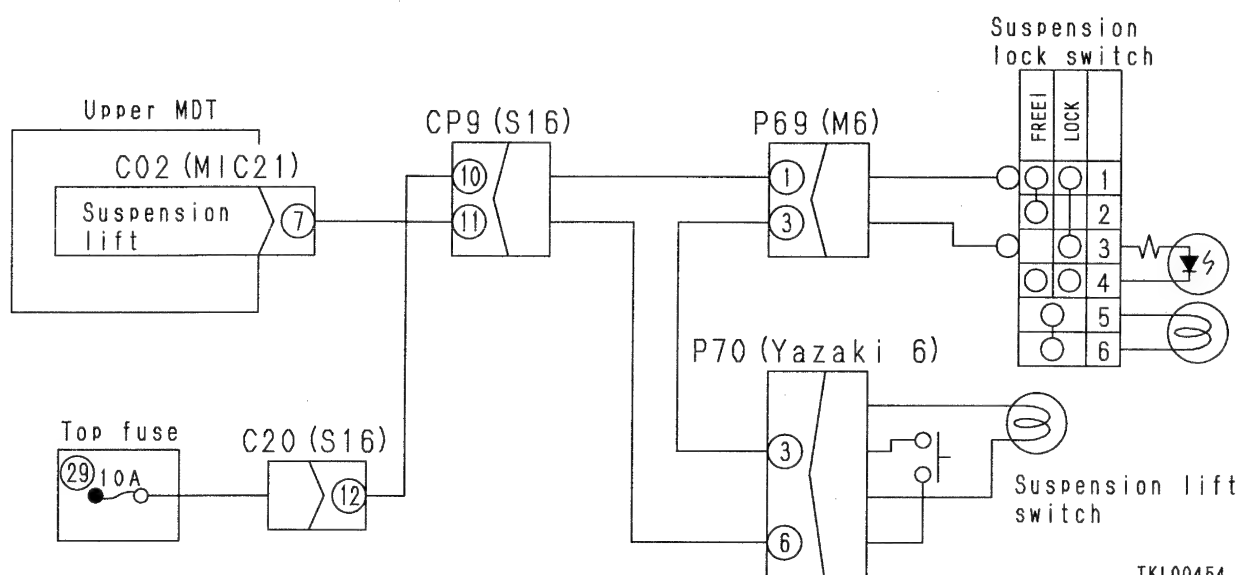


Table 1 {Resistance value between terminals of suspension lift switch P70 (female)}

P70 (male) terminal	ON(lift)	OFF
Between (3) – (6)	Max. 1 Ω	Min. 1 M Ω

EU-52 Related electric circuit diagram

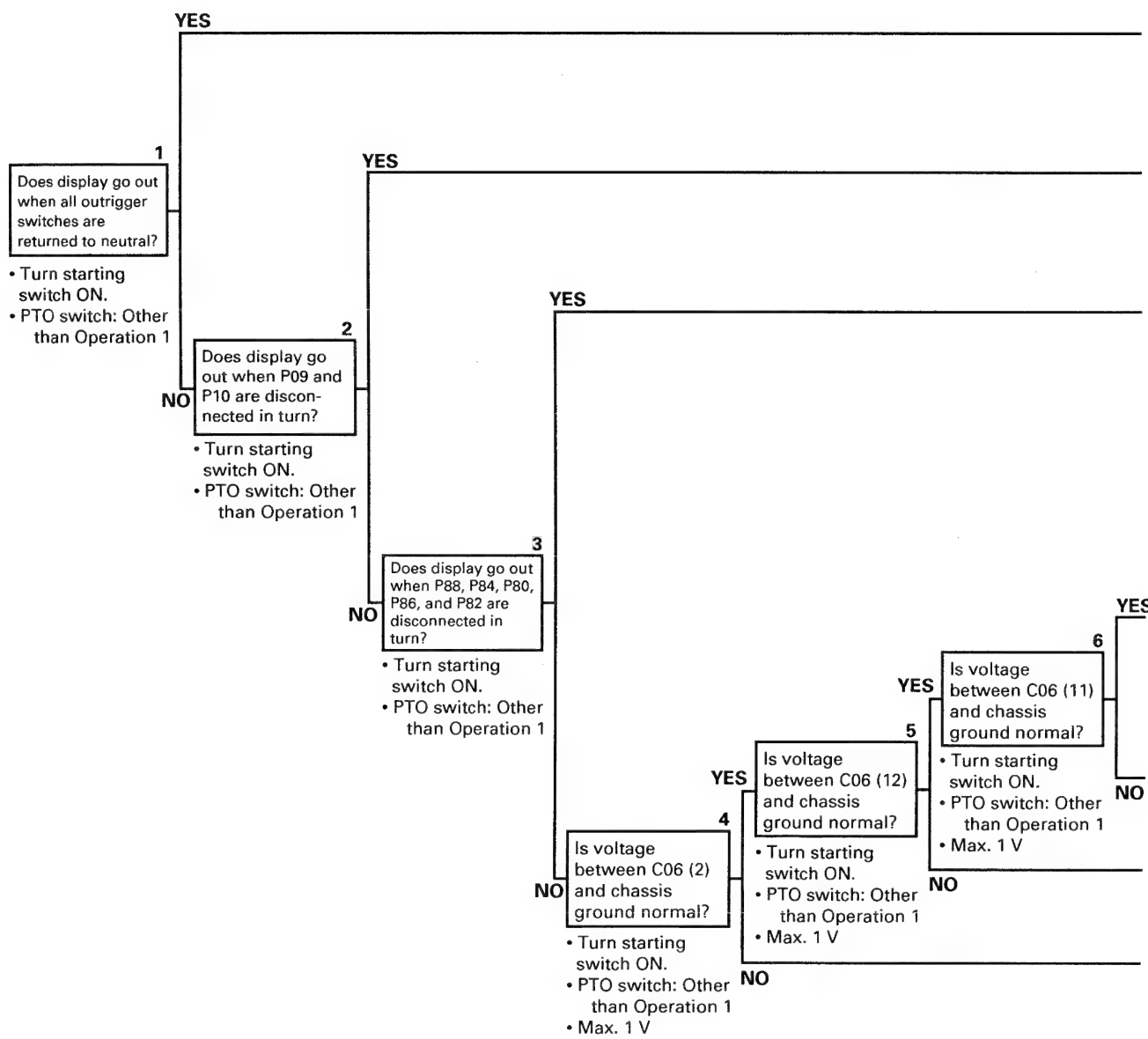


TKI 00454

EU-53 MDTU error EE5 (Abnormality in outrigger control switch) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Troubleshooting flow chart (1/2)



023S02

		Cause	Remedy
		Wiring harness between C01 (female) (14) – CP3 (2) – P09 (male) (1), P10 (male) (1), P81, P83, P79, P85, or P87 short circuiting with power source	Repair or replace
		Defective switch for connector where display has gone out P09: EXTEND/STOW switch P10: SLIDE/JACK switch	Replace
		Defective switch for wiring where display has gone out P87: Defective ALL control switch P83: Defective front left switch P79: Defective front right switch P85: Defective rear left switch P81: Defective rear right switch	Replace
<div>9 YES → [Go to A on 2/2]</div>			
<div>8 YES</div> <div>Is voltage between C06 (3) and chassis ground normal?</div> <div>• Turn starting switch ON. • PTO switch: Other than Operation 1 • Max. 1 V</div> <div>NO</div>		Wiring harness between C06 (female) (3) – CP3 (9) – P84 short circuiting with power source	Repair or replace
<div>7 YES</div> <div>Is voltage between C06 (15) and chassis ground normal?</div> <div>• Turn starting switch ON. • PTO switch: Other than Operation 1 • Max. 1 V</div> <div>NO</div>		Wiring harness between C06 (female) (15) – CP3 (11) – P88 short circuiting with power source	Repair or replace
<div>7 NO</div> <div>Is voltage between C06 (1) and chassis ground normal?</div> <div>• Turn starting switch ON. • PTO switch: Other than Operation 1 • Max. 1 V</div>		Wiring harness between C06 (female) (1) – CP3 (6) – P10 (male) (2) short circuiting with power source	Repair or replace
		Wiring harness between C06 (female) (11) – CP3 (5) – P10 (male) (3) short circuiting with power source	Repair or replace
		Wiring harness between C06 (female) (12) – CP3 (4) – P09 (male) (2) short circuiting with power source	Repair or replace
		Wiring harness between C06 (female) (2) – CP3 (3) – P09 (male) (3) short circuiting with power source	Repair or replace

Troubleshooting flow chart (2/2)

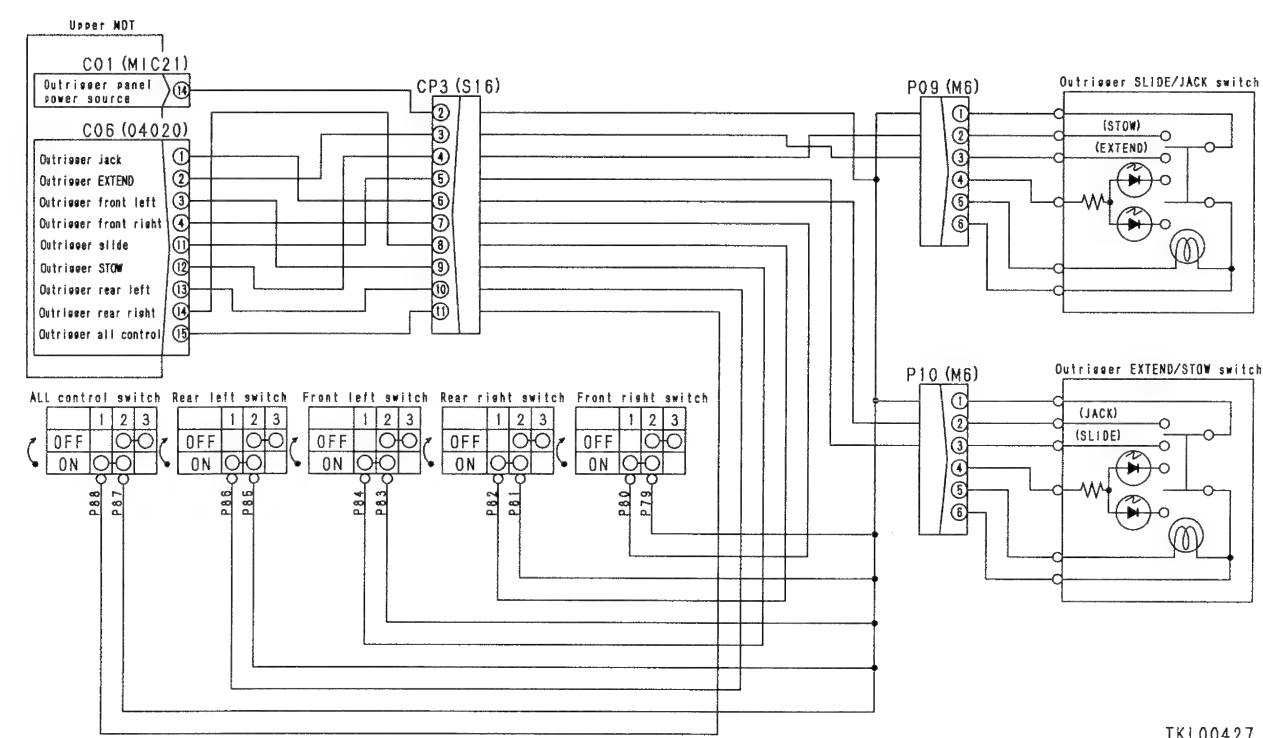
			Cause	Remedy
<div>10</div> <div>Is voltage between C06 (4) and chassis ground normal?</div> <div>• Turn starting switch ON. • PTO switch: Other than Operation 1 • Max. 1 V</div>				
YES	<div>11</div> <div>Is voltage between C06 (13) and chassis ground normal?</div> <div>• Turn starting switch ON. • PTO switch: Other than Operation 1 • Max. 1 V</div>			
	YES	<div>12</div> <div>Is voltage between C06 (14) and chassis ground normal?</div> <div>• Turn starting switch ON. • PTO switch: Other than Operation 1 • Max. 1 V</div>		
		YES	Defective upper MDT	Replace
		NO	Wiring harness between C06 (female) (14) – CP3 (8) – P82 short circuiting with power source	Repair or replace
	NO		Wiring harness between C06 (female) (13) – CP3 (10) – P86 short circuiting with power source	Repair or replace
			Wiring harness between C06 (female) (4) – CP3 (7) – P80 short circuiting with power source	Repair or replace

NO

Wiring harness between C06 (female) (4) – CP3 (7) – P80 short circuiting with power source

Repair or replace

EU-53 Related electric circuit diagram



TKL00427

EU-54 MDTU error EE6 (Top outrigger EXTEND + RETRACT switches input simultaneously) is displayed
MDTU error EE6 (Top outrigger JACK + SLIDE input simultaneously) is displayed

Judgment of abnormal system

- ★ MDTU error EE6 is displayed if there is any abnormal simultaneous output, either of the outrigger EXTEND/STOW switch or the outrigger SLIDE/JACK switch.
For this reason, if this error code is given, use the procedure below to judge which switch the error code is being given for before going on to the main troubleshooting.
- 1. When the error code is displayed, turn the starting switch OFF.
(If the starting switch is already OFF, this action is unnecessary.)
- 2. Set the outrigger EXTEND/STOW switch and SLIDE/JACK switch to the neutral position, then turn the starting switch ON.
- 3. Operate the outrigger EXTEND/STOW switch.
 - Error code is given: simultaneous input of outrigger EXTEND/STOW switch
 - Error code is not given: simultaneous input of outrigger SLIDE/JACK switch

023S02

a) Outrigger JACK and SLIDE input simultaneously

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

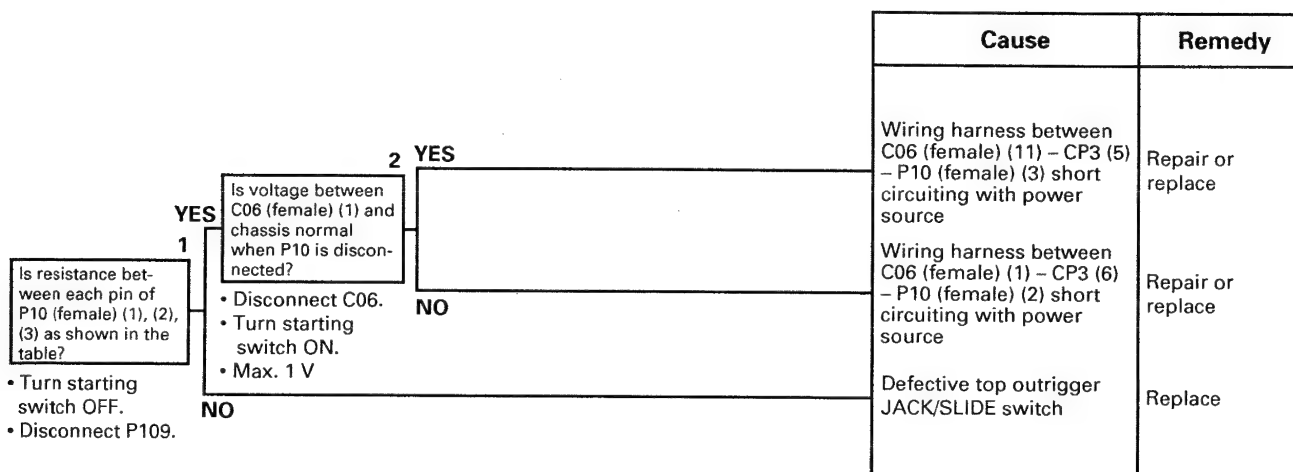
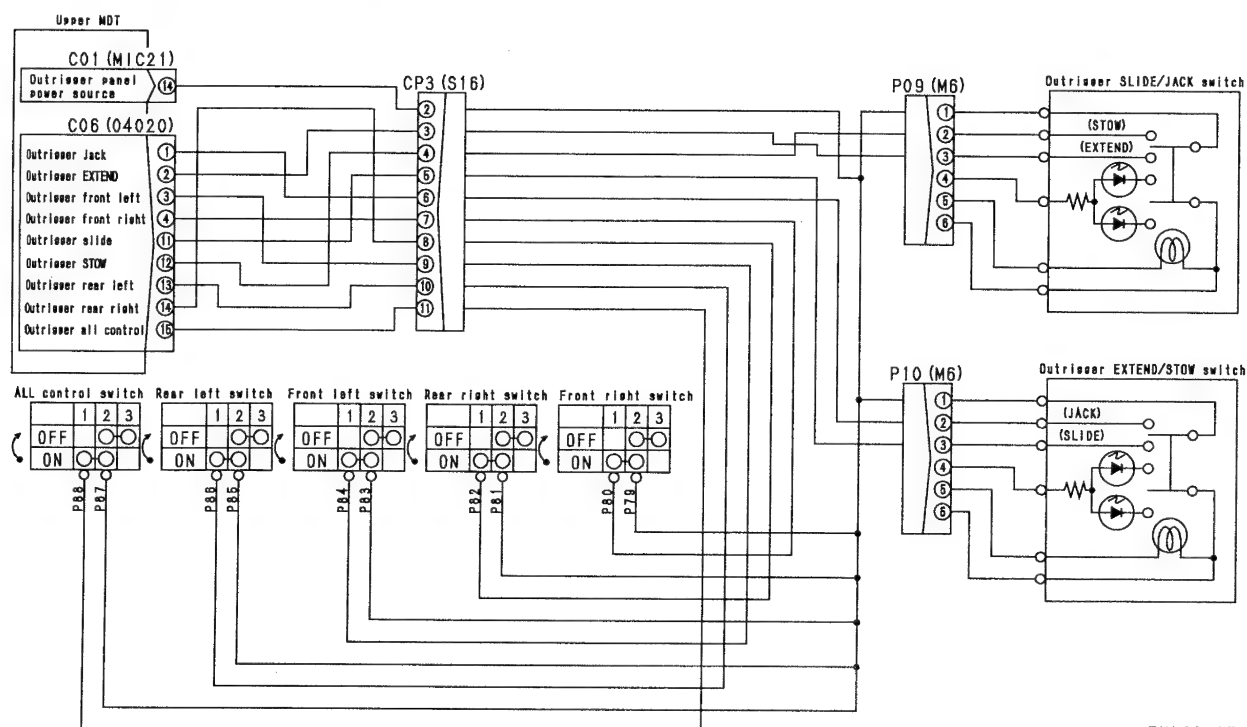


Table	Outrigger JACK/SLIDE switch		
P10 (female)	Jack	Neutral	Slide
Between (1) – (2)	Max. 1 Ω	Min. 1 M Ω	Min. 1 M Ω
Between (1) – (3)	Min. 1 M Ω	Min. 1 M Ω	Max. 1 Ω
Between (2) – (3)	Min. 1 M Ω		

023S02

EU-54 Related electric circuit diagram



TKL00427

b) Outrigger EXTEND and STOW input simultaneously

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

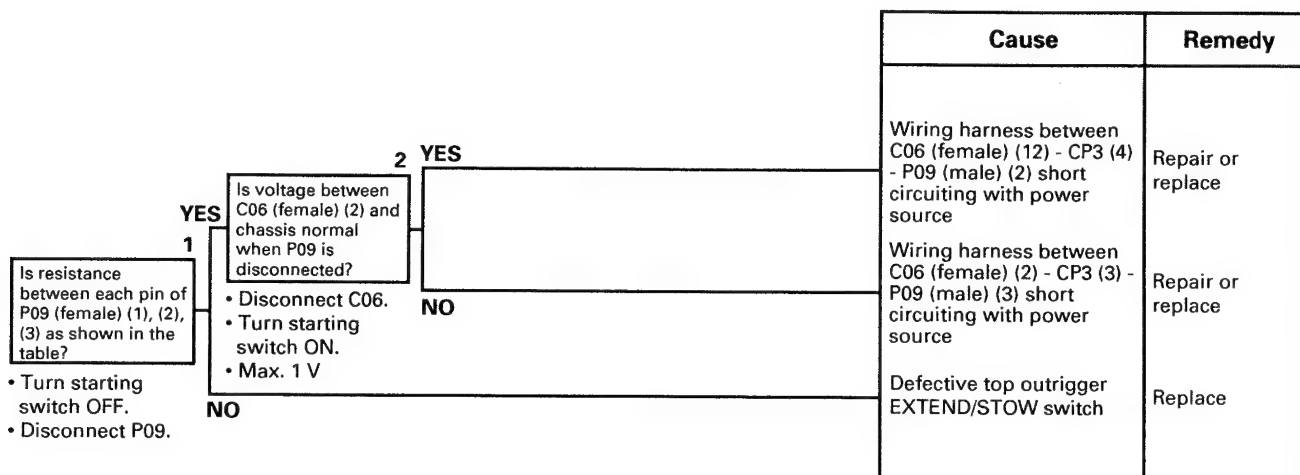


Table	Outrigger EXTEND/STOW switch		
P10 (female)	Extension	Neutral	Stow
Between (1) – (2)	Min. 1 MΩ	Min. 1 MΩ	Max. 1 Ω
Between (1) – (3)	Max. 1 Ω	Min. 1 MΩ	Min. 1 MΩ
Between (2) – (3)	Min. 1 MΩ		

023S02

EU-55 MDTU error EEA (Abnormality in steering mode switch input) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that top fuse 28 is normal.

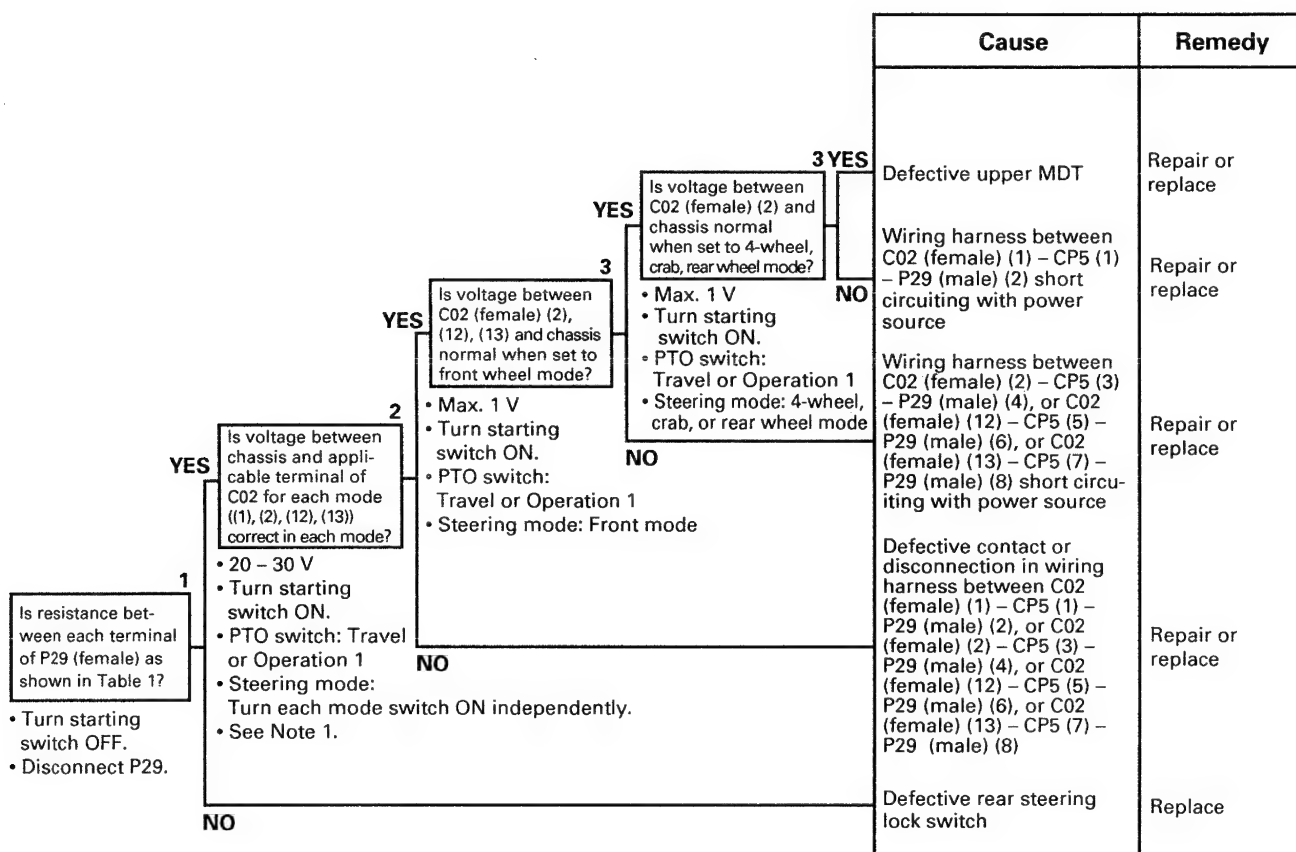


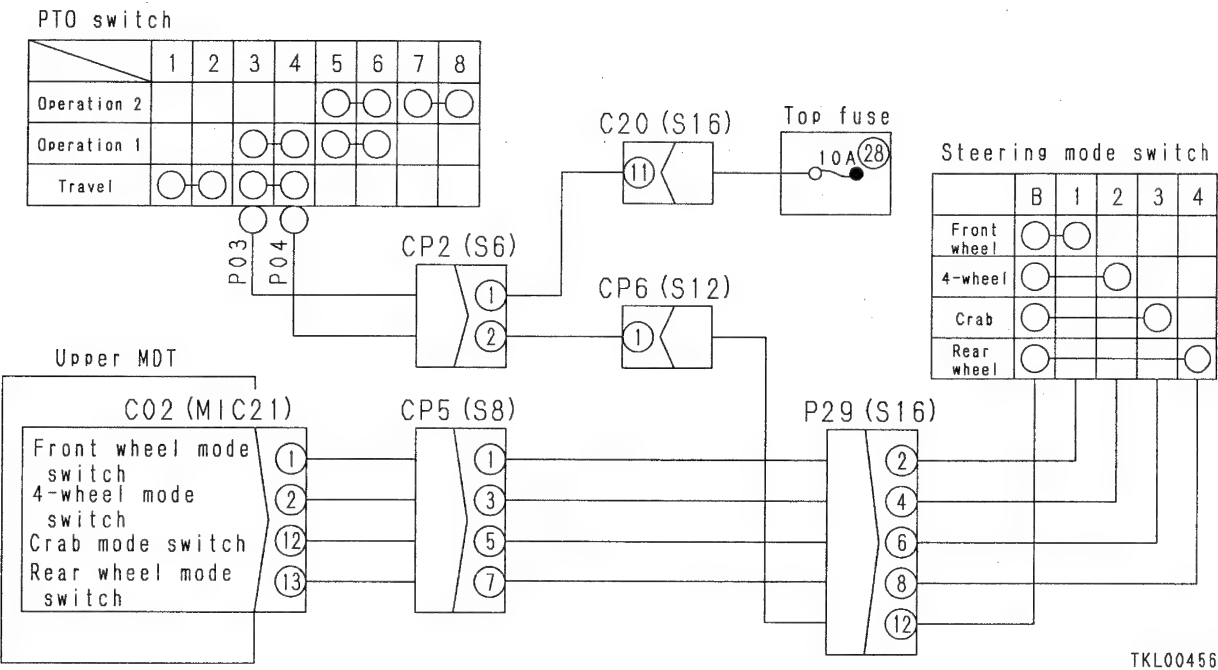
Table 1 {Steering mode and resistance value between terminals of P29 (female)}

P29 (female) terminal	Front wheel mode	4-wheel mode	Crab mode	Rear wheel mode
Between (12) - (2)	Max. 1 Ω	Min. 1 MΩ	Min. 1 MΩ	Min. 1 MΩ
Between (12) - (4)	Min. 1 MΩ	Max. 1 Ω	Min. 1 MΩ	Min. 1 MΩ
Between (12) - (6)	Min. 1 MΩ	Min. 1 MΩ	Max. 1 Ω	Min. 1 MΩ
Between (12) - (8)	Min. 1 MΩ	Min. 1 MΩ	Min. 1 MΩ	Max. 1 Ω

Note 1: (Each mode and applicable terminal of C02)

- Front wheel mode: C02 (1)
- 4-wheel mode : C02 (2)
- Crab mode : C02 (12)
- Rear wheel mode : C02 (13)

EU-55 Related electric circuit diagram



023S02

EU-56 MDTU error EEC (Rear steering LOCK + FREE command input simultaneously) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
| | |

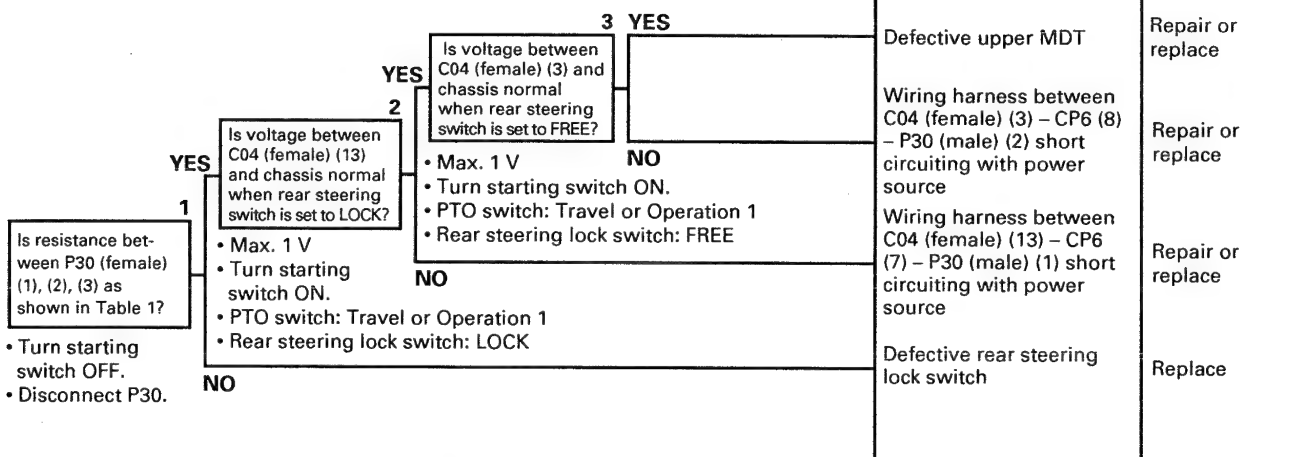
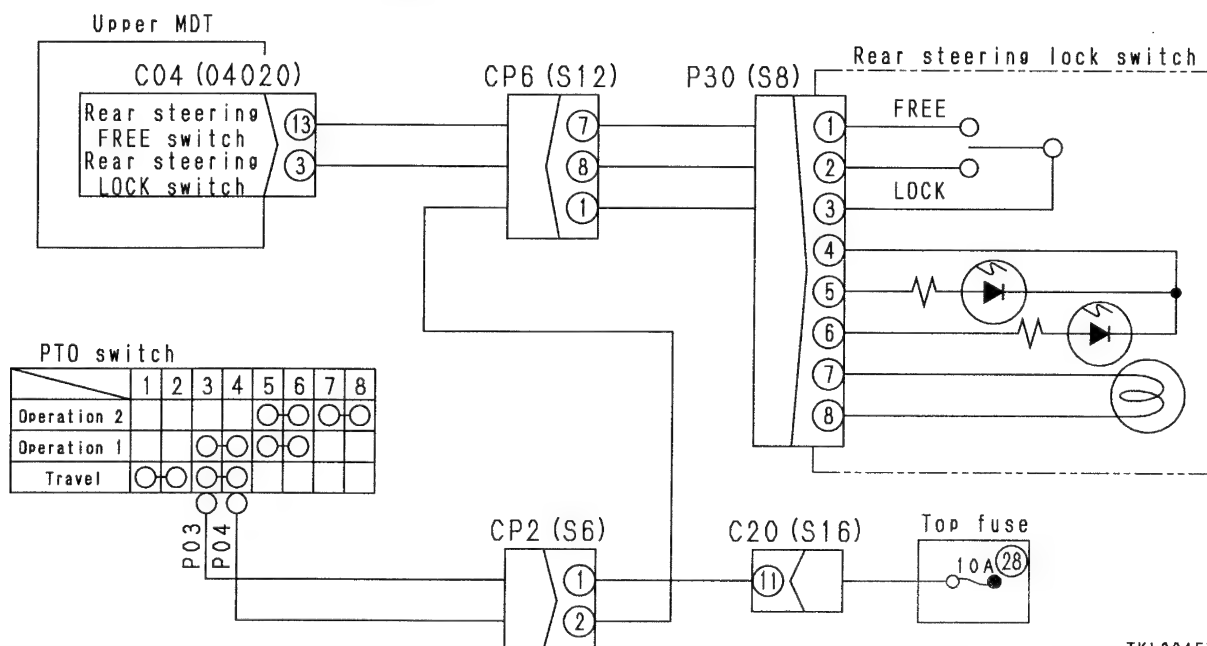


Table 1

Terminal	Rear steering lock switch		
	FREE	Neutral	LOCK
Between P30 (female)(1) – (2)	Min. 1 M Ω	Min. 1 M Ω	Min. 1 M Ω
Between P30 (female)(1) – (3)	Max. 1 Ω	Min. 1 M Ω	Min. 1 M Ω
Between P30 (female)(2) – (3)	Min. 1 M Ω	Min. 1 M Ω	Max. 1 Ω

EU-56 Related electric circuit diagram



TKL00457

TROUBLESHOOTING OF LOWER MDT CONTROLLER SYSTEM (EL MODE)

Table of error codes and troubleshooting codes	20-503
Action of controller and condition of machine when abnormality occurs	20-512
Judgement table for lower MDT, and hydraulic and mechanical systems (1/2)	20-548
Judgement table for lower MDT, and hydraulic and mechanical systems (2/2)	20-550
Electrical circuit diagram of power source, starting, charging, and preheating systems	20-554
Electrical circuit diagram of network system	20-556
Electrical circuit diagram of brake system	20-557
Electrical circuit diagram of steering system	20-558
Electrical circuit diagram of suspension system	20-560
Electrical circuit diagram of outrigger system	20-562
Electrical circuit diagram of machine monitor system	20-564
Electrical circuit diagram of turn signal and swing flasher systems	20-566
Electrical circuit diagram of lighting and horn systems	20-568
EL- 1 MDTL error E00 (MDT system error) is displayed	20-570
EL- 2 MDTL error E10 (Shut off when low voltage) is displayed	20-570
EL- 3 MDTL error E11 (Shut off when high temperature) is displayed	20-571
EL- 4 MDTL error E18 (Disconnection in tachometer sensor) is displayed	20-572
EL- 5 MDTL error E19 (Disconnection in speedometer sensor 2) is displayed	20-573
EL- 6 MDTL error E20 (Top, bottom don't match (application stopped)) is displayed	20-574
EL- 7 MDTL error E21 (Top, bottom selection warning) is displayed	20-574
EL- 8 MDTL error E24 (Model doesn't match (application stopped)) is displayed	20-575
EL- 9 MDTL error E25 (Model selection warning) is displayed	20-575
EL-10 MDTL error E28 (Abnormality in C-NET communication between MDTs) is displayed	20-576
EL-11 MDTL error E29 (Abnormality in S-NET communication between MDT and transmission controller) is displayed	20-577
EL-22 MDTL error E40 (Outrigger jack RL short circuited with ground) is displayed	20-578
EL-23 MDTL error E41 (Outrigger jack FL short circuited with ground) is displayed	20-580
EL-24 MDTL error E42 (Outrigger jack RR short circuited with ground) is displayed	20-582
EL-25 MDTL error E43 (Outrigger jack FR short circuited with ground) is displayed	20-584
EL-26 MDTL error E44 (Outrigger slide RL short circuited with ground) is displayed	20-586
EL-27 MDTL error E45 (Outrigger slide FL short circuited with ground) is displayed	20-587
EL-28 MDTL error E46 (Outrigger slide RR short circuited with ground) is displayed	20-588
EL-29 MDTL error E47 (Outrigger slide FR short circuited with ground) is displayed	20-589
EL-30 MDTL error E48 (Outrigger selector EXTEND short circuited with ground) is displayed	20-590
EL-31 MDTL error E49 (Outrigger selector STOW short circuited with ground) is displayed	20-591
EL-32 MDTL error E4A (Rear steering LOCK solenoid short circuited with ground) is displayed	20-592
EL-33 MDTL error E4B (Rear steering FREE solenoid short circuited with ground) is displayed	20-593
EL-34 MDTL error E4C (Service brake solenoid short circuited with ground) is displayed	20-594
EL-35 MDTL error E4D (Exhaust brake solenoid short circuited with ground) is displayed	20-595
EL-37 MDTL error E4F (Preheating [heater relay circuit] short circuited with ground) is displayed	20-596
EL-38 MDTL error E50 (Electric stowing mirror set relay short circuited with ground) is displayed	20-596-1
EL-40 MDTL error E52 (Electric stowing mirror stowing relay short circuited with ground) is displayed	20-596-2
EL-43 MDTL error E5A (Head lamp Hi relay short circuited with ground) is displayed	20-597
EL-44 MDTL error E5B (Head lamp Lo relay short circuited with ground) is displayed	20-598
EL-45 MDTL error E5C (Side lamp relay short circuited with ground) is displayed	20-599
EL-47 MDTL error E5E (Right turn relay short circuited with ground) is displayed	20-600
EL-48 MDTL error E5F (Left turn relay short circuited with ground) is displayed	20-601
EL-49 MDTL error E60 (Steering mode solenoid a short circuited with ground) is displayed	20-602
EL-50 MDTL error E61 (Steering mode solenoid c short circuited with ground) is displayed	20-603
EL-51 MDTL error E62 (Steering mode solenoid b short circuited with ground) is displayed	20-604
EL-52 MDTL error E63 (Steering mode solenoid d short circuited with ground) is displayed	20-605
EL-53 MDTL error E64 (Swing pump merge solenoid short circuited with ground) is displayed	20-606
EL-55 MDTL error E67 (Suspension lift solenoid short circuited with ground) is displayed	20-607
EL-56 MDTL error E76 (Outrigger length sensor power source [5V] output short circuited with ground) is displayed	20-608
EL-57 MDTL error E80 (Outrigger jack RL short circuited with power source) is displayed	20-609
EL-58 MDTL error E81 (Outrigger jack FL short circuited with power source) is displayed	20-611
EL-59 MDTL error E82 (Outrigger jack RR short circuited with power source) is displayed	20-613
EL-60 MDTL error E83 (Outrigger jack FR short circuited with power source) is displayed	20-615

EL-61	MDTL error E84	(Outrigger slide RL short circuited with power source) is displayed	20-617
EL-62	MDTL error E85	(Outrigger slide FL short circuited with power source) is displayed	20-618
EL-63	MDTL error E86	(Outrigger slide RR short circuited with power source) is displayed	20-619
EL-64	MDTL error E87	(Outrigger slide FR short circuited with power source) is displayed	20-620
EL-65	MDTL error E88	(Outrigger selector EXTEND short circuited with power source) is displayed	20-621
EL-66	MDTL error E89	(Outrigger selector STOW short circuited with power source) is displayed	20-622
EL-67	MDTL error E8A	(Rear steering LOCK solenoid short circuited with power source) is displayed	20-623
EL-68	MDTL error E8B	(Rear steering FREE solenoid short circuited with power source) is displayed	20-623
EL-69	MDTL error E8C	(Service brake solenoid short circuited with power source) is displayed	20-624
EL-70	MDTL error E8D	(Exhaust brake solenoid short circuited with power source) is displayed	20-624
EL-72	MDTL error E8F	(Preheating [heater relay circuit] short circuited with power source) is displayed	20-625
EL-73	MDTL error E9A	(Head lamp Hi relay short circuited with power source) is displayed	20-626
EL-74	MDTL error E9B	(Head lamp Lo relay short circuited with power source) is displayed	20-627
EL-75	MDTL error E9C	(Side lamp relay short circuited with power source) is displayed	20-628
EL-76	MDTL error E9E	(Right turn relay short circuited with power source) is displayed	20-629
EL-77	MDTL error E9F	(Left turn relay short circuited with power source) is displayed	20-629
EL-78	MDTL error EA0	(Steering mode solenoid a short circuited with power source) is displayed	20-630
EL-79	MDTL error EA1	(Steering mode solenoid c short circuited with power source) is displayed	20-631
EL-80	MDTL error EA2	(Steering mode solenoid b short circuited with power source) is displayed	20-632
EL-81	MDTL error EA3	(Steering mode solenoid d short circuited with power source) is displayed	20-633
EL-82	MDTL error EA4	(Swing pump merge solenoid short circuited with power source) is displayed	20-634
EL-83	MDTL error EA7	(Suspension lift solenoid short circuited with power source) is displayed	20-635
EL-84	MDTL error EB0	(Disconnection in outrigger jack RL) is displayed	20-636
EL-85	MDTL error EB1	(Disconnection in outrigger jack FL) is displayed	20-638
EL-86	MDTL error EB2	(Disconnection in outrigger jack RR) is displayed	20-640
EL-87	MDTL error EB3	(Disconnection in outrigger jack FR) is displayed	20-642
EL-88	MDTL error EB4	(Disconnection in outrigger slide RL) is displayed	20-644
EL-89	MDTL error EB5	(Disconnection in outrigger slide FL) is displayed	20-645
EL-90	MDTL error EB6	(Disconnection in outrigger slide RR) is displayed	20-646
EL-91	MDTL error EB7	(Disconnection in outrigger slide FR) is displayed	20-647
EL-92	MDTL error EB8	(Disconnection in outrigger selector EXTEND) is displayed	20-648
EL-93	MDTL error EB9	(Disconnection in outrigger selector STOW) is displayed	20-649
EL-94	MDTL error EBA	(Disconnection in rear steering LOCK solenoid) is displayed	20-650
EL-95	MDTL error EBB	(Disconnection in rear steering FREE solenoid) is displayed	20-651
EL-96	MDTL error EBC	(Disconnection in service brake solenoid) is displayed	20-652
EL-97	MDTL error EBD	(Disconnection in exhaust brake solenoid) is displayed	20-653
EL-98	MDTL error EBF	(Disconnection in preheating [heater relay circuit]) is displayed	20-654
EL-99	MDTL error ECA	(Disconnection in head lamp Hi relay) is displayed	20-655
EL-100	MDTL error ECB	(Disconnection in head lamp Lo relay) is displayed	20-656
EL-101	MDTL error ECC	(Disconnection in side lamp relay) is displayed	20-657
EL-102	MDTL error ECE	(Disconnection in right turn relay) is displayed	20-658
EL-103	MDTL error ECF	(Disconnection in left turn relay) is displayed	20-659
EL-104	MDTL error ED0	(Disconnection in steering mode solenoid a) is displayed	20-660
EL-105	MDTL error ED1	(Disconnection in steering mode solenoid c) is displayed	20-661
EL-106	MDTL error ED2	(Disconnection in steering mode solenoid b) is displayed	20-662
EL-107	MDTL error ED3	(Disconnection in steering mode solenoid d) is displayed	20-663
EL-108	MDTL error ED4	(Disconnection in swing pump merge solenoid) is displayed	20-664
EL-109	MDTL error ED7	(Disconnection in suspension lift) is displayed	20-665
EL-110	MDTL error EE7	(Outrigger control signal short circuited with power source) is displayed	20-666
EL-111	MDTL error EE8	(Outrigger control signal short circuited with ground, disconnection) is displayed	20-667
EL-112	MDTL error EE9	(Disconnection in fuel sensor) is displayed	20-668
EL-113	MDTL error EEB	(Abnormality in rear steering LOCK limit switch/FREE limit switch) is displayed	20-669
EL-114	MDTL error EEE	(Failure of both speedometer sensors) is displayed	20-671
EL-115	MDTL error EEF	(MDT speedometer sensor failure) is displayed	20-673
EL-116	MDTL error EF0	(Special steering failure emergency stop mode) is displayed	20-674
EL-117	MDTL error EF1	(Reverse steering failure emergency stop mode) is displayed	20-675
EL-118	MDTL error EF2	(Special steering failure) is displayed	20-676
EL-119	MDTL error EF3	(Reverse steering failure 1, normal steering held) is displayed	20-677
EL-120	MDTL error EF4	(Reverse steering failure 2, normal steering held) is displayed	20-678
EL-121	MDTL error EFE	(Abnormality in right turn relay) is displayed	20-680
EL-122	MDTL error EFF	(Abnormality in left turn relay) is displayed	20-682

TABLE OF ERROR CODES AND TROUBLESHOOTING CODES

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
(Upper MDT related)			
MDTU error E00	MDT system error	Action impossible, travel, operation stopped	EU- 1
MDTU error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EU- 2
MDTU error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EU- 3
MDTU error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EU- 4
MDTU error E21	Top, bottom selection warning	Travel, operation stopped	EU- 5
MDTU error E24	Model doesn't match (application stopped)	Action impossible, travel, operation stopped	EU- 6
MDTU error E25	Model selection warning	Travel, operation stopped	EU- 7
MDTU error E28	Abnormality in C-NET communication between MDTs (output stopped)	Travel, operation stopped	EU- 8
MDTU error E29	Abnormality in S-NET communication between MDT and moment limiter	Operation stopped	EU- 9
MDTU error E40	Swing flasher output short circuited with ground	Swing flasher does not flash	EU-10
MDTU error E41	Power source for outrigger panel short circuited with ground	Top outrigger cannot be operated	EU-11
MDTU error E43	Outrigger mode power source short circuited with ground	Outrigger cannot be operated	EU-13
MDTU error E44	Crab mode LED short circuited with ground	Crab mode LED does not light up	EU-14
MDTU error E45	Front wheel mode LED short circuited with ground	Front wheel mode LED does not light up	EU-15
MDTU error E46	Rear wheel mode LED short circuited with ground	Rear wheel mode LED does not light up	EU-16
MDTU error E47	4-wheel mode LED short circuited with ground	4-wheel mode LED does not light up	EU-17
MDTU error E48	Rear steering LOCK LED short circuited with ground	Rear steering LOCK LED does not light up	EU-18
MDTU error E49	Rear steering FREE LED short circuited with ground	Rear steering FREE LED does not light up	EU-19
MDTU error E4A	Rear steering CENTER LED short circuited with ground	Rear steering CENTER LED does not light up	EU-20
MDTU error E4B	Reverse steering display lamp short circuited with ground	Reverse steering display lamp does not light up	EU-21
MDTU error E4C	Winch rotation buzzer (main winch) short circuited with ground	Main winch buzzer does not sound	EU-22
MDTU error E4D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	EU-23
MDTU error E4E	Winch rotation buzzer (auxiliary winch) short circuited with ground	Auxiliary winch buzzer does not sound	EU-24
MDTU error E4F	Monitor central buzzer short circuited with ground	Monitor central buzzer does not sound	EU-25
MDTU error E50	Tachometer signal output short circuited	Tachometer does not work	EU-26
MDTU error E51	Speedometer signal output short circuited	Speedometer does not work	EU-27
MDTU error E52	Fuel level signal output short circuited	Fuel gauge does not work	EU-28
MDTU error E53	Engine water temperature signal output short circuited	Engine water temperature gauge does not work	EU-29
MDTU error E55	Torque converter oil temperature output short circuited	Torque converter overheat caution lamp does not light up	EU-30
MDTU error E56	Engine oil pressure output short circuited	Engine oil pressure caution lamp does not light up	EU-31

023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTU error E57	Preheating pilot output short circuited	Glow lamp (preheating pilot lamp) does not light up	EU-32
MDTU error E58	Parking brake actuation lamp output short circuited	Parking brake indicator lamp does not light up	EU-33
MDTU error E59	Retarder lamp output short circuited	Magnetic retarder lamp does not light up	EU-34
MDTU error E5A	Hi beam pilot output short circuited with ground	Hi beam pilot lamp does not light up	EU-35
MDTU error E5B	Hourmeter output short circuited with ground	Service meter does not work	EU-36
MDTU error E5C	Charge lamp output short circuited with ground	Battery charge caution lamp does not light up	EU-37
MDTU error E5D	Brake fluid (oil) level output short circuited with ground	Brake fluid (oil) level lamp does not light up	EU-38
MDTU error E5E	Right turn pilot output short circuited with ground	Right turn pilot lamp does not flash	EU-39
MDTU error E5F	Left turn pilot output short circuited with ground	Left turn pilot lamp does not flash	EU-40
MDTU error E72	LED dimmer 1 short circuited with ground	Shift position LED is not dimmed when using night lighting (lamp ON)	EU-41
MDTU error E73	LED dimmer 1 short circuited with power source	Shift position LED goes out or becomes excessively dim	EU-42
MDTU error E74	LED dimmer 2 short circuited with ground	Rear steering LOCK LED is not dimmed when using night lighting (lamp ON)	EU-43
MDTU error E75	LED dimmer 2 short circuited with power source	Rear steering LOCK LED goes out or becomes excessively dim	EU-44
MDTU error E80	Swing flasher output short circuited with power source	Swing flasher lamp does not go out	EU-46
MDTU error E83	Outrigger mode power source short circuited with power source	Bottom outrigger operation possible at position other than Operation 1 (PTO 1)	EU-47
MDTU error EB3	Disconnection in outrigger mode power source	Outrigger cannot be operated	EU-48
MDTU error EE0	PTO mode doesn't match	Action impossible (controller at PTO 1) travel, operation stopped	EU-49
MDTU error EE1	Abnormality in 2WD Hi/4WD Hi/4WD Lo input	Action impossible (controller at 4WD Hi)	EU-50
MDTU error EE3	Abnormality in service brake input	Possible to apply parking brake	EU-51
MDTU error EE4	Abnormality in suspension lift switch	Impossible to use suspension lift	EU-52
MDTU error EE5	Abnormality in outrigger control switch	Top outrigger cannot be operated	EU-53
MDTU error EE6	Outrigger EXTEND + RETRACT input simultaneously, JACK + SLIDE input simultaneously	Top outrigger cannot be operated	EU-54
MDTU error EEA	Abnormality in steering mode switch input	Steering mode does not switch	EU-55
MDTU error EEC	Rear steering LOCK + FREE command input simultaneously	Rear steering LOCK/FREE cannot be operated	EU-56
(Lower MDT related)			
MDTL error E00	MDT system error	Action impossible, travel, operation stopped	EL- 1
MDTL error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EL- 2
MDTL error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EL- 3
MDTL error E18	Disconnection in tachometer sensor	Tachometer does not work	EL- 4
MDTL error E19	Disconnection in speedometer sensor	Speedometer does not work	EL- 5
MDTL error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EL- 6
MDTL error E21	Top, bottom selection warning	Travel, operation stopped	EL- 7
MDTL error E24	Model doesn't match (application stopped)	Action impossible, travel, operation stopped	EL- 8

023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E25	Model selection warning	Travel, operation stopped	EL- 9
MDTL error E28	Abnormality in C-NET communication between MDTs	Travel, operation stopped	EL-10
MDTL error E29	Abnormality in S-NET communication between MDT and transmission controller	Travel, operation stopped	EL-11
MDTL error E40	Outrigger jack RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-22
MDTL error E41	Outrigger jack FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-23
MDTL error E42	Outrigger jack RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-24
MDTL error E43	Outrigger jack FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-25
MDTL error E44	Outrigger slide RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-26
MDTL error E45	Outrigger slide FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-27
MDTL error E46	Outrigger slide RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-28
MDTL error E47	Outrigger slide FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-29
MDTL error E48	Outrigger selector EXTEND short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-30
MDTL error E49	Outrigger selector RETRACT short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-31
MDTL error E4A	Rear steering LOCK solenoid short circuited with ground	Rear steering LOCK cannot be operated	EL-32
MDTL error E4B	Rear steering FREE solenoid short circuited with ground	Rear steering FREE cannot be operated	EL-33
MDTL error E4C	Service brake short circuited with ground	Auxiliary brake cannot be applied	EL-34
MDTL error E4D	Exhaust brake short circuited with ground	Exhaust brake cannot be applied	EL-35
MDTL error E4E	Retarder short circuited with ground	Retarder brake cannot be applied	EL-36
MDTL error E4F	Preheating short circuited with ground	Preheating does not work	EL-37
MDTL error E50	Electric stowing mirror set relay short circuited with ground	Electric mirror cannot be set (pulled out)	EL-38
MDTL error E51	Retarder speed output short circuited with ground	Retarder brake cannot be applied	EL-39
MDTL error E52	Electric stowing mirror stowing relay short circuited with ground	Electric mirror cannot be stowed	EL-40
MDTL error E5A	Head lamp Hi relay short circuited with ground	Hi beam does not work	EL-43
MDTL error E5B	Head lamp Lo relay short circuited with ground	Lo beam does not work	EL-44
MDTL error E5C	Side lamp relay short circuited with ground	Side lamp does not work	EL-45
MDTL error E5D	Service lamp relay short circuited with ground	Service lamp does not work	EL-46
MDTL error E5E	Right turn relay short circuited with ground	Turn signal indicator does not work	EL-47
MDTL error E5F	Left turn relay short circuited with ground	Turn signal indicator does not work	EL-48
MDTL error E60	Steering mode solenoid a short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-49
MDTL error E61	Steering mode solenoid c short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-50
MDTL error E62	Steering mode solenoid b short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-51
MDTL error E63	Steering mode solenoid d short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-52
MDTL error E64	Pump merge solenoid short circuited with ground	Lack of speed when outrigger ALL switch is operated	EL-53

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E67	Suspension lift solenoid short circuited with ground	Impossible to use suspension lift	EL-55
MDTL error E76	5V output short circuited with ground	Outrigger cannot be set, possible to actuate in emergency setting	EL-56
MDTL error E80	Outrigger jack RL short circuited with power source	Abnormal telescoping of outrigger	EL-57
MDTL error E81	Outrigger jack FL short circuited with power source	Abnormal telescoping of outrigger	EL-58
MDTL error E82	Outrigger jack RR short circuited with power source	Abnormal telescoping of outrigger	EL-59
MDTL error E83	Outrigger jack FR short circuited with power source	Abnormal telescoping of outrigger	EL-60
MDTL error E84	Outrigger slide RL short circuited with power source	Abnormal telescoping of outrigger	EL-61
MDTL error E85	Outrigger slide FL short circuited with power source	Abnormal telescoping of outrigger	EL-62
MDTL error E86	Outrigger slide RR short circuited with power source	Abnormal telescoping of outrigger	EL-63
MDTL error E87	Outrigger slide FR short circuited with power source	Abnormal telescoping of outrigger	EL-64
MDTL error E88	Outrigger selector EXTEND short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-65
MDTL error E89	Outrigger selector RETRACT short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-66
MDTL error E8A	Rear steering LOCK solenoid short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-67
MDTL error E8B	Rear steering FREE solenoid short circuited with power source	Rear steering FREE (travel carefully)	EL-68
MDTL error E8C	Service brake short circuited with power source	Impossible to release auxiliary brake	EL-69
MDTL error E8D	Exhaust brake short circuited with power source	Impossible to release exhaust brake	EL-70
MDTL error E8E	Retarder short circuited with power source	Impossible to release retarder brake	EL-71
MDTL error E8F	Preheating short circuited with power source	Preheating continues, abnormal engine exhaust color, drop in horsepower	EL-72
MDTL error E9A	Head lamp Hi short circuited with power source	Stays lighted at Hi beam	EL-73
MDTL error E9B	Head lamp Lo short circuited with power source	Stays lighted at Lo beam	EL-74
MDTL error E9C	Side lamp short circuited with power source	Side lamp stays lighted up	EL-75
MDTL error E9E	Right turn relay short circuited with power source	Turn signal remains actuated	EL-76
MDTL error E9F	Left turn relay short circuited with power source	Turn signal remains actuated	EL-77
MDTL error EA0	Steering mode solenoid a short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-78
MDTL error EA1	Steering mode solenoid c short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-79
MDTL error EA2	Steering mode solenoid b short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-80
MDTL error EA3	Steering mode solenoid d short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-81
MDTL error EA4	Pump merge solenoid short circuited with power source	Impossible to operate swing	EL-82
MDTL error EA7	Suspension lift solenoid short circuited with power source	Impossible to extend outrigger	EL-83
MDTL error EB0	Disconnection in outrigger jack RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-84
MDTL error EB1	Disconnection in outrigger jack FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-85
MDTL error EB2	Disconnection in outrigger jack RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-86
MDTL error EB3	Disconnection in outrigger jack FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-87

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error EB4	Disconnection in outrigger slide RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 88
MDTL error EB5	Disconnection in outrigger slide FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 89
MDTL error EB6	Disconnection in outrigger slide RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 90
MDTL error EB7	Disconnection in outrigger slide FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 91
MDTL error EB8	Disconnection in outrigger selector EXTEND	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 92
MDTL error EB9	Disconnection in outrigger selector RETRACT	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL- 93
MDTL error EBA	Disconnection in rear steering LOCK solenoid	Impossible to set rear steering to LOCK (when at LOCK, impossible to rear steering to FREE)	EL- 94
MDTL error EBB	Disconnection in rear steering FREE solenoid	Impossible to set rear steering to FREE	EL- 95
MDTL error EBC	Disconnection in service brake	Impossible to operate auxiliary brake	EL- 96
MDTL error EBD	Disconnection in exhaust brake	Impossible to operate exhaust brake	EL- 97
MDTL error EBF	Disconnection in preheating	Impossible to operate preheating	EL- 98
MDTL error ECA	Disconnection in head lamp Hi relay	Impossible to operate Hi beam	EL- 99
MDTL error ECB	Disconnection in head lamp Lo relay	Impossible to operate Lo beam	EL-100
MDTL error ECC	Disconnection in side lamp relay	Impossible to operate side lamp	EL-101
MDTL error ECE	Disconnection in right turn relay	Impossible to operate turn signal	EL-102
MDTL error ECF	Disconnection in left turn relay	Impossible to operate turn signal	EL-103
MDTL error ED0	Disconnection in steering mode solenoid a	Rear steering set to LOCK, travel with front 2-wheel steering	EL-104
MDTL error ED1	Disconnection in steering mode solenoid c	Rear steering set to LOCK, travel with front 2-wheel steering	EL-105
MDTL error ED2	Disconnection in steering mode solenoid b	Rear steering set to LOCK, travel with front 2-wheel steering	EL-106
MDTL error ED3	Disconnection in steering mode solenoid d	Rear steering set to LOCK, travel with front 2-wheel steering	EL-107
MDTL error ED4	Disconnection in pump merge solenoid	Lack of speed when outrigger ALL switch is operated	EL-108
MDTL error ED7	Disconnection in suspension lift	Impossible to use suspension lift	EL-109
MDTL error EE7	Outrigger control signal short circuited with power source	Immediately stops travel, impossible to operate steering, actuates emergency steering	EL-110
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	Takes no particular action, impossible to detect occurrence of secondary problem	EL-111
MDTL error EE9	Disconnection in fuel sensor	Fuel level unknown	EL-112
MDTL error EEB	Abnormality in rear steering LOCK limit switch/ FREE limit switch	Rear steering set to LOCK, travel with front 2-wheel steering	EL-113
MDTL error EEE	Failure of both speedometer sensors	No speedometer display, rear steering set to LOCK, travel with front 2-wheel steering	EL-114
MDTL error EEF	MDT speedometer sensor failure	Rear steering set to LOCK, travel with front 2-wheel steering	EL-115
MDTL error EF0	Special steering failure (emergency stop mode)	Immediately stops travel	EL-116
MDTL error EF1	Reverse steering failure (emergency stop mode)	Immediately stops travel	EL-117
MDTL error EF2	Special steering failure	Immediately stops travel, rear steering set to LOCK, travel with front 2-wheel steering	EL-118
MDTL error EF3	Reverse steering failure 1	Travels with normal steering, cannot set to reverse steering	EL-119
MDTL error EF4	Reverse steering failure 2	Immediately stops travel, rear steering set to LOCK, travel with normal steering	EL-120

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error EFE	Abnormality in right turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-121
MDTL error EFF	Abnormality in left turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-122
(Moment limiter controller related)			
OSS error E00	Abnormality in panel communication	Impossible to change working mode	EM- 1
OSS error E01	Panel system error	Impossible to change working mode	EM- 2
OSS error E02	Abnormality in panel rotary switch	Impossible to change working mode	EM- 3
OSS error E10	Moment limiter system error	Action impossible, stops work	EM- 4
OSS error E20	Abnormality in S-NET (communication between MDTs)	Action impossible, stops work	EM- 5
OSS error E21	Abnormality in outrigger length sensor FL system	Outrigger cannot be set, outrigger emergency setting mode	EM- 6
OSS error E22	Abnormality in outrigger length sensor FR system	Outrigger cannot be set, outrigger emergency setting mode	EM- 7
OSS error E23	Abnormality in outrigger length sensor RL system	Outrigger cannot be set, outrigger emergency setting mode	EM- 8
OSS error E24	Abnormality in outrigger length sensor RR system	Outrigger cannot be set, outrigger emergency setting mode	EM- 9
OSS error E30	Abnormality in jib transmission module communication	Impossible to operate jib	EM-10
OSS error E31	Abnormality in tilt angle sensor system	Impossible to operate jib, jib angle unknown	EM-11
OSS error E41	Abnormality in boom angle sensor system	Impossible to operate boom, boom angle unknown, hook load unknown	EM-12
OSS error E43	Abnormality in boom length sensor system	Impossible to operate boom, boom length unknown, hook load unknown	EM-13
OSS error E44	Abnormality in bottom pressure sensor system	Impossible to operate boom, hook load unknown	EM-14
OSS error E45	Abnormality in head pressure sensor system	Impossible to operate boom, hook load unknown	EM-15
OSS error E46	Abnormality in swing angle sensor system	Impossible to operate boom, swing position unknown	EM-16
OSS error E48	Reverse rotation of hoist cylinder axis power	Boom hoist cylinder stroke end, impossible to operate boom, hook load unknown	EM-17
OSS error E50	Main unload solenoid short circuited with ground	Work equipment does not move	EM-18
OSS error E51	PPC unload solenoid short circuited with ground	Jib tilt does not work	EM-19
OSS error E52	Jib telescope selector solenoid short circuited with ground	Top telescope cylinder does not work	EM-20
OSS error E53	Automatic stop cancel prohibition relay short circuited with ground	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	EM-21
OSS error E58	Jib EXTEND/STOW relay short circuited with ground	Impossible to extend or stow jib	EM-26
OSS error E59	Jib rotation permission relay short circuited with ground	Impossible to extend or stow jib (impossible to rotate)	EM-27
OSS error E5C	Moment limiter buzzer short circuited with ground	Moment limiter buzzer does not sound	EM-30
OSS error E5D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	EM-31
OSS error E68	10 V power source short circuited with ground	Impossible to operate boom, hook load unknown	EM-32
OSS error E6A	15 V power source short circuited with ground	Impossible to operate boom, hook load unknown	EM-33
OSS error E70	Main unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop	EM-34
OSS error E71	PPC unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop (jib LOWER only)	EM-35
OSS error E72	Jib telescope selector solenoid short circuited with power source	2nd boom telescope cylinder does not move	EM-36

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
OSS error E73	Automatic stop cancel prohibition relay short circuited with power source	Impossible to use automatic stop cancel	EM-37
OSS error E78	Jib EXTEND/STOW relay short circuited with power source	Impossible to operate jib	EM-41
OSS error E79	Jib rotation permission relay short circuited with power source	Impossible to extend or stow jib	EM-42
OSS error E88	Disconnection in main unload solenoid	Stays at automatic stop	EM-43
OSS error E89	Disconnection in PPC unload solenoid	Stays at automatic stop (jib LOWER only)	EM-44
OSS error E8A	Disconnection in jib telescope selector solenoid	Top boom telescope cylinder does not move	EM-45
OSS error E8B	Disconnection in automatic stop cancel prohibition relay	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	EM-46
OSS error EA0	Abnormality in over-front limit switch	For on-tire operation, traveling with raised load, over-front load table is not given	EM-47
OSS error EA1	Abnormality in top boom stow limit switch	Boom telescope abnormal, rated load limited	EM-48
OSS error EA2	Abnormality in boom selection switch	Manual telescope impossible	EM-49
OSS error EA3	Left lock pin input short circuited with power source	Abnormality in jib EXTEND/STOW	EM-50
OSS error EA5	Abnormality in PTO switch	Action impossible (controller at PTO 1 condition)	EM-52
OSS error EA6	H/X selection doesn't match (outrigger)	Action impossible (controller at X-shape condition)	EM-53
OSS error EA7	Specification selection rotary switch setting not available	Action impossible, stops work	EM-54
OSS error EA8	PPC pressure switch boom RAISE short circuited with ground	Automatic stop	EM-55
OSS error EA9	PPC pressure switch boom LOWER short circuited with ground	Automatic stop	EM-56
OSS error EAA	PPC pressure switch boom EXTEND short circuited with ground	Automatic stop	EM-57
OSS error EAB	PPC pressure switch boom RETRACT short circuited with ground	Automatic stop	EM-58
OSS error EAC	PPC pressure switch jib RAISE short circuited with ground	Automatic stop	EM-59
OSS error EAD	PPC pressure switch jib LOWER short circuited with ground	Automatic stop	EM-60
OSS error EB0	PPC pressure switch boom RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-61
OSS error EB1	PPC pressure switch boom EXTEND + RETRACT input simultaneously	Automatic stop reset impossible	EM-62
OSS error EB2	PPC pressure switch jib RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-63
OSS error EB3	PPC pressure switch swing left + right input simultaneously	Automatic stop reset impossible	EM-64
OSS error EB4	PPC pressure switch main winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-65
OSS error EB5	PPC pressure switch auxiliary winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-66
(Transmission controller related)			
ATM error E11	Disconnection in tachometer sensor	Shock when shifting gear but travel possible	ET- 1
ATM error E12	Disconnection in speed sensor 1	Nothing in particular (emergency stop when secondary problem occurs)	ET- 2
ATM error E13	Disconnection in speed sensor 2	Nothing in particular (emergency stop when secondary problem occurs)	ET- 3
ATM error E14	Disconnection in accelerator potentiometer	Shock when shifting gear but travel possible	ET- 4
ATM error E17	Disconnection in shift lever	Time lag when shifting gear	ET- 5
ATM error E18	Disconnection in FR signal for interlock	Time lag when shifting gear	ET- 6

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
ATM error E19	No input for solenoid power source monitor	Normal travel possible (detection impossible when secondary problem occurs)	ET- 7
ATM error E24	Accelerator potentiometer short circuited	Shock when shifting gear but travel possible	ET- 8
ATM error E25	Abnormality in emergency gear shift switch or abnormality in PTO 2 switch	Emergency travel impossible, operate valve in emergency	ET- 9
ATM error E32	Abnormality in speed sensor 1	Normal travel possible (emergency stop when secondary problem occurs)	ET-10
ATM error E33	Abnormality in speed sensor 2	Normal travel possible (emergency stop when secondary problem occurs)	ET-11
ATM error E35	MDT at other than N with interlock signal N	Travel possible in emergency gear shift mode	ET-12
ATM error E37	Abnormality in shift lever (2 or more signals ON)	Travel possible in emergency gear shift mode from neutral	ET-13
ATM error E38	Interlock F + R signals ON simultaneously	Travel possible (time lag when shifting gear)	ET-14
ATM error E39	Interlock signal F or R but MDT at N	Travel possible in emergency gear shift mode	ET-15
ATM error E3F	Abnormality in S-NET (communication between MDTs)	Travel possible under certain conditions (★)	ET-16
ATM error E53	Overrun	Normal travel possible (overrun warning only)	ET-17
ATM error E55	Drop in battery voltage	Stop, travel possible with emergency gear shift mode	ET-18
ATM error E5A	Special steering system short circuited with ground	Normal travel possible	ET-19
ATM error E5B	Disconnection in special steering system	Impossible to change from front wheel mode	ET-20
ATM error E5C	Reverse steering system short circuited with ground	Normal travel possible	ET-21
ATM error E5D	Disconnection in reverse steering system	Impossible to change to reverse steering mode	ET-22
ATM error E70	Disconnection in R solenoid (ECMV) system	Cannot travel in reverse	ET-23
ATM error E71	Disconnection in F2 solenoid (ECMV) system	Cannot travel forward	ET-24
ATM error E72	Disconnection in F1 solenoid (ECMV) system	Cannot travel forward	ET-25
ATM error E73	Disconnection in F3 solenoid (ECMV) system	Cannot travel forward	ET-26
ATM error E74	Disconnection in lock-up solenoid (ECMV) system	Torque converter lock-up impossible	ET-27
ATM error E78	Disconnection in Lo solenoid system	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-28
ATM error E79	Disconnection in 4WD solenoid system	4WD travel impossible (travel possible in 2WD Hi)	ET-29
ATM error E7B	Disconnection in reverse steering compensation relay system	Travel possible except in reverse steering mode	ET-30
ATM error E7C	Disconnection in F2, R solenoid cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-31
ATM error E7D	Disconnection in back-up lamp relay	Back-up lamp does not light up in REVERSE	ET-32
ATM error E7E	Disconnection in F1, F3 solenoid (ECMV) cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-33
ATM error E7F	Disconnection in special steering relay system	Travel possible in front wheel mode	ET-34
ATM error E80	R solenoid (ECMV) system short circuited	Cannot travel in reverse	ET-35
ATM error E81	F2 solenoid (ECMV) system short circuited	Cannot travel forward	ET-36
ATM error E82	F1 solenoid (ECMV) system short circuited	Cannot travel forward	ET-37
ATM error E83	F3 solenoid (ECMV) system short circuited	Cannot travel forward	ET-38
ATM error E84	Lock-up solenoid (ECMV) system short circuited	Torque converter lock-up impossible	ET-39


Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
ATM error E88	Lo solenoid system short circuited	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-40
ATM error E89	4WD solenoid system short circuited	4WD travel impossible (travel possible in 2WD Hi)	ET-41
ATM error E8B	Reverse steering compensation system short circuited	Travel possible except in reverse steering mode	ET-42
ATM error E8C	F2, R solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-43
ATM error E8D	Back-up lamp relay system short circuited	Back-up lamp does not light up in REVERSE	ET-44
ATM error E8E	F1, F3 solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-45
ATM error E8F	Special steering mode relay system short circuited	Travel possible in front wheel mode	ET-46
ATM error E90,E91	R or F2 solenoid system short circuited with power source	Cannot travel	ET-47
ATM error E92,E93	F3 or F1 solenoid system short circuited with power source	Cannot travel forward	ET-48
ATM error E94	Lock-up solenoid system short circuited with power source	Torque converter lock-up impossible	ET-49

- ★ For "certain conditions" for ATM error E3F in the Problem on machine column, see the transmission controller related section in ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS.

ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS






Error code	Abnormal system	Nature of abnormality
MDTL error E00	MDT system error	1) System error inside lower MDT (internal defect)
MDTL error E10	Shut off when low voltage	1) Drop in battery voltage
MDTL error E11	Shut off when high temperature	1) Rise in temperature inside lower MDT
MDTL error E18	Disconnection in tachometer sensor	1) Defective tachometer sensor 2) Defective contact or disconnection in wiring harness between M06 (female) (7) – LM05 (5) – EL1 (1) – E01 (female) (1) 3) Defective contact or disconnection in wiring harness between M06 (female) (10) – LM05 (4) – EL1 (2) – E01 (female) (2) 4) Defective lower MDT
MDTL error E19	Disconnection in speedometer sensor	1) Defective speedometer sensor 2) Defective contact or disconnection in wiring harness between M06 (female) (15) – LM02 (3) – L103 (female) (1) 3) Defective contact or disconnection in wiring harness between M06 (female) (10) – LM02 (4) – L103 (female) (2) 4) Defective lower MDT
MDTL error E20	Top, bottom don't match (application stopped)	1) Defective contact or disconnection in wiring harness between M03 (female) (18) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 2) Contact of M03 (female) (8) with GND 3) Defective contact or disconnection in wiring harness between C04 (female) (8) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) 4) Contact of C04 (female) (18) with GND 5) Defective lower MDT 6) Defective upper MDT (If problem occurs when starting)

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
—	1) Output stopped	1) Travel, operation stopped (action impossible)	EL-1
1) Battery voltage: Min. 20 V	1) Output stopped	1) Travel, operation stopped (action impossible)	EL-2
1) Internal temperature of lower MDT: Max. 90°C	1) Output stopped	1) Travel, operation stopped (action impossible) • Wait for the internal tem- perature to go down, then start the engine again.	EL-3
Voltage (between M06 (female) (7) – (10)) • When starting engine: Min. 0.5 V Sensor resistance value • 100 – 500 Ω	1) Does not take any particu- lar action (only records error code)	1) Tachometer does not work	EL-4
Sensor resistance value • 500 – 1000 Ω	1) Controls with transmission controller speedometer sensor value 2) Actuates emergency alarm buzzer	1) Speedometer does not work	EL-5
Voltage 1) Between upper MDT terminal C04 (8) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (18) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (8) and M02 (11), (21): 15 – 30 V 4) Between lower MDT terminal M03 (18) and M02 (11), (21): Max. 1 V	1) Output stopped 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Travel, operation stopped (action impossible)	EL-6

Error code	Abnormal system	Nature of abnormality
MDTL error E21	Top, bottom selection warning	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between M03 (female) (18) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 2) Contact of M03 (female) (8) with GND 3) Defective contact or disconnection in wiring harness between C04 (female) (8) – CR3 (14),(13) – CR3 (1),(2) – (slip ring) and connecting point of L03 (1),(2) and LM04 (female) (13), LM03 (male) (10) 4) Contact of C04 (female) (18) with GND 5) Defective lower MDT 6) Defective upper MDT (If problem occurs after starting)
MDTL error E24	Model doesn't match (application stopped)	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between M03 (female) (9),(10) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 2) Contact of M03 (female) (19),(20) with GND 3) Defective contact or disconnection in wiring harness between C04 (female) (9),(10) – C02 (11),(21) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) and connecting point of L03 (male) (1),(2) and LM04 (female) (13), LM03 (male) (10) 4) Contact of C04 (female) (19),(20) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs when starting)
MDTL error E25	Model selection warning	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between M03 (female) (9),(10) and connecting point of M02 (11),(21) and LM04 (male) (13), LM03 (female) (10) 2) Contact of M03 (female) (19),(20) with GND 3) Defective contact or disconnection in wiring harness between C04 (female) (9),(10) – C02 (11),(21) – CR3 (14),(13) – R03 (1),(2) – (slip ring) – L03 (1),(2) and connecting point of L03 (male) (1),(2) and LM04 (female) (13), LM03 (male) (10) 4) Contact of C04 (female) (19),(20) with GND 5) Defective upper MDT 6) Defective lower MDT (If problem occurs after starting)
MDTL error E28	Abnormality in C-NET communication between MDTs	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between C05 (female) (5) – CR1 (1) – R03 (7) – (slip ring) – L03 (7) – LM02 (1) – M06 (female) (5), or short circuit with ground 2) Defective contact or disconnection in wiring harness between C05 (female) (13) – CR1 (2) – R04 (12) – (slip ring) – L04 (12) – LM03 (1) – M06 (female) (13) 3) Defective contact or disconnection in wiring harness between C05 (female) (6) – CR1 (3) – R03 (8) – (slip ring) – L03 (8) – LM02 (2) – M06 (female) (6), or short circuit with ground 4) Defective contact or disconnection in wiring harness between C05 (female) (14) – CR1 (4) – R04 (14) – (slip ring) – L04 (14) – LM03 (2) – M06 (female) (14) 5) Defective upper MDT 6) Defective lower MDT
MDTL error E29	Abnormality in S-NET communication between MDT and transmission controller	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between M06 (female) (4) and M13 (female) (1), or short circuit with ground 2) Defective contact or disconnection in wiring harness between M06 (female) (12) and M13 (female) (12), or short circuit with ground 3) Defective lower MDT
MDTL error E40	Outrigger jack RL short circuited with ground	<ol style="list-style-type: none"> 1) Defective outrigger jack RL solenoid 2) (X-shape) Wiring harness between M01 (female) (3) – LM10 (7) – L37 (female) (1), or between intermediate connecting point of L37 (female) (1) and LM10 (male) (7) – L05 (female) (1) short circuiting with chassis ground (H-shape) Wiring harness between M01 (female) (3) – LM10 (7) – L34 (female) (1), or between intermediate connecting point of L37 (female) (1) and LM10 (male) (7) – L05 (female) (1) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage 1) Between upper MDT terminal C04 (8) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (18) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (8) and M02 (11), (21): 15 – 30 V 4) Between lower MDT terminal M03 (18) and M02 (11), (21): Max. 1 V	1) Displays emergency stop mode  2) Actuates emergency alarm buzzer 3) Carries out other outputs as	1) Travel, operation stopped	EL-7
Voltage 1) Between upper MDT terminal C04 (9), (10) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (19), (20) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (9), (10) and M02 (11), (21): Max. 1 V 4) Between lower MDT terminal M03 (19), (20) and M02 (11), (21): 15 – 30 V	1) Output stopped 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Travel, operation stopped (action impossible)	EL-8
Voltage 1) Between upper MDT terminal C04 (9), (10) and C02 (11), (21): Max. 1V 2) Between upper MDT terminal C04 (19), (20) and C02 (11), (21): 15 – 30 V 3) Between lower MDT terminal M03 (9), (10) and M02 (11), (21): Max. 1 V 4) Between lower MDT terminal M03 (19), (20) and M02 (11), (21): 15 – 30 V	1) Displays emergency stop mode  2) Actuates emergency alarm buzzer 3) Carries out other outputs as normal	1) Travel, operation stopped	EL-9
Voltage (Between lower MDT terminal M06 (5), (13) and (6), (14)): 7 – 11V	1) When engine is started, side lamps and head lamps Lo light up, left and right turn signal lamps flash 2) Steering mode is set to HOLD, outrigger mode power source is output Prohibits outrigger output 3) Displays emergency stop mode  4) Actuates emergency alarm buzzer	1) Travel, operation stopped	EL-10
Voltage (between lower MDT terminal M06 (4), (12) and (10)): 4 – 8V	1) Holds steering mode. 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Travel, operation stopped	EL-11
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (3) and chassis) • When outrigger jack RL solenoid is actuated: 17 – 30 V	1) Stops output to outrigger jack RL solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-22

023S02

Error code	Abnormal system	Nature of abnormality
MDTL error E41	Outrigger jack FL short circuited with ground	1) Defective outrigger jack FL solenoid 2) (X-shape) Wiring harness between M01 (female) (14) – LM10 (9) – L40 (female) (1), or between intermediate connecting point of L40 (female) (1) and LM10 (male) (9) – L05 (female) (3) short circuiting with chassis ground (H-shape) Wiring harness between M01 (female) (14) – LM10 (9) – L43 (female) (1), or between intermediate connecting point of L43 (female) (1) and LM10 (male) (9) – L05 (female) (3) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E42	Outrigger jack RR short circuited with ground	1) Defective outrigger jack RR solenoid 2) (X-shape) Wiring harness between M01 (female) (4) – LM10 (11) – L34 (female) (1), or between intermediate connecting point of L34 (female) (1) and LM10 (male) (11) – L05 (female) (5) short circuiting with chassis ground (H-shape) Wiring harness between M01 (female) (4) – LM10 (11) – L37 (female) (1), or between intermediate connecting point of L37 (female) (1) and LM10 (male) (11) – L05 (female) (5) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E43	Outrigger jack FR short circuited with ground	1) Defective outrigger jack FR solenoid 2) (X-shape) Wiring harness between M01 (female) (15) – LM10 (13) – L43 (female) (1), or between intermediate connecting point of L43 (female) (1) and LM10 (male) (13) – L05 (female) (7) short circuiting with chassis ground (H-shape) Wiring harness between M01 (female) (15) – LM10 (13) – L40 (female) (1), or between intermediate connecting point of L40 (female) (1) and LM10 (male) (13) – L05 (female) (7) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E44	Outrigger slide RL short circuited with ground	1) Defective outrigger slide RL solenoid 2) Wiring harness between M01 (female) (5) – LM10 (8) – L154 (female) (1), or between intermediate connecting point of L154 (female) (1) and LM10 (male) (8) – L05 (female) (2) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E45	Outrigger slide FL short circuited with ground	1) Defective outrigger slide FL solenoid 2) Wiring harness between M01 (female) (16) – LM10 (10) – L152 (female) (1), or between intermediate connecting point of L152 (female) (1) and LM10 (male) (10) – L05 (female) (4) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E46	Outrigger slide RR short circuited with ground	1) Defective outrigger slide RR solenoid 2) Wiring harness between M01 (female) (7) – LM10 (12) – L153 (female) (1), or between intermediate connecting point of L153 (female) (1) and LM10 (male) (12) – L05 (female) (6) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (14) and chassis) • When outrigger jack FL solenoid is actuated: 17 – 30 V	1) Stops output to outrigger jack FL solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-23
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (4) and chassis) • When outrigger jack RR solenoid is actuated: 17 – 30 V	1) Stops output to outrigger jack RR solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-24
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (15) and chassis) • When outrigger jack FR solenoid is actuated: 17 – 30 V	1) Stops output to outrigger jack FR solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-25
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (5) and chassis) • When outrigger slide RL solenoid is actuated: 17 – 30 V	1) Stops output to outrigger slide RL solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-26
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (16) and chassis) • When outrigger slide FL solenoid is actuated: 17 – 30 V	1) Stops output to outrigger slide FL solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-27
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (7) and chassis) • When outrigger slide RR solenoid is actuated: 17 – 30 V	1) Stops output to outrigger slide RR solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-28

023S02

Error code	Abnormal system	Nature of abnormality
MDTL error E47	MDT system error	1) Defective outrigger slide FR solenoid 2) Wiring harness between M01 (female) (17) – LM10 (14) – L151 (female) (1), or between intermediate connecting point of L151 (female) (1) and LM10 (male) (14) – L05 (female) (8) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E48	Shut off when low voltage	1) Defective outrigger selector EXTEND solenoid 2) Defective outrigger selector relay 3) Wiring harness between M01 (female) (8) – M21 (2) – M37 (female) (1) short circuiting with chassis ground 4) Wiring harness between M02 (female) (7) – LM10 (5) – L16 (female) (1), between intermediate connecting point of M02 (female) (7) and LM10 (female) (5) – M21 (3) – M37 (female) (2), or between intermediate connecting point of LM10 (male) (5) and L16 (female) (1) – L05 (female) (9) short circuiting with chassis ground 5) Defective bottom outrigger control panel 6) Defective lower MDT
MDTL error E49	Shut off when high temperature	1) Defective outrigger selector stow (RETRACT) solenoid 2) Defective outrigger selector relay 3) Wiring harness between M01 (female) (18) – M21 (1) – M37 (female) (3) short circuiting with chassis ground 4) Wiring harness between M02 (female) (8) – LM10 (6) – L140 (female) (1), between intermediate connecting point of M02 (female) (8) and LM10 (male) (6) – M21 (4) – M37 (female) (4) short circuiting with chassis ground 5) Defective bottom outrigger control panel 6) Defective lower MDT
MDTL error E4A	Disconnection in tachometer sensor	1) Defective rear steering LOCK solenoid 2) Wiring harness between M01 (female) (9) – LM06 (5) – L70 (6) – L12 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E4B	Disconnection in speedometer sensor	1) Defective rear steering FREE solenoid 2) Wiring harness between M01 (female) (19) – LM06 (6) – L70 (7) – L13 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E4C	Top, bottom don't match (application stopped)	1) Defective service (auxiliary) brake solenoid 2) Wiring harness between M01 (female) (10) – LM05 (10) – L70 (5) – L71 (female) (1) – L72 (female) (1) short circuiting with chassis ground 3) Defective lower MDT





023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Solenoid resistance value: 10 – 30 Ω Voltage (between M01 (17) and chassis) • When outrigger slide FR solenoid is actuated: 17 – 30 V	1) Stops output to outrigger slide FR solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-29
Solenoid resistance value: 30 – 80 Ω Voltage (between M01 (8) and chassis) • When outrigger selector EXTEND solenoid is actuated: 17 – 30 V	1) Stops output to outrigger selector EXTEND solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated) 2) Suspension lift cannot be used	EL-30
Solenoid resistance value: 30 – 80 Ω Voltage (between M01 (18) and chassis) • When outrigger selector stow (RETRACT) solenoid is actuated: 17 – 30 V	1) Stops output to outrigger stow (RETRACT) solenoid.	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-31
Solenoid resistance value: 10 – 20 Ω Voltage (between M01 (9) and chassis) • When rear steering LOCK is actuated: 17 – 30 V	1) Stops output to rear steering LOCK solenoid. Actuates emergency alarm buzzer	1) Rear steering LOCK cannot be operated.	EL-32
Solenoid resistance value: 10 – 20 Ω Voltage (between M01 (19) and chassis) • When rear steering FREE is actuated: 17 – 30 V	1) Stops output to rear steering FREE solenoid. 2) Actuates emergency alarm buzzer	1) Rear steering FREE cannot be operated.	EL-33
Solenoid resistance value: 20 – 60 Ω Voltage (between M01 (10) and chassis) • When service (auxiliary) brake is actuated: 17 – 30 V	1) Stops output to service (auxiliary) brake solenoid.	1) Service (auxiliary) brake cannot be operated.	EL-34

Error code	Abnormal system	Nature of abnormality
MDTL error E4D	Exhaust brake solenoid short circuited with ground	1) Defective exhaust brake solenoid 2) Wiring harness between M01 (female) (20) – LM05 (9) – L57 (female) (1) {– L58 (female) (1)} short circuiting with chassis ground 3) Defective lower MDT
MDTL error E4F	Preheating [heater relay] short circuited with ground	1) Defective heater relay 2) Wiring harness between M01 (female) (21) – LM07 (9) – EL2 (5) – heater relay terminal (female) (5) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E50	Electric stowing mirror set relay short circuited with ground	1) Defective electric stowing mirror set relay 2) Wiring harness between M44 (female) (6) and M04 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E52	Electric stowing mirror stowing relay short circuited with ground	1) Defective electric stowing mirror stowing relay 2) Wiring harness between M43 (female) (6) and M04 (female) (2) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E5A	Side lamp relay short circuited with ground	1) Defective side lamp relay 2) Wiring harness between M04 (female) (7) – M19 (5) – M27 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E5B	Head lamp Lo relay short circuited with ground	1) Defective head lamp Lo relay 2) Wiring harness between M04 (female) (14) – M19 (3) – M25 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E5C	Side lamp relay short circuited with ground	1) Defective side lamp relay 2) Wiring harness between M04 (female) (7) – M19 (5) – M27 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E5E	Right turn relay short circuited with ground	1) Defective right turn relay 2) Wiring harness between M04 (female) (8) – M19 (6) – M28 (female) (1) short circuiting with chassis ground 3) Defective lower MDT

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Solenoid resistance value: 20 – 60 Ω Voltage (between M01 (20) and chassis) • When exhaust brake is actuated: 17 – 30 V	1) Stops output to exhaust brake solenoid.	1) Exhaust brake cannot be operated.	EL-35
Voltage (between M01 (21) and chassis) • Starting switch at HEAT: 17 – 30 V	1) Stops output to heater re- lay.	1) Preheating cannot be oper- ated.	EL-37
Voltage (between M04 (1) and chassis) Electric stowing mirror switch at STOW : 17 – 30 V Electric stowing mirror switch at SET : Max. 1V	1) Stops output to electric stowing mirror set relay.	1) Electric mirror cannot be set (pulled out)	EL-38
Voltage (between M04 (2) and chassis) Electric stowing mirror switch at STOW : Max. 1V Electric stowing mirror switch at SET : 17 – 30 V	1) Stops output to electric stowing mirror stowing relay.	1) Electric mirror cannot be stowed	EL-40
Voltage (between M04 (6) and chassis) • Lamp switch stage 2 ON, dimmer switch pressed odd number of times: 17 – 30 V	1) Stops output to head lamp Hi relay.	1) Head lamp Hi beam cannot be operated.	EL-43
Voltage (between M04 (14) and chassis) • Lamp switch stage 2 ON, dimmer switch pressed even number of times: 17 – 30 V	1) Stops output to head lamp Lo relay.	1) Head lamp Lo beam cannot be operated.	EL-44
Voltage (between M04 (7) and chassis) • Lamp switch stage 1 ON: 17 – 30 V	1) Stops output to side lamp relay.	1) Side lamp cannot be oper- ated.	EL-45
Voltage (between M04 (8) and chassis) • Right turn indicator lever ON: 17 – 30 V	1) Stops output to right turn relay.	1) Right turn signal cannot be operated.	EL-47

Error code	Abnormal system	Nature of abnormality
MDTL error E5F	Left turn relay short circuited with ground	1) Defective left turn relay 2) Wiring harness between M04 (female) (16) – M19 (7) – M29 (female) (1) short-circuiting with chassis ground 3) Defective lower MDT
MDTL error E60	Steering mode solenoid a short circuited with ground	1) Defective steering mode solenoid a 2) Wiring harness between M02 (female) (1) – LM06 (11) – L23 (female) (1), or between M14 (female) (13) – intermediate connecting point of M02 (female) (1) and LM06 (male) (11) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E61	Steering mode solenoid c short circuited with ground	1) Defective steering mode solenoid c 2) Wiring harness between M02 (female) (12) – LM06 (9) – L20 (female) (1), or between M14 (female) (11) – intermediate connecting point of M02 (female) (12) and LM06 (male) (9) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E62	Steering mode solenoid b short circuited with ground	1) Defective steering mode solenoid b 2) Wiring harness between M02 (female) (2) – LM06 (7) – L19 (female) (1), or between M14 (female) (12) – intermediate connecting point of M02 (female) (2) and LM06 (male) (7) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E63	Steering mode solenoid d short circuited with ground	1) Defective steering mode solenoid d 2) Wiring harness between M02 (female) (13) – LM06 (13) – L25 (female) (1) {– L26 (female) (1)}, or between M14 (female) (14) – intermediate connecting point of M02 (female) (13) and LM06 (male) (13) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E64	Swing pump merge solenoid short circuited with ground	1) Defective swing pump merge solenoid relay 2) Wiring harness between M02 (female) (3) – M19 (8) – M31 (female) (1) short circuiting with chassis ground 3) Defective lower MDT

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between M04 (16) and chassis) • Left turn indicator lever ON: 17 – 30 V	1) Stops output to left turn relay.	1) Left turn signal cannot be operated.	EL-48
Solenoid resistance value: 10 – 20 Ω Voltage (between M02 (1) and chassis) • When steering mode solenoid a is actuated: 17 – 30 V	1) Stops output to steering mode solenoid a, sets steering mode to front wheel mode. 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer + monitor central buzzer 4) Displays error code (E60 + EF0)	1) Steering mode cannot be set to rear wheel mode (it is set to front wheel mode) 2) Rear steering cannot be set to LOCK.	EL-49
Solenoid resistance value: 10 – 20 Ω Voltage (between M02 (12) and chassis) • When steering mode solenoid c is actuated: 17 – 30 V	1) Stops output to steering mode solenoid c, sets steering mode to front wheel mode. 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer + monitor central buzzer 4) Displays error code (E61 + EF0)	1) Steering mode cannot be set to crab mode (it is set to front wheel mode) 2) Rear steering cannot be set to LOCK.	EL-50
Solenoid resistance value: 10 – 20 Ω Voltage (between M02 (2) and chassis) • When steering mode solenoid b is actuated: 17 – 30 V	1) Stops output to steering mode solenoid b, sets steering mode to front wheel mode. 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer + monitor central buzzer 4) Displays error code (E62 + EF0)	1) Steering mode cannot be set to rear wheel, 4-wheel mode (it is set to front wheel mode) 2) Rear steering cannot be set to LOCK.	EL-51
Solenoid resistance value: 10 – 20 Ω Voltage (between M02 (13) and chassis) • When steering mode solenoid d is actuated: 17 – 30 V	1) Stops output to steering mode solenoid d, sets steering mode to normal steering mode. 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer + monitor central buzzer 4) Displays error code (E63 + EF1)	1) Steering mode cannot be set to reverse steering mode (stays in normal steering mode) (reverse steering switch is turned OFF and machine travels in normal steering mode)	EL-52
Voltage (between M02 (3) and chassis) • When outrigger ALL control switch is ON: 17 – 30 V (if actuation conditions are correct)	1) Stops output to swing pump merge solenoid relay. 2) Actuates emergency alarm buzzer.	1) Lacks speed during outrigger ALL operation. 2) Steering wheel becomes heavy when traveling with engine at low speed.	EL-53



Error code	Abnormal system	Nature of abnormality
MDTL error E67	Suspension lift solenoid short circuited with ground	1) Defective suspension lift solenoid 2) Wiring harness between M02 (female) (15) – LM05 (13) – L31 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E76	Outrigger length sensor power source (5V) short circuited with ground	1) Defective outrigger length sensor (one or more of FL, FR, RL, RR) 2) Wiring harness between M06 (female) (2) – LM10 (15) – L42 (female) (1), L39 (female) (1), L33 (female) (1) or L36 (female) (1) short circuiting with chassis ground 3) Defective lower MDT
MDTL error E80	Outrigger jack RL short circuited with power source	1) (X-shape) Wiring harness between M01 (female) (3) – LM10 (7) – L37 (female) (1), or between intermediate connecting point of L37 (female) (1) and LM10 (male) (7) – L05 (female) (1) short circuiting with power source (H-shape) Wiring harness between M01 (female) (3) – LM10 (7) – L34 (female) (1), or between intermediate connecting point of L34 (female) (1) and LM10 (male) (7) – L05 (female) (1) short circuiting with power source 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E81	Outrigger jack FL short circuited with power source	1) (X-shape) Wiring harness between M01 (female) (14) – LM10 (9) – L40 (female) (1), or between intermediate connecting point of L40 (female) (1) and LM10 (male) (9) – L05 (female) (3) short circuiting with power source (H-shape) Wiring harness between M01 (female) (14) – LM10 (9) – L43 (female) (1), or between intermediate connecting point of L43 (female) (1) and LM10 (male) (9) – L05 (female) (3) short circuiting with power source 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E82	Outrigger jack RR short circuited with power source	1) (X-shape) Wiring harness between M01 (female) (4) – LM10 (11) – L34 (female) (1), or between intermediate connecting point of L34 (female) (1) and LM10 (male) (11) – L05 (female) (5) short circuiting with power source (H-shape) Wiring harness between M01 (female) (4) – LM10 (11) – L37 (female) (1), or between intermediate connecting point of L37 (female) (1) and LM10 (male) (11) – L05 (female) (5) short circuiting with power source 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E83	Outrigger jack FR short circuited with power source	1) (X-shape) Wiring harness between M01 (female) (15) – LM10 (13) – L43 (female) (1), or between intermediate connecting point of L43 (female) (1) and LM10 (male) (13) – L05 (female) (7) short circuiting with power source (H-shape) Wiring harness between M01 (female) (15) – LM10 (13) – L40 (female) (1), or between intermediate connecting point of L40 (female) (1) and LM10 (male) (13) – L05 (female) (7) short circuiting with power source 3) Defective bottom outrigger control panel 4) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Solenoid resistance value: 10 – 30 Ω Voltage (between M02 (13) and chassis) • When suspension lift solenoid is actuated: 17 – 30 V	1) Stops output to suspension lift solenoid.	1) Suspension lift cannot be operated	EL-55
Voltage (between M06 (2) and chassis): 4.75 – 5.25 V Sensor resistance value: 1900 – 2100 Ω	1) Stops power source (5V) output to outrigger length sensor.	1) Outrigger setting impossible. (possible to operate in emergency setting)	EL-56
Voltage (between M01 (3) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger jack RL	EL-57
Voltage (between M01 (14) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger jack FL	EL-58
Voltage (between M01 (4) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger jack RR	EL-59
Voltage (between M01 (15) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger jack FR	EL-60

Error code	Abnormal system	Nature of abnormality
MDTL error E84	Outrigger slide RL short circuited with power source	1) Wiring harness between M01 (female) (5) – LM10 (8) – L154 (female) (1) or intermediate connecting point of L154 (female) (1) and LM10 (male) (8) – L05 (female) (2) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E85	Outrigger slide FL short circuited with power source	1) Wiring harness between M01 (female) (16) – LM10 (10) – L152 (female) (1) or intermediate connecting point of L152 (female) (1) and LM10 (male) (8) – L05 (female) (4) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E86	Outrigger slide RR short circuited with power source	1) Wiring harness between M01 (female) (7) – LM10 (12) – L153 (female) (1) or intermediate connecting point of L153 (female) (1) and LM10 (male) (12) – L05 (female) (6) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E87	Outrigger slide FR short circuited with power source	1) Wiring harness between M01 (female) (17) – LM10 (14) – L151 (female) (1) or intermediate connecting point of L151 (female) (1) and LM10 (male) (14) – L05 (female) (8) short circuiting with power source 2) Defective bottom outrigger control panel 3) Defective lower MDT
MDTL error E88	Outrigger selector EXTEND short circuited with power source	1) Wiring harness between M01 (female) (8) – M21 (2) – M37 (female) (1) short circuiting with chassis ground 2) Wiring harness between M02 (female) (7) – LM10 (5) – L16 (female) (1), between intermediate connecting point of M02 (female) (7) and LM10 (female) (5) – M21 (3) – M37 (female) (2), or between intermediate connecting point of LM10 (male) (5) and L16 (female) (1) – L05 (female) (9) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT
MDTL error E89	Outrigger selector stow (RETRACT) short circuited with power source	1) Wiring harness between M01 (female) (18) – M21 (1) – M37 (female) (3) short circuiting with chassis ground 2) Wiring harness between M02 (female) (8) – LM10 (6) – L140 (female) (1), between connecting point of M02 (female) (8) and LM10 (female) (6) – M21 (4) – M37 (female) (4), or between connecting point of LM10 (male) (6) and L140 (female) (1) – L05 (female) (10) short circuiting with chassis ground 3) Defective bottom outrigger control panel 4) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between M01 (5) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger slide RL	EL-61
Voltage (between M01 (16) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger slide FL	EL-62
Voltage (between M01 (7) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger slide RR	EL-63
Voltage (between M01 (17) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) When outrigger selector valve is actuated, there is abnormal telescoping of outrigger slide FR	EL-64
Voltage (between M01 (8) and chassis) • Starting switch at ON: Max. 1 V	1) Stops output of outrigger panel power source and outrigger mode power source 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Impossible to operate steering, impossible to use suspension lift (travel immediately stops)	EL-65
Voltage (between M01 (18) and chassis) • Starting switch at ON: Max. 1 V	1) Stops output of outrigger panel power source and outrigger mode power source 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Impossible to operate steering, impossible to use suspension lift (travel immediately stops)	EL-66

023S02

Error code	Abnormal system	Nature of abnormality
MDTL error E8A	Rear steering LOCK solenoid short circuited with power source	1) Wiring harness between M01 (female) (9) – LM06 (5) – L70 (6) – L12 (female) (1) short circuiting with power source 2) Defective lower MDT
MDTL error E8B	Rear steering FREE solenoid short circuited with power source	1) Wiring harness between M01 (female) (19) – LM06 (6) – L70 (7) – L13 (female) (1) short circuiting with power source 2) Defective lower MDT
MDTL error E8C	Service (auxiliary) brake solenoid short circuited with power source	1) Wiring harness between M01 (female) (10) – LM05 (10) – L70 (5) – L71 (female) (1) {– L72 (female) (1)} short circuiting with power source 2) Defective lower MDT
MDTL error E8D	Exhaust brake solenoid short circuited with power source	1) Wiring harness between M01 (female) (20) – LM05 (9) – L57 (female) (1) {– L58 (female) (1)} short circuiting with power source 2) Defective lower MDT
MDTL error E8F	Preheating [heater relay] short circuited with power source	1) Wiring harness between M01 (female) (21) – LM07 (9) – EL2 (5) – heater relay terminal (female) (5) short circuiting with power source 2) Defective lower MDT
MDTL error E9A	Head lamp Hi relay short circuited with power source	1) Wiring harness between M04 (female) (6) – M19 (4) – M26 (female) (1) short circuiting with power source 2) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between M01 (9) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action 2) Actuates emergency alarm buzzer	1) Impossible to set rear steering to FREE. (Rear steering set to LOCK, travel with front 2-wheel steering)	EL-67
Voltage (between M01 (19) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action 2) Actuates emergency alarm buzzer	1) Impossible to set rear steering to LOCK. (Rear steering at FREE)	EL-68
Voltage (between M01 (10) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action 2) Actuates emergency alarm buzzer	1) Impossible to release service (auxiliary) brake	EL-69
Voltage (between M01 (20) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) Impossible to release exhaust brake	EL-70
Voltage (between M01 (21) and chassis) • Starting switch at ON: Max. 1 V	1) Preheating pilot output flashes	1) Abnormal engine exhaust gas color, drop in horsepower (stays at preheating)	EL-71
Voltage (between M04 (6) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) Head lamp Hi beam stays lighted up.	EL-72

Error code	Abnormal system	Nature of abnormality
MDTL error E9B	Head lamp Lo relay short circuited with power source	1) Wiring harness between M04 (female) (14) – M19 (3) – M25 (female) (1) short circuiting with power source 2) Defective lower MDT
MDTL error E9C	Side lamp relay short circuited with power source	1) Wiring harness between M04 (female) (7) – M19 (5) – M27 (female) (1) short circuiting with power source 2) Defective lower MDT
MDTL error E9E	Right turn relay short circuited with power source	1) Wiring harness between M04 (female) (8) – M19 (6) – M28 (female) (1) short circuiting with power source 2) Defective lower MDT
MDTL error E9F	Left turn relay short circuited with power source	1) Wiring harness between M04 (female) (16) – M19 (7) – M29 (female) (1) short circuiting with power source 2) Defective lower MDT
MDTL error EA0	Steering mode solenoid a short circuited with power source	1) Wiring harness between M02 (female) (1) – LM06 (11) – L23 (female) (1), or between M14 (female) (13) – intermediate connecting point of M02 (female) (1) and LM06 (male) (11) short circuiting with power source 2) Defective lower MDT
MDTL error EA1	Steering mode solenoid c short circuited with power source	1) Wiring harness between M02 (female) (12) – LM06 (9) – L20 (female) (1), or between M14 (female) (11) – intermediate connecting point of M02 (female) (12) and LM06 (male) (9) short circuiting with power source 2) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between M04 (14) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) Head lamp Lo beam stays lighted up.	EL-74
Voltage (between M04 (7) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) Side lamp stays lighted up.	EL-75
Voltage (between M04 (8) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) Right turn signal remains actuated.	EL-76
Voltage (between M04 (16) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action	1) Left turn signal remains actuated.	EL-77
Voltage (between M02 (1) and chassis) • Starting switch at ON: Max. 1 V	1) Rear steering at LOCK • Sets steering mode to front wheel mode • Actuates monitor central buzzer • Displays error code (EA0 + EF2) 2) Rear steering LOCK canceled • Sets steering mode to front wheel mode • Rear steering LOCK/CANCEL prohibition • Displays emergency stop mode ▲ • Actuates emergency alarm buzzer + monitor central buzzer • Displays error code (EA0 + EF0)	1) At rear steering LOCK, possible to travel in front wheel mode 2) At rear steering FREE, rear steering cannot be set to LOCK, so in some cases it may be impossible to travel	EL-78
Voltage (between M02 (1) and chassis) • Starting switch at ON: Max. 1 V	1) Rear steering at LOCK • Sets steering mode to front wheel mode • Actuates monitor central buzzer • Displays error code (EA1 + EF2) 2) Rear steering LOCK canceled • Sets steering mode to front wheel mode • Rear steering LOCK/CANCEL prohibition • Displays emergency stop mode ▲ • Actuates emergency alarm buzzer + monitor central buzzer • Displays error code (EA1 + EF0)	1) At rear steering LOCK, possible to travel in front wheel mode 2) At rear steering FREE, rear steering cannot be set to LOCK, so in some cases it may be impossible to travel	EL-79

023S02

Error code	Abnormal system	Nature of abnormality
MDTL error EA2	Steering mode solenoid b short circuited with power source	1) Wiring harness between M02 (female) (2) – LM06 (7) – L19 (female) (1), or between M14 (female) (12) – intermediate connecting point of M02 (female) (2) and LM06 (male) (7) short circuiting with power source 2) Defective lower MDT
MDTL error EA3	Steering mode solenoid d short circuited with power source	1) Wiring harness between M02 (female) (13) – LM06 (13) – L25 (female) (1) – L26 (female) (1)}, or between M14 (female) (14) – intermediate connecting point of M02 (female) (13) and LM06 (male) (13) short circuiting with power source 2) Defective lower MDT
MDTL error EA4	Swing pump merge solenoid short circuited with power source	1) Wiring harness between M02 (female) (3) – M19 (8) – M31 (female) (1) short circuiting with chassis ground 2) Defective lower MDT
MDTL error EA7	Suspension lift solenoid short circuit with power source	1) Wiring harness between M02 (female) (15) – LM05 (13) – M31 (female) (1) short circuiting with chassis ground 2) Defective lower MDT
MDTL error EB0	Disconnection in outrigger jack RL	1) Defective outrigger jack RL solenoid 2) (X-shape) Defective contact or disconnection in wiring harness between M01 (female) (3) – LM10 (7) – L37 (female) (1) (H-shape) Defective contact or disconnection in wiring harness between M01 (female) (3) – LM10 (7) – L34 (female) (1) 3) (X-shape) Defective contact or disconnection in wiring harness between L37 (female) (2) and chassis (H-shape) Defective contact or disconnection in wiring harness between L34 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT
MDTL error EB1	Disconnection in outrigger jack FL	1) Defective outrigger jack FL solenoid 2) (X-shape) Defective contact or disconnection in wiring harness between M01 (female) (14) – LM10 (9) – L40 (female) (1) (H-shape) Defective contact or disconnection in wiring harness between M01 (female) (14) – LM10 (9) – L43 (female) (1) 3) (X-shape) Defective contact or disconnection in wiring harness between L40 (female) (2) and chassis (H-shape) Defective contact or disconnection in wiring harness between L43 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between M02 (2) and chassis) • Starting switch at ON: Max. 1 V	1) Rear steering at LOCK • Sets steering mode to front wheel mode • Actuates monitor central buzzer • Displays error code (EA2 + EF2) 2) Rear steering at FREE • Sets steering mode to front wheel mode • Rear steering LOCK/CANCEL prohibition • Displays emergency stop mode ▲ • Actuates emergency alarm buzzer + monitor central buzzer • Displays error code (EA2 + EF0)	1) When set to rear steering LOCK, possible to travel in front wheel mode 2) When set to rear steering FREE, rear steering cannot be set to LOCK, so in some cases it may be impossible to travel	EL-80
Voltage (between M02 (15) and chassis) • Starting switch at ON: Max. 1 V	1) Sets steering mode to normal steering mode 2) Displays error code (EA3 + EF3)	1) Impossible to set steering mode to reverse steering mode (remains in normal steering mode)	EL-81
Voltage (between M02 (3) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action 2) Actuates emergency alarm buzzer	1) Swing operation cannot be operated	EL-82
Voltage (between M02 (15) and chassis) • Starting switch at ON: Max. 1 V	1) Does not take any particular action 2) Actuates emergency alarm buzzer	1) When outrigger EXTEND operation is carried out, suspension lift is operated.	EL-83
Solenoid resistance value : 10 – 30 Ω Resistance value {between M01 (female) (3) and chassis} : 10 – 30 Ω Resistance value {X-shape: between L37 (female) (2) and chassis} {H-shape: between L34 (female) (2) and chassis} : Max. 1 Ω	1) Does not take any particular action	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-84
Solenoid resistance value : 10 – 30 Ω Resistance value {between M01 (female) (14) and chassis} : 10 – 30 Ω Resistance value {X-shape: between L40 (female) (2) and chassis} {H-shape: between L43 (female) (2) and chassis} : Max. 1 Ω	1) Does not take any particular action	1) Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-85

Error code	Abnormal system	Nature of abnormality
MDTL error EB2	Disconnection in outrigger jack RR	1) Defective outrigger jack RR solenoid 2) (X-shape) Defective contact or disconnection in wiring harness between M01 (female) (4) – LM10 (11) – L34 (female) (1) (H-shape) Defective contact or disconnection in wiring harness between M01 (female) (4) – LM10 (11) – L37 (female) (1) 3) (X-shape) Defective contact or disconnection in wiring harness between L34 (female) (2) and chassis (H-shape) Defective contact or disconnection in wiring harness between L37 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT
MDTL error EB3	Disconnection in outrigger jack FR	1) Defective outrigger jack FR solenoid 2) (X-shape) Defective contact or disconnection in wiring harness between M01 (female) (15) – LM10 (13) – L43 (female) (1) (H-shape) Defective contact or disconnection in wiring harness between M01 (female) (15) – LM10 (13) – L40 (female) (1) 3) (X-shape) Defective contact or disconnection in wiring harness between L43 (female) (2) and chassis (H-shape) Defective contact or disconnection in wiring harness between L40 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT
MDTL error EB4	Disconnection in outrigger slide RL	1) Defective outrigger slide RL solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (5) – LM10 (8) – L154 (female) (1) 3) Defective contact or disconnection in wiring harness between L154 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT
MDTL error EB5	Disconnection in outrigger slide FL	1) Defective outrigger slide FL solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (16) – LM10 (10) – L152 (female) (1) 3) Defective contact or disconnection in wiring harness between L152 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT
MDTL error EB6	Disconnection in outrigger slide RR	1) Defective outrigger slide RR solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (7) – LM10 (12) – L153 (female) (1) 3) Defective contact or disconnection in wiring harness between L153 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT
MDTL error EB7	Disconnection in outrigger slide FR	1) Defective outrigger slide FR solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (17) – LM10 (14) – L151 (female) (1) 3) Defective contact or disconnection in wiring harness between L151 (female) (2) and chassis 4) Defective bottom outrigger control panel 5) Defective lower MDT

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Solenoid resistance value: 10 – 30 Ω Resistance value {between M01 (4) and chassis} : 10 – 30 Ω Resistance value {X-shape: between L34 (female) (2) and chassis ground} {H-shape: between L37 (female) (2) and chassis ground} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated)	EL-86
Solenoid resistance value: 10 – 30 Ω Resistance value {between M01 (15) and chassis} : 10 – 30 Ω Resistance value {X-shape: between L43 (female) (2) and chassis ground} {H-shape: between L40 (female) (2) and chassis ground} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated)	EL-87
Solenoid resistance value: 10 – 30 Ω Resistance value {between M01 (5) and chassis} : 10 – 30 Ω Resistance value {Between L154 (female) (2) and chas- sis ground} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated)	EL-88
Solenoid resistance value: 10 - 30 Ω Resistance value {between M01 (16) and chassis} : 10 – 30 Ω Resistance value {Between L152 (female) (2) and chas- sis ground} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated)	EL-89
Solenoid resistance value: 10 - 30 Ω Resistance value {between M01 (7) and chassis} : 10 – 30 Ω Resistance value {Between L153 (female) (2) and chas- sis ground} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated)	EL-90
Solenoid resistance value: 10 - 30 Ω Resistance value {between M01 (17) and chassis} : 10 – 30 Ω Resistance value {Between L151 (female) (2) and chas- sis ground} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated)	EL-91

023S02

Error code	Abnormal system	Nature of abnormality
MDTL error EB8	Disconnection in outrigger selector	1) Defective outrigger selector EXTEND solenoid 2) Defective outrigger selector relay 3) Defective contact or disconnection in wiring harness between M01 (female) (8) – M21 (2) – M37 (female) (1) 4) Defective contact or disconnection in wiring harness between M37 (female) (2) – M21 (3) – intermediate connecting point of M02 (female) (7) and LM10 (female) (5) 5) Defective contact or disconnection in wiring harness between M02 (female) (7) – LM10 (5) – L16 (female) (1) 6) Defective bottom outrigger control panel 7) Defective lower MDT
MDTL error EB9	Disconnection in outrigger selector stow	1) Defective outrigger selector stow (RETRACT) solenoid 2) Defective outrigger selector relay 3) Defective contact or disconnection in wiring harness between M01 (female) (18) – M21 (1) – M37 (female) (3) 4) Defective contact or disconnection in wiring harness between M37 (female) (4) – M21 (4) – intermediate connecting point of M02 (female) (8) and LM10 (female) (6) 5) Defective contact or disconnection in wiring harness between M02 (female) (8) – LM10 (6) – L40 (female) (1) 6) Defective bottom outrigger control panel 7) Defective lower MDT
MDTL error EBA	Disconnection in rear steering LOCK solenoid	1) Defective rear steering LOCK solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (9) – LM06 (5) – L70 (6) – L12 (female) (1) 3) Defective contact or disconnection in wiring harness between L12 (female) (2) – L70 (14) – chassis 4) Defective lower MDT
MDTL error EBB	Disconnection in rear steering FREE solenoid	1) Defective rear steering FREE solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (19) – LM06 (6) – L70 (7) – L13 (female) (1) 3) Defective contact or disconnection in wiring harness between L13 (female) (2) – L70 (14) – chassis 4) Defective lower MDT
MDTL error EBC	Disconnection in service (auxiliary) brake solenoid	1) Defective service (auxiliary) brake solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (10) – LM05 (10) – L70 (5) – L71 (female) (1) 3) Defective contact or disconnection in wiring harness between L71 (female) (2) – L70 (14) – chassis 4) Defective lower MDT
MDTL error EBD	Disconnection in exhaust brake solenoid	1) Defective exhaust brake solenoid 2) Defective contact or disconnection in wiring harness between M01 (female) (20) – LM05 (9) – L57 (female) (1) 3) Defective contact or disconnection in wiring harness between L57 (female) (2) – L70 (14) – chassis 4) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Solenoid resistance value: 30 – 80 Ω Voltage (L16 (1) and chassis) • When outrigger selector (EXTEND) solenoid is actuated : 17 – 30 V Resistance value {between L16 (fe- male) (2) and chassis} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated) 2) Suspension lift cannot be operated	EL-92
Solenoid resistance value: 30 – 80 Ω Voltage (L140 (1) and chassis) • When outrigger selector (RETRACT) solenoid is actuated : 17 – 30 V Resistance value {between L140 (fe- male) (2) and chassis} : Max. 1 Ω	1) Does not take any particu- lar action	1) Top outrigger cannot be op- erated (in some cases, bot- tom outrigger also cannot be operated)	EL-93
Solenoid resistance value: 10 – 20 Ω Resistance value (M01 (9) and chas- sis) : 10 – 20 Ω Resistance value {between L12 (fe- male) (2) and chassis} : Max. 1 Ω	1) Does not take any particu- lar action 2) Actuates emergency alarm buzzer	1) Rear steering LOCK cannot be operated	EL-94
Solenoid resistance value: 10 – 20 Ω Resistance value (M01 (19) and chas- sis) : 10 – 20 Ω Resistance value {between L13 (fe- male) (2) and chassis} : Max. 1 Ω	1) Does not take any particu- lar action 2) Actuates emergency alarm buzzer	1) Rear steering FREE cannot be operated	EL-95
Solenoid resistance value : 10 – 20 Ω Resistance value (M01 (10) and chas- sis) : 10 – 20 Ω Resistance value {between L71 (fe- male) (2) and chassis} : Max. 1 Ω	1) Does not take any particu- lar action (Displays error code)	1) Service (auxiliary) brake cannot be used	EL-96
Solenoid resistance value: 10 – 20 Ω Resistance value (M01 (20) and chas- sis) : 20 – 60 Ω Resistance value {between L57 (fe- male) (2) and chassis} : Max. 1 Ω	1) Does not take any particu- lar action (Displays error code)	1) Exhaust brake cannot be used	EL-97

Error code	Abnormal system	Nature of abnormality
MDTL error EBF	Disconnection in preheating [heater relay]	1) Defective heater relay 2) Defective contact or disconnection in wiring harness between M01 (female) (21) – LM07 (9) – EL2 (6) – heater relay terminal (female) (5) 3) Defective contact or disconnection in wiring harness between heater relay terminal (female) E - chassis 4) Defective lower MDT
MDTL error ECA	Disconnection in head lamp Hi relay	1) Defective head lamp Hi relay 2) Defective contact or disconnection in wiring harness between M04 (female) (6) – M19 (4) – M26 (female) (1) 3) Defective contact or disconnection in wiring harness between M26 (female) (2) and chassis 4) Defective lower MDT
MDTL error ECB	Disconnection in head lamp Lo relay	1) Defective head lamp Lo relay 2) Defective contact or disconnection in wiring harness between M04 (female) (14) – M19 (3) – M25 (female) (1) 3) Defective contact or disconnection in wiring harness between M25 (female) (2) and chassis 4) Defective lower MDT
MDTL error ECC	Disconnection in side lamp relay	1) Defective side lamp relay 2) Defective contact or disconnection in wiring harness between M04 (female) (7) – M19 (5) – M27 (female) (1) 3) Defective contact or disconnection in wiring harness between M27 (female) (2) and chassis 4) Defective lower MDT
MDTL error ECE	Disconnection in right turn relay	1) Defective right turn relay 2) Defective contact or disconnection in wiring harness between M04 (female) (8) – M19 (6) – M28 (female) (1) 3) Defective contact or disconnection in wiring harness between M28 (female) (2) and chassis 4) Defective lower MDT
MDTL error ECF	Disconnection in left turn relay	1) Defective left turn relay 2) Defective contact or disconnection in wiring harness between M04 (female) (16) – M19 (7) – M29 (female) (1) 3) Defective contact or disconnection in wiring harness between M29 (female) (2) and chassis 4) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Resistance value (M01 (21) and chassis): 20 – 24 Ω Resistance value {heater relay terminal (female) (E) and chassis}: Max. 1 Ω	1) Does not take any particular action	1) Preheating cannot be operated	EL-98
Relay resistance value: 200 – 400 Ω Resistance value (M04 (6) and chassis): 200 – 400 Ω Resistance value {M26 (female) (2) and chassis}: Max. 1 Ω	1) Does not take any particular action	1) Head lamp Hi beam cannot be operated	EL-99
Relay resistance value: 200 – 400 Ω Resistance value (M04 (14) and chassis): 200 – 400 Ω Resistance value {M25 (female) (2) and chassis}: Max. 1 Ω	1) Does not take any particular action	1) Head lamp Lo beam cannot be operated	EL-100
Relay resistance value: 200 – 400 Ω Resistance value (M04 (7) and chassis): 200 – 400 Ω Resistance value {M27 (female) (2) and chassis}: Max. 1 Ω	1) Does not take any particular action	1) Side lamp cannot be operated	EL-101
Relay resistance value: 200 – 400 Ω Resistance value (M04 (8) and chassis): 200 – 400 Ω Resistance value {M28 (female) (2) and chassis}: Max. 1 Ω	1) Does not take any particular action	1) Right turn signal indicator cannot be operated	EL-102
Relay resistance value: 200 – 400 Ω Resistance value (M04 (16) and chassis): 200 – 400 Ω Resistance value {M29 (female) (2) and chassis}: Max. 1 Ω	1) Does not take any particular action	1) Left turn signal indicator cannot be operated	EL-103


023S02

Error code	Abnormal system	Nature of abnormality
MDTL error ED0	Disconnection in steering mode solenoid	1) Defective steering mode solenoid a 2) Defective contact or disconnection in wiring harness between M02 (female) (1) – LM06 (11) – L23 (female) (1) 3) Defective contact or disconnection in wiring harness between M23 (female) (2) – LM06 (12) – M65 (2),(1) – L19 (14) – M33 (female) (5) 4) Defective lower MDT
MDTL error ED1	Disconnection in steering mode solenoid	1) Defective steering mode solenoid c 2) Defective contact or disconnection in wiring harness between M02 (female) (12) – LM06 (9) – L20 (female) (1) 3) Defective contact or disconnection in wiring harness between M20 (female) (2) – LM06 (10) – M64 (2),(1) – L19 (14) – M33 (female) (5) 4) Defective lower MDT
MDTL error ED2	Disconnection in steering mode solenoid	1) Defective steering mode solenoid b 2) Defective contact or disconnection in wiring harness between M02 (female) (2) – LM06 (7) – L19 (female) (1) 3) Defective contact or disconnection in wiring harness between L19 (female) (2) – LM06 (8) – M63 (2),(1) – L19 (14) – M33 (female) (5) 4) Defective lower MDT
MDTL error ED3	Disconnection in steering mode solenoid	1) Defective steering mode solenoid d 2) Defective contact or disconnection in wiring harness between M02 (female) (13) – LM06 (13) – L25 (female) (1) 3) Defective contact or disconnection in wiring harness between M25 (female) (2) – M146 (2),(1) – LM06 (14) – M19 (12) – M32 (female) (5) 4) Defective lower MDT
MDTL error ED4	Disconnection in swing pump merge solenoid relay	1) Defective swing pump merge solenoid relay 2) Defective contact or disconnection in wiring harness between M02 (female) (3) – M19 (8) – M31 (female) (1) 3) Defective contact or disconnection in wiring harness between M31 (female) (2) – M19 (16), M20 (16) – LM04 (14), LM05 (14) – chassis 4) Defective lower MDT
MDTL error ED7	Disconnection in suspension lift solenoid	1) Defective suspension lift solenoid 2) Defective contact or disconnection in wiring harness between M02 (female) (15) – LM05 (11) – L31 (female) (1) 3) Defective contact or disconnection in wiring harness between L31 (female) (2) and chassis 4) Defective lower MDT

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Solenoid resistance value: 10 – 20 Ω Voltage (between L23 (1) and chassis) • When steering mode solenoid a is actuated: 17 – 30 V	1) Does not take any particular action	1) Steering mode cannot be set to rear wheel mode (rear steering is set to LOCK, travels in front 2-wheel steering) 2) Possible to travel as normal in other steering modes	EL-104
Solenoid resistance value: 10 – 20 Ω Voltage (between L20 (1) and chassis) • When steering mode solenoid c is actuated: 17 – 30 V	1) Does not take any particular action	1) Steering mode cannot be set to crab mode (rear steering is set to LOCK, travels in front 2-wheel steering) 2) Possible to travel as normal in other steering modes	EL-105
Solenoid resistance value: 10 – 20 Ω Voltage (between L19 (1) and chassis) • When steering mode solenoid b is actuated: 17 – 30 V	1) Does not take any particular action	1) Steering mode cannot be set to rear wheel, 4-wheel mode (rear steering is set to LOCK, travels in front 2-wheel steering) 2) Possible to travel as normal in other steering modes	EL-106
Solenoid resistance value: 10 – 20 Ω Voltage (between L25 (1) and chassis) • When steering mode solenoid d is actuated: 17 – 30 V	1) Does not take any particular action	1) Steering mode cannot be set to reverse steering mode (remains in normal steering)	EL-107
Relay resistance value: 200 – 400 Ω Resistance value {between M02 (female) (3) and chassis} : 200 – 400 Ω Resistance value {between M31 (female) (2) and chassis} : Max. 1 Ω	1) Does not take any particular action 2) Actuates emergency alarm buzzer	1) Lacks speed during outrigger ALL operation. 2) Steering wheel becomes heavy when traveling with engine at low speed.	EL-108
Relay resistance value: 10 – 30 Ω Resistance value {between M02 (15) and chassis} : 10 – 30 Ω Resistance value {between M31 (female) (2) and chassis} : Max. 1 Ω	1) Does not take any particular action	1) Suspension lift cannot be operated	EL-109

Error code	Abnormal system	Nature of abnormality
MDTL error EE7	Outrigger control signal short circuited with power source	<ol style="list-style-type: none"> 1) Wiring harness between M02 (female) (7) and M21 (female) (3) short circuiting with power source 2) Wiring harness between M02 (female) (8) and M21 (female) (4) short circuiting with power source 3) Defective lower MDT
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	<ol style="list-style-type: none"> 1) Wiring harness between M02 (female) (7) and M21 (female) (3) short circuiting with chassis ground 2) Wiring harness between M02 (female) (8) and M21 (female) (4) short circuiting with chassis ground 3) Defective contact or disconnection in wiring harness between M02 (female) (7) – M21 (3) – M37 (female) (2) 4) Defective contact or disconnection in wiring harness between M02 (female) (8) – M21 (4) – M37 (female) (4) 5) Defective lower MDT
MDTL error EE9	Disconnection in fuel sensor	<ol style="list-style-type: none"> 1) Defective fuel sensor 2) Defective contact or disconnection in wiring harness between fuel sensor terminal L86 – L70 (12) – chassis 3) Defective contact or disconnection in wiring harness between M05 (female) (8) – LM05 (7) – L70 (11) – fuel sensor terminal L85 4) Defective lower MDT
MDTL error EEB	Abnormality in rear steering LOCK limit switch/FREE limit switch	<ol style="list-style-type: none"> 1) Defective rear steering LOCK/FREE detection limit switch 2) Defective contact or disconnection in wiring harness between L11 (female) (2),(4) – L70 (12) – chassis 3) Defective contact or disconnection in wiring harness between M02 (female) (5) – LM06 (3) – L11 (female) (1), or short circuit with ground 4) Defective contact or disconnection in wiring harness between M02 (female) (16) – LM06 (4) – L11 (female) (3), or short circuit with ground 5) Defective lower MDT
MDTL error EEE	Failure of both speedometer sensors	<ol style="list-style-type: none"> 1) Defective speedometer sensors (both) 2) Defective contact or disconnection in wiring harness between M06 (female) (10) – LM02 (4) – L103 (female) (2), and between M15 (female) (12) – LM03 (12) – L104 (female) (2) 3) Defective contact or disconnection in wiring harness between M06 (female) (15) – LM02 (3) – L103 (female) (1), and between M15 (female) (5) – LM03 (11) – L104 (female) (1) 4) Defective contact or disconnection in wiring harness between M06 (female) (15) – LM02 (3) – L103 (female) (1), and between M15 (female) (5) – LM03 (11) – L104 (female) (1) 5) Defective lower MDT 6) Defective transmission controller
MDTL error EEF	Speedometer sensor failure	<ol style="list-style-type: none"> 1) Defective speedometer 2 (L103) 2) Defective contact or disconnection in wiring harness between M06 (female) (15) – LM02 (3) – L103 (female) (1), or short circuit with ground 3) Defective contact or disconnection in wiring harness between M06 (female) (10) – LM02 (4) – L103 (female) (2) 4) Defective lower MDT



023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between M02 (7), (8) and chassis) • When starting switch is turned ON: Max. 1 V	1) Does not take any particular action 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer	1) Steering may be set to LOCK, so carries out emergency stop.	EL-110
Voltage (between M02 (7), (8) and chassis) • When outrigger EXTEND or STOW solenoid is actuated : 17 – 30 V • When actuating conditions are correct (not operated) : Max. 1 V	1) If "Nature of abnormality" is 1) or 2), it stops output to outrigger EXTEND or STOW solenoid. 2) If "Nature of abnormality" is 3) or 4), it takes no particular action and sounds emergency alarm buzzer. 3) If "Nature of abnormality" is 5), it depends on the type of failure.	1) It may be impossible to extend or stow the outrigger.	EL-111
Fuel sensor resistance value • FULL: Approx. 12 Ω • EMPTY : Approx. 85 – 110 Ω	1) Does not take any particular action	1) Fuel level gauge does not work	EL-112
Voltage (between M02 (5) and chassis) • Rear steering LOCK : Max. 1 V • Rear steering FREE : 15 – 30 V Voltage (between M02 (16) and chassis) • Rear steering LOCK : 15 – 30 V • Rear steering FREE : Max. 1 V	1) If LOCK limit switch/FREE limit switch are not detected simultaneously: • Holds steering mode. • Prohibits switching of steering mode (possible to change to front wheel mode). • Actuates emergency alarm buzzer. 2) If LOCK limit switch/FREE limit switch are detected simultaneously: • Sets steering mode to front wheel mode. • Actuates emergency alarm buzzer. • Actuates monitor central buzzer (except in front wheel mode) 3) If LOCK limit switch is detected in other than front wheel mode: • Sets steering mode to front wheel mode. • Actuates emergency alarm buzzer. • Actuates monitor central buzzer (except in front wheel mode)	1) Cannot set steering to LOCK or cannot release lock. 2) Steering mode does not switch.	EL-113
Sensor resistance value : 500 – 1000 Ω	1) While rear steering is set to FREE, holds present steering mode; after rear steering is set to LOCK, holds front 2-wheel mode, impossible to release rear steering, travels in speed limit mode.	1) Speedometer does not work 2) Travel speed is slow 3) Steering mode does not switch 4) Rear steering cannot be canceled 5) Rear steering LOCK cannot be operated	EL-114
Sensor resistance value : 500 – 1000 Ω	1) Controls according to speedometer sensor value of transmission controller		EL-115

023S02

Error code	Abnormal system	Nature of abnormality
MDTL error EF0	Special steering failure (emergency stop mode)	1) See MDTL error [E60] (Troubleshooting code EL-50), [E61] (Troubleshooting code EL-51), [E62] (Troubleshooting code EL-52), [EA0] (Troubleshooting code EL-78), [EA1] (Troubleshooting code EL-79), [EA2] (Troubleshooting code EL-80), [ED0] (Troubleshooting code EL-104), [ED1] (Troubleshooting code EL-105), [ED2] (Troubleshooting code EL-106), and ATM error [E5A] (Troubleshooting code ET-19), [E5B] (Troubleshooting code ET-20), [E7F] (Troubleshooting code ET-34), [E8F] (Troubleshooting code ET-46) of steering mode solenoid system error.
MDTL error EF1	Reverse steering failure (emergency stop mode)	1) See MDTL error [E63] (Troubleshooting code EL-53), [EA3] (Troubleshooting code EL-81), [ED3] (Troubleshooting code EL-107), and ATM error [E5C] (Troubleshooting code ET-21), [E5D] (Troubleshooting code ET-22), [E7B] (Troubleshooting code ET-30), [E8B] (Troubleshooting code ET-42) of steering mode solenoid system error.
MDTL error EF2	Special steering failure	1) See MDTL error [E60] (Troubleshooting code EL-50), [E61] (Troubleshooting code EL-51), [E62] (Troubleshooting code EL-52), [EA0] (Troubleshooting code EL-78), [EA1] (Troubleshooting code EL-79), [EA2] (Troubleshooting code EL-80), [ED0] (Troubleshooting code EL-104), [ED1] (Troubleshooting code EL-105), [ED2] (Troubleshooting code EL-106), and ATM error [E5A] (Troubleshooting code ET-19), [E5B] (Troubleshooting code ET-20), [E7F] (Troubleshooting code ET-34), [E8F] (Troubleshooting code ET-46) of steering mode solenoid system error.
MDTL error EF3	Reverse steering failure 1, holds normal steering	1) See MDTL error [E63] (Troubleshooting code EL-53), [EA3] (Troubleshooting code EL-81), [ED3] (Troubleshooting code EL-107), and ATM error [E5C] (Troubleshooting code ET-21), [E5D] (Troubleshooting code ET-22), [E7B] (Troubleshooting code ET-30), [E8B] (Troubleshooting code ET-42) of steering mode solenoid system error.
MDTL error EF4	Reverse steering failure 2, holds reverse steering	1) See MDTL error [E63] (Troubleshooting code EL-53), [EA3] (Troubleshooting code EL-81), [ED3] (Troubleshooting code EL-107), and ATM error [E5C] (Troubleshooting code ET-21), [E5D] (Troubleshooting code ET-22), [E7B] (Troubleshooting code ET-30), [E8B] (Troubleshooting code ET-42) of steering mode solenoid system error.
MDTL error EFE	Abnormality in right turn relay	1) Defective right turn relay 2) Defective flasher unit 3) Defective contact or disconnection in wiring harness between bottom fuse III-3 – M44 (female) (3) 4) Defective contact or disconnection in wiring harness between M44 (female) (1) and chassis 5) Defective contact or disconnection in wiring harness between M28 (female) (3) – M44 (female) (4), short circuit with ground, or short circuit with power source 6) Wiring harness between M03 (female) (6) – M20 (8) – M28 (female) (5), between intermediate connecting point of M03 (female) (6) and M20 (female) (8) – LM04 (6) – L55 (female) (1), between intermediate connecting point of LM04 (female) (6) and L55 (female) (1) – L45 (4) – L46 (female) (1) short circuiting with chassis ground, or short circuiting with power source 7) Defective contact or disconnection in wiring harness between M03 (female) (6) and M28 (female) (5) 8) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
See error code for same nature of abnormality.	1) Stops output to steering mode solenoids a, b, c (sets to front wheel mode) 2) Stops output to rear steer- ing LOCK/FREE solenoid 3) Displays emergency stop mode  4) Actuates emergency alarm buzzer, monitor central buzzer	1) Steering mode does not switch (front wheel mode) 2) Rear steering cannot be canceled 3) Rear steering LOCK cannot be operated	EL-116
See error code for same nature of abnormality.	1) Stops output to steering mode solenoid d (sets to front wheel mode) 2) Displays emergency stop mode  3) Actuates emergency alarm buzzer, monitor central buzzer	1) Failure causes steering mode to switch from normal steering to reverse steering, and it is im- possible to switch to normal steering 2) Failure causes steering mode to switch from reverse steering to normal steering	EL-117
See error code for same nature of abnormality.	1) When rear steering is set to LOCK, it prohibits release of rear steering lock and holds in front wheel mode 2) When rear steering is set to FREE, it is possible to switch steering mode, but after rear steering is set to LOCK, it prohibits release of rear steering lock and holds in front wheel mode	1) When rear steering is set to LOCK, front wheel mode is held and rear steering lock cannot be canceled. 2) When rear steering is set to FREE, it is possible to switch steering mode, but after rear steering is set to LOCK, it becomes as in 1).	EL-118
See error code for same nature of abnormality.	1) Holds normal steering mode, prohibits switching to reverse steering	1) When in normal steering mode, normal steering mode is held 2) When in reverse steering mode, switches to normal steering mode	EL-119
See error code for same nature of abnormality.	1) After switching to normal steering, it prohibits switch- ing to reverse steering.	1) Nothing in particular (re- verse steering mode)	EL-120
Voltage (between M03 (6) and chas- sis) • Right turn signal lever ON: 20 – 30 V intermittently • Turn signal indicator lever OFF: Max. 1 V	1) Does not take any particu- lar action	1) Right turn signal lamp can- not be operated or right turn signal lamp remains actuated.	EL-121

Error code	Abnormal system	Nature of abnormality
MDTL error EFF	Abnormality in left turn relay	1) Defective left turn relay 2) Defective flasher unit 3) Defective contact or disconnection in wiring harness between bottom fuse III-3 – M44 (female) (3) 4) Defective contact or disconnection in wiring harness between M44 (female) (1) and chassis 5) Defective contact or disconnection in wiring harness between M29 (female) (3) – M44 (female) (4), short circuit with ground, or short circuit with power source 6) Wiring harness between M03 (female) (16) and M29 (female) (5), between intermediate connecting point of M03 (female) (16) and M20 (female) (9) – LM04 (9) – L52 (female) (1), between intermediate connecting point of LM04 (female) (9) and L52 (female) (1) – L45 (7) – L51 (female) (1) short circuiting with chassis ground, or short circuiting with power source 7) Defective contact or disconnection in wiring harness between M03 (female) (16) and M29 (female) (5) 8) Defective lower MDT

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
Voltage (between M03 (16) and chassis) • Left turn signal lever ON: 20 – 30 V intermittently • Turn signal indicator lever OFF: Max. 1 V	1) Does not take any particular action	1) Left turn signal lamp cannot be operated or left turn signal lamp remains actuated.	EL-122

023S02

(): Depending on the steering mode, the problem may not appear when a failure occurs.

For details of the Failure mode – and problem that appears on the machine, see 20-514, 552, 553.

<div><div>Location of failure</div><div>Failure mode</div><div>Error code</div></div>			Self-diagnostic display(abnormality display)																											
			MDTL errors																											
			E 00	E 10	E 11	E 18	E 19	E 20	E 21	E 24	E 25	E 28	E 29	E 40	E 41	E 42	E 43	E 44	E 45	E 46	E 47	E 48	E 49	E 4A						
			MDT system error	Shut off when low voltage	Shut off when high temperature	Disconnection in tachometer sensor	Disconnection in speedometer sensor	Top, bottom don't match (application stopped)	Top, bottom selection warning	Model doesn't match (application stopped)	Model selection warning	Abnormality in C-NET communication between MDTs	Abnormality in S-NET communication between MDT and transmission controller	Outrigger jack RL short circuited with ground	Outrigger jack FL short circuited with ground	Outrigger jack RR short circuited with ground	Outrigger jack FR short circuited with ground	Outrigger slide RL short circuited with ground	Outrigger slide FL short circuited with ground	Outrigger slide RR short circuited with ground	Outrigger slide FR short circuited with ground	Outrigger selector EXTEND short circuited with ground	Outrigger selector RETRACT short circuited with ground	Rear steering LOCK solenoid short circuited with ground						
Work equipment system	1	BWork equipment and outrigger do not move																												
	2	Boom cannot be raised or lowered or speed is slow																												
	3	Boom cannot be extended or retractedd, or speed is slow																												
	4	Winch cannot be wound in or wound out, or speed is slow																												
	5	Winch moves intermittently (there is hunting)																												
	6	Jib cannot be raised, lowered, or extended, stowed, or rotated																												
	7	Upper structure cannot be swung or swing speed is slow																												
	8	Outriggers cannot be extended or stowed	○	○	○			○		○						○	○	○	○	○	○	○	○	○	○	○				
	9	Excessive hydraulic drift																												
Travel system	11	Machine does not move off																												
	12	Machine does not accelerate or does not decelerate																												
	13	Travel speed is slow or lacks power																												
	14	Torque converter lock-up does not engage or cannot be disengaged (engine stalls when machine is stopped or moves off)																												
	15	Excessive time lag when moving off (shifting gear), or shift up is slow	○			○		○		○					○	○														
	16	Torque converter oil temperature becomes high																												
	17	Brake cannot be applied (braking effect is poor) or cannot be released (drags), pulls to one side	○	○	○			○		○																				
	18	Exhaust brake cannot be applied or cannot be released	○	○	○			○		○																				
	19	Air pressure does not rise or is too low																												
	20	Cannot switch between 2-wheel drive and 4-wheel drive	○					○		○				○	○															
	21	Steering mode cannot be switched	○	○	○			○		○				○	(○)															
	22	Wheels do not move when steering wheel is turned (steering does not turn or is difficult to turn)	○	●	●			○		○																				
	23	Rear steering is not locked or is not released	○	○	○			○		○				○																
	24	Suspension cannot be locked or cannot be set free																												
	25	Suspension lift cannot be used	○	○	○			○		○				○											○					
	Buzzer, lamp, gauge does not work, etc.			○	○	○	○	○	○		○		○																	
Troubleshooting code when error code is displayed			EL 1	EL 2	EL 3	EL 4	EL 5	EL 6	EL 7	EL 8	EL 9	EL 10	EL 11	EL 22	EL 23	EL 24	EL 25	EL 26	EL 27	EL 28	EL 29	EL 30	EL 31	EL 32						

For items marked ●, the steering wheel becomes heavy when traveling with the engine running at low speed.

- Changes to (emergency stop mode) but works as normal

Note 1 : Error codes for spare inputs/outputs and troubleshooting for problems related to the retarder, outrigger automatic horizontal extension, electric stowing mirror, service lamp, and other options are not included.
Note 2 : Troubleshooting codes E-2 – 4 are for the engine starting system.

Self-diagnostic display(abnormality display)																																			Troubleshooting code when there is no abnormality display
Rear steering FREE solenoid short circuited with ground	Service brake short circuited with ground	Exhaust brake short circuited with ground	Preheating short circuited with ground	Electric stowing mirror set relay short circuited with ground	Electric stowing mirror stowing relay short circuited with ground	Head lamp Hi relay short circuited with ground	Head lamp Lo relay short circuited with ground	Side lamp relay short circuited with ground	Service lamp (opt) relay short circuited with ground	Right turn relay short circuited with ground	Left turn relay short circuited with ground	Steering mode solenoid a short circuited with ground	Steering mode solenoid c short circuited with ground	Steering mode solenoid b short circuited with ground	Steering mode solenoid d short circuited with ground	Pump merge solenoid short circuited with ground	Suspension lift solenoid short circuited with ground	5V output short circuited with ground	Outrigger jack RL short circuited with power source	Outrigger jack FL short circuited with power source	Outrigger jack RR short circuited with power source	Outrigger jack FR short circuited with power source	Outrigger slide RL short circuited with power source	Outrigger slide FL short circuited with power source	Outrigger slide RR short circuited with power source	Outrigger slide FR short circuited with power source	Outrigger selector EXTEND short circuited with power source	Outrigger selector RETRACT short circuited with power source	Rear steering LOCK solenoid short circuited with power source	Rear steering FREE solenoid short circuited with power source	Service brake short circuited with power source	Exhaust brake short circuited with power source	Preheating short circuited with power source		
MDTL errors																																			
F 4B	F 4C	F 4D	F 4F	F 50	F 52	F 5A	F 5B	F 5C	F 5D	F 5E	F 5F	F 60	F 61	F 62	F 63	F 64	F 67	F 76	F 80	F 81	F 82	F 83	F 84	F 85	F 86	F 87	F 88	F 89	F 8A	F 8B	F 8C	F 8D	F 8F		
																																		E-1,5,EM-101,102,104,H-1	
																																		H-2	
																																		EM-106-1,EM-131, H-3	
																																		EM106,131, H-4	
																																		H-5	
																																		H-6	
																																		EM-103,109 – 124, H-7	
																																		EM-201 – 226, H-8	
																	○		○	○	○	○	○	○	○	○	○	○						H-9	
																																		H-101	
																																		H-102	
																																		E-6, H-103	
																																		H-104	
																																		H-105	
																																		H-106	
			○																												○			H-107	
																															○			H-108	
																																		H-109	
																																		H-110	
												○	○	○	○																			H-111	
												○	○	○	○																			H-112	
		○										○	○	○	○													○	○		○	○		E-7, H-113	
																																		E-8, H-114	
																	○											○	○					E-8, H-115	
				○	○	○	○	○	○	○	○																							E9 – 13,EM125 – 128,139 – 140	
EL 33	EL 34	EL 35	EU 37 (E4)	EL 38	EL 40	EL 43	EL 44	EL 45	EL 46	EL 47	EL 48	EL 49	EL 50	EL 51	EL 52	EL 53	EL 55	EL 56	EL 57	EL 58	EL 59	EL 60	EL 61	EL 62	EL 63	EL 64	EL 65	EL 66	EL 67	EL 68	EL 69	EL 70	EL 72		

Engine preheating impossible

For details of the Failure mode and problem that appears on the machine, see 20-514, 552, 553.

Self-diagnostic display (abnormality display)

MDTL errors

JUDGEMENT TABLE FOR LOWER MDT, AND HYDRAULIC AND MECHANICAL SYSTEMS (2/2)

(): Depending on the steering mode, the problem may not appear when a failure occurs.

Location of failure		Self-diagnostic display(abnormality display)																			
		MDTL errors																			
		9A	9B	9C	9E	9F	A0	A1	A2	A3	A4	A7	B0	B1	B2	B3	B4	B5	B6	B7	B8
Work equipment system	1	BWork equipment and outrigger do not move																			
	2	Boom cannot be raised or lowered or speed is slow																			
	3	Boom cannot be extended or retracted, or speed is slow																			
	4	Winch cannot be wound in or wound out, or speed is slow																			
	5	Winch moves intermittently (there is hunting)																			
	6	Jib cannot be raised, lowered, or extended, stowed, or rotated																			
	7	Upper structure cannot be swung or swing speed is slow																			
	8	Outriggers cannot be extended or stowed																			
	9	Excessive hydraulic drift																			
Travel system	11	Machine does not move off																			
	12	Machine does not accelerate or does not decelerate																			
	13	Travel speed is slow or lacks power																			
	14	Torque converter lock-up does not engage or cannot be disengaged (engine stalls when machine is stopped or moves off)																			
	15	Excessive time lag when moving off (shifting gear), or shift up is slow																			
	16	Torque converter oil temperature becomes high																			
	17	Brake cannot be applied (braking effect is poor) or cannot be released (drags), pulls to one side																			
	18	Exhaust brake cannot be applied or cannot be released																			
	19	Air pressure does not rise or is too low																			
	20	Cannot switch between 2-wheel drive and 4-wheel drive																			
	21	Steering mode cannot be switched																			
	22	Wheels do not move when steering wheel is turned (steering does not turn or is difficult to turn)																			
	23	Rear steering is not locked or is not released																			
	24	Suspension cannot be locked or cannot be set free																			
	25	Suspension lift cannot be used																			
Buzzer, lamp, gauge does not work, etc.																					
Troubleshooting code when error code is displayed		EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL	EL
		73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92

↑ When outrigger is extended, suspension lift is operated

023S02

Note 1 : Error codes for spare inputs/outputs and troubleshooting for problems related to the retarder, outrigger automatic horizontal extension, electric stowing mirror, service lamp, and other options are not included.
Note 2 : Troubleshooting codes E-2 – 4 are for the engine starting system.

Self-diagnostic display(abnormality display)																												Troubleshooting code when there is no abnormality display
Disconnection in rear steering FREE solenoid Disconnection in service brake Disconnection in exhaust brake Disconnection in preheating Disconnection in head lamp Hi relay Disconnection in head lamp Lo relay Disconnection in side lamp relay Disconnection in right turn relay Disconnection in left turn relay Disconnection in steering mode solenoid a Disconnection in steering mode solenoid c Disconnection in steering mode solenoid b Disconnection in steering mode solenoid d Disconnection in pump merge solenoid Disconnection in suspension lift Outtrigger control signal short circuited with power source Outtrigger control signal short circuited with ground, disconnection Disconnection in fuel sensor Abnormality in rear steering LOCK limit switch/FREE limit switch Failure of both speedometer sensors Speedometer sensor failure Special steering failure (emergency stop mode) Reverse steering failure (emergency stop mode) Special steering failure Reverse steering failure 1 Reverse steering failure 2 Abnormality in right turn relay Abnormality in left turn relay																												
MDTL errors																												
E BB	E BC	E BD	E BF	E CAC	E CB	E CC	E CE	E CF	E D0	E D1	E D2	E D3	E D4	E D7	E E7	E E8	E E9	E EB	E EE	E EF	E F0	E F1	E F2	E F3	E F4	E FE	E FF	
																												E-1,5,EM-101,102,104,H-1
																												H-2
																												EM-106-1,EM-131, H-3
																												EM106,131, H-4
																												H-5
																												H-6
																												EM-103,109 – 124, H-7
																(O)												EM-201 – 224, H-8
																												H-9
																												H-101
																												H-102
																				O								E-6, H-103
																												H-104
																												H-105
																												H-106
																												H-107
																												H-108
																												H-109
																												H-110
																												H-111
																												H-112
																												H-113
																												H-114
																												H-115
																												E9 – 13,EM125 – 128,139 – 140
EL 95	EL 96	EL 97	EU 98 (E4)	EL 99	EL 100	EL 101	EL 102	EL 103	EL 104	EL 105	EL 106	EL 107	EL 108	EL 109	EL 110	EL 111	EL 112	EL 113	EL 114	EL 115	EL 116	EL 117	EL 118	EL 119	EL 120	EL 121	EL 122	

Engine
preheating
impossible

The movement is the same as
usual, but there are cases where
the steering is set to LOCK, so the
mode switches to the emergency
stop mode.

- When the rear steering is set to FREE, the steering mode is held, but after the rear steering is set to LOCK, it is held in the front wheel mode.
- Impossible after rear steering is set to LOCK, travels in speed limit mode.

ACTION TAKEN BY CONTROLLER AND PROBLEM THAT APPEARS ON MACHINE (FAILURE MODE) WHEN MDTL ERROR E28 OR MDTL ERROR E28 OCCUR**1. Upper MDT (MDTU)**

- 1) The rear steering LOCK/FREE/CENTER condition is held at the condition in operation before the failure occurred.
- 2) The steering mode is held at the condition in operation before the error occurred.
- 3) The outrigger power source is switched ON to make it possible to operate with the bottom outrigger control panel.
- 4) The machine model, top, and bottom selection are held in the condition in operation before the error occurred.
- 5) The winch rotation buzzer signal (pulse) is output.

2. Lower MDT (MDTL)

- 1) The output to the outrigger related solenoids is stopped.
- 2) The steering mode is held at the condition in operation before the error occurred.
- 3) The side lamp, head lamp, and hazard lamp functions are turned ON (when the engine is started).
- 4) The machine model, top, and bottom selection are held in the condition in operation before the error occurred.
- 5) The other outputs sent by the lower MDT to the solenoids for suspension lift, service (auxiliary) brake, and exhaust brake are stopped

3. Moment limiter

- 1) Emergency stop mode (▲) display (graphic display) + emergency alarm buzzer
- 2) All other displays go out.
- 3) Possible to clear outrigger setting and operate motion cut (automatic stop) or over-rear stability stop

4. Transmission controller

- 1) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).

- 2) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)

ACTION TAKEN BY CONTROLLER AND PROBLEM THAT APPEARS ON MACHINE (FAILURE MODE) WHEN MDTU ERROR E29 OR OSS ERROR E20 OCCUR**1. Upper MDT (MDTU), lower MDT (MDTL)**

- 1) Impossible to switch normal steering to reverse steering
- 2) Swing flasher does not function.

2. Moment limiter


- 1) Emergency stop mode (▲) display (graphic display) + emergency alarm buzzer
- 2) Turns the moment limiter panel lamp (night lighting) ON.
- 3) Possible to clear outrigger setting and operate motion cut (automatic stop) or over-rear stability stop

3. Transmission controller


- 1) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).
- 2) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)

023S02

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MA-
CHINE (FAILURE MODE) WHEN MDTL
ERROR E29 OCCURS**

1. **Upper MDT (MDTU), lower MDT (MDTL)**
 - 1) The steering mode is held at the condition in operation before the error occurred.
2. **Moment limiter**
 - 1) If the PTO mode switch is at Travel or Operation 1, emergency stop mode () display + emergency alarm buzzer
3. **Transmission controller**
 - 1) The gear shift lever signal is held at the condition in operation before the error occurred.
Gear shifting is carried out by the input signal sent by the interlock signal (2 seconds after the lever position is changed)
 - 2) The travel mode (2WD Hi, 4WD Hi, 4WD Lo) is held at the condition in operation before the error occurred.
 - 3) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).
 - 4) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)
 - 5) The steering mode relay is held at the condition in operation before the error occurred.
 - 6) After the starting switch is turned OFF, the PTO mode is set to Travel and the travel mode is set to 2WD Hi.

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MA-
CHINE (FAILURE MODE) WHEN OSS
ERROR E00 OCCURS**

1. Upper MDT (MDTU), lower MDT (MDTL), transmission controller
 - No response (ignores condition)
2. Moment limiter
 - 1) The condition in operation before the error occurred is held until the starting switch is turned OFF (the overload automatic stop also functions), but after the starting switch is turned OFF, it cannot be reset.
 - 2) The moment limiter panel lamp (night lighting) is lighted up.
 - 3) Emergency stop mode () display + emergency alarm buzzer

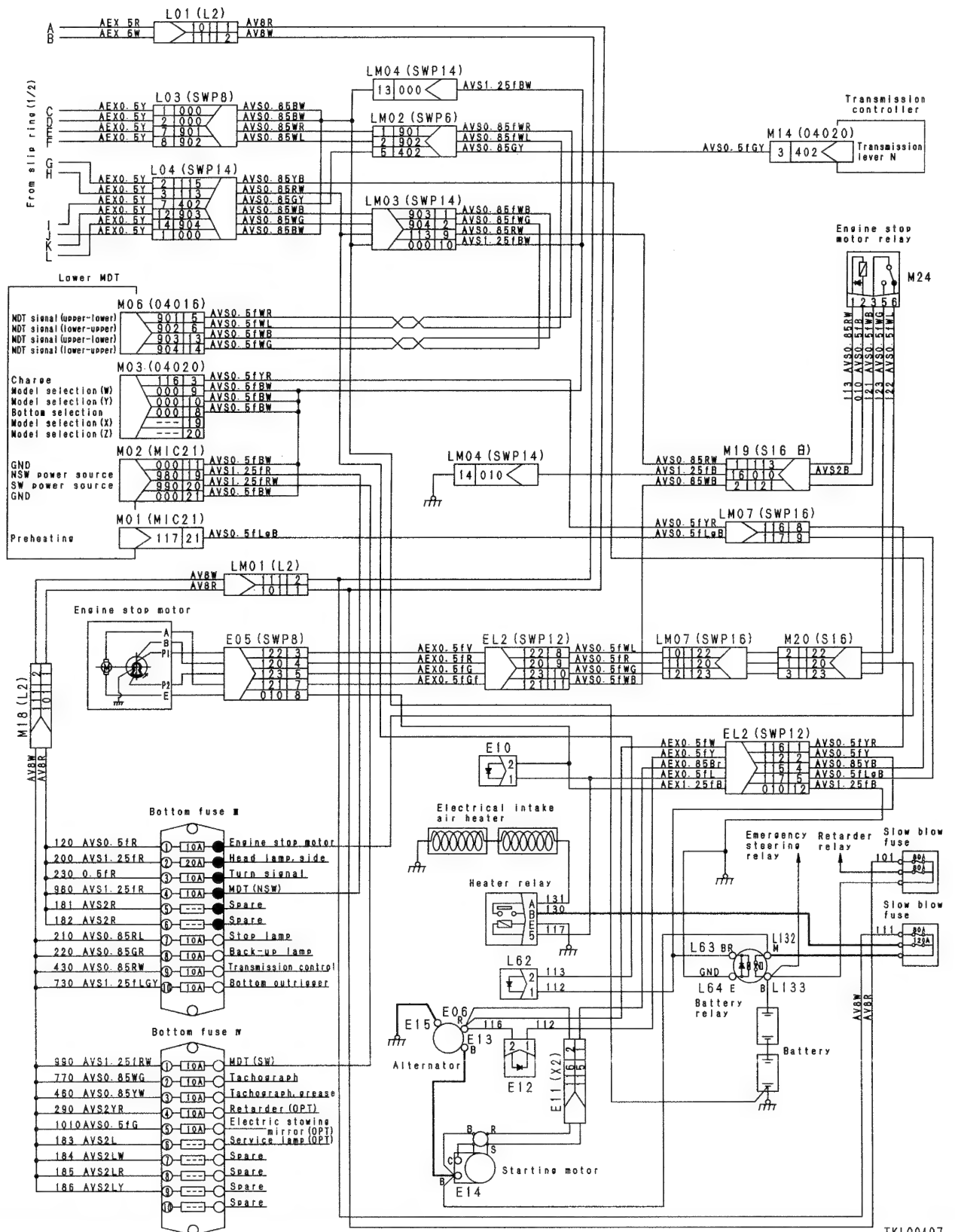
**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MA-
CHINE (FAILURE MODE) WHEN OSS
ERROR E30 OCCURS**

1. Upper MDT (MDTU), lower MDT (MDTL), transmission controller
 - No response (ignores condition)
2. Moment limiter
 - 1) If the problem occurs during jib operations, the following are carried out: motion cut, error code display + emergency alarm buzzer

023S02

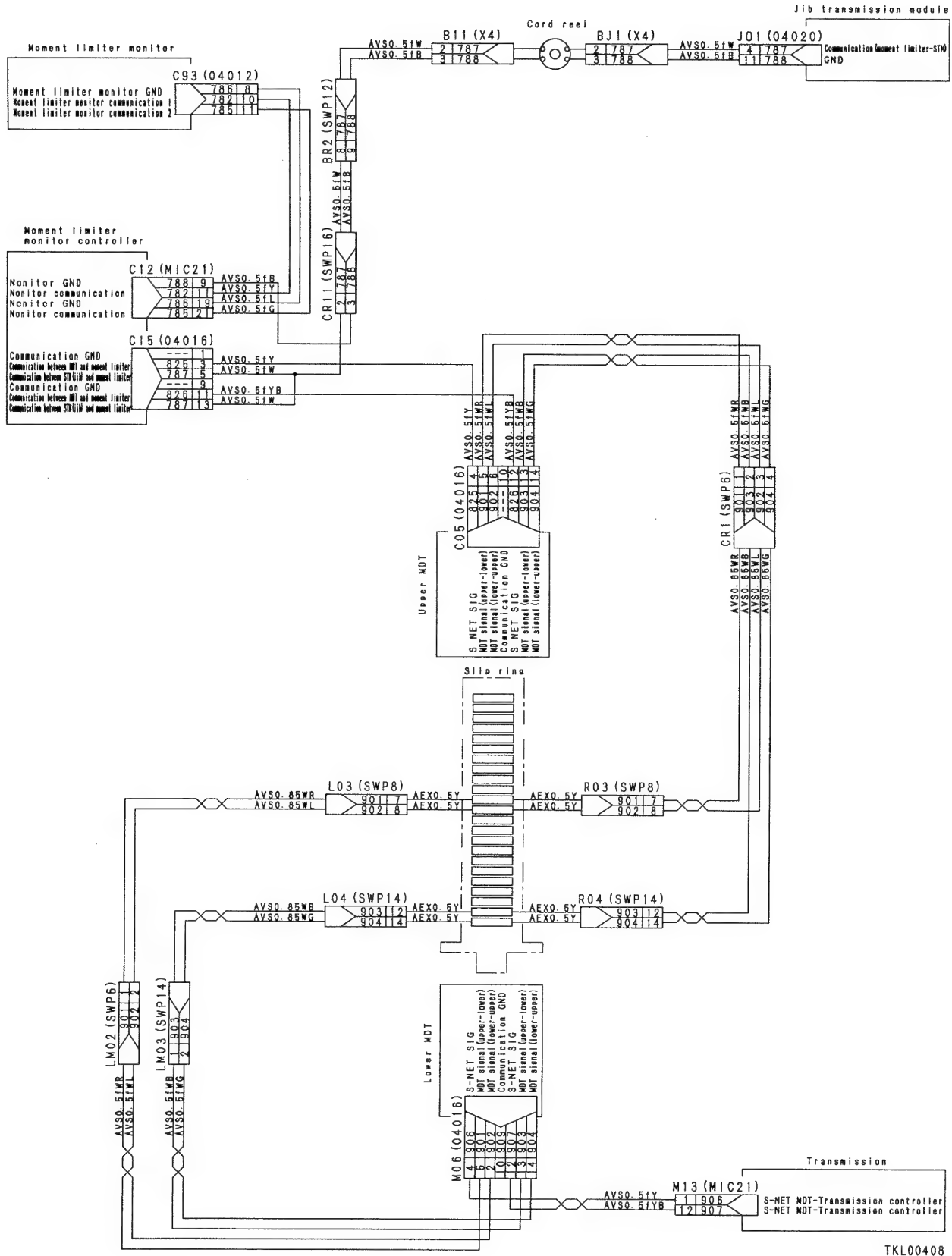


023S02



TKL00407

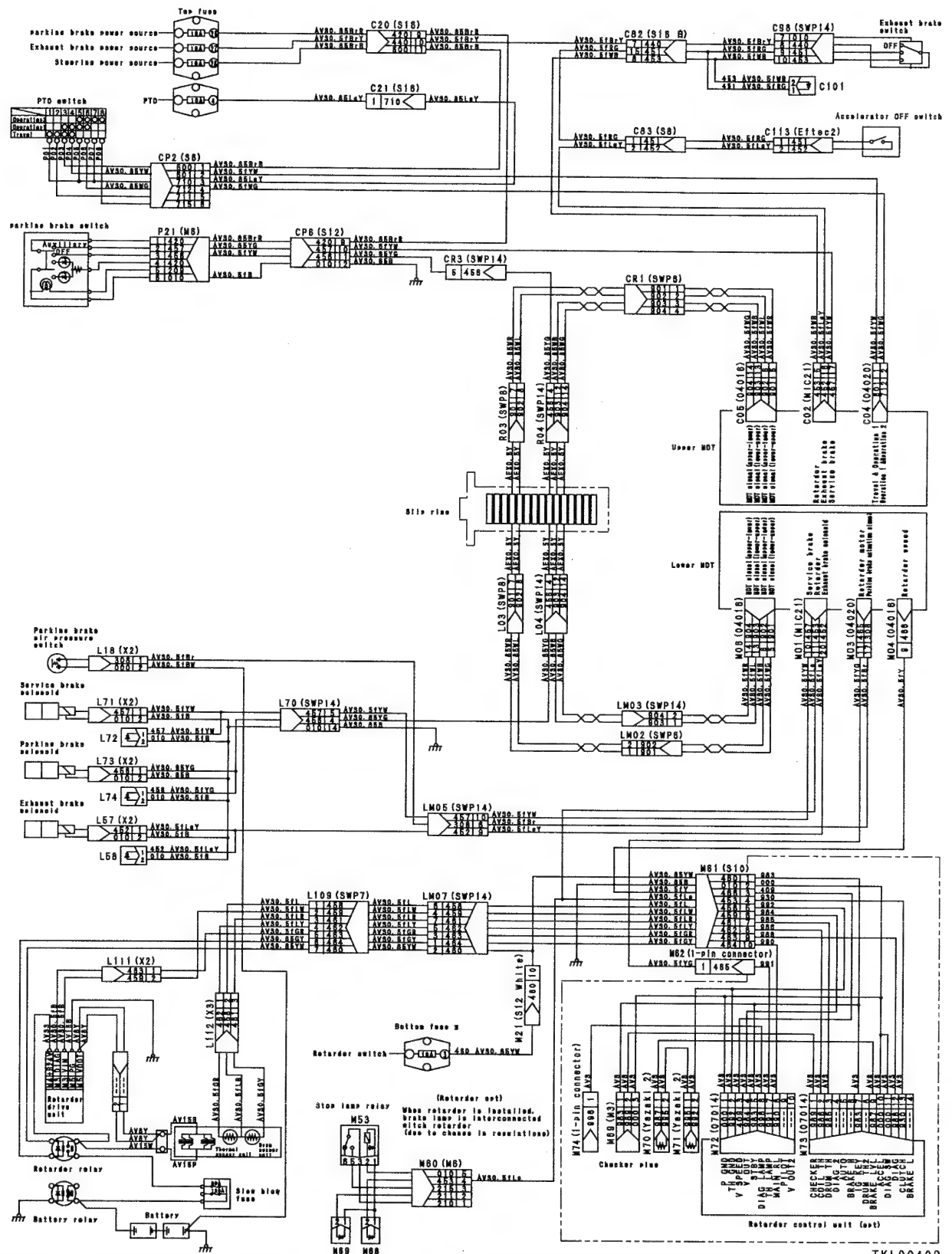
ELECTRICAL CIRCUIT DIAGRAM OF NETWORK SYSTEM



TKL00408

023S02

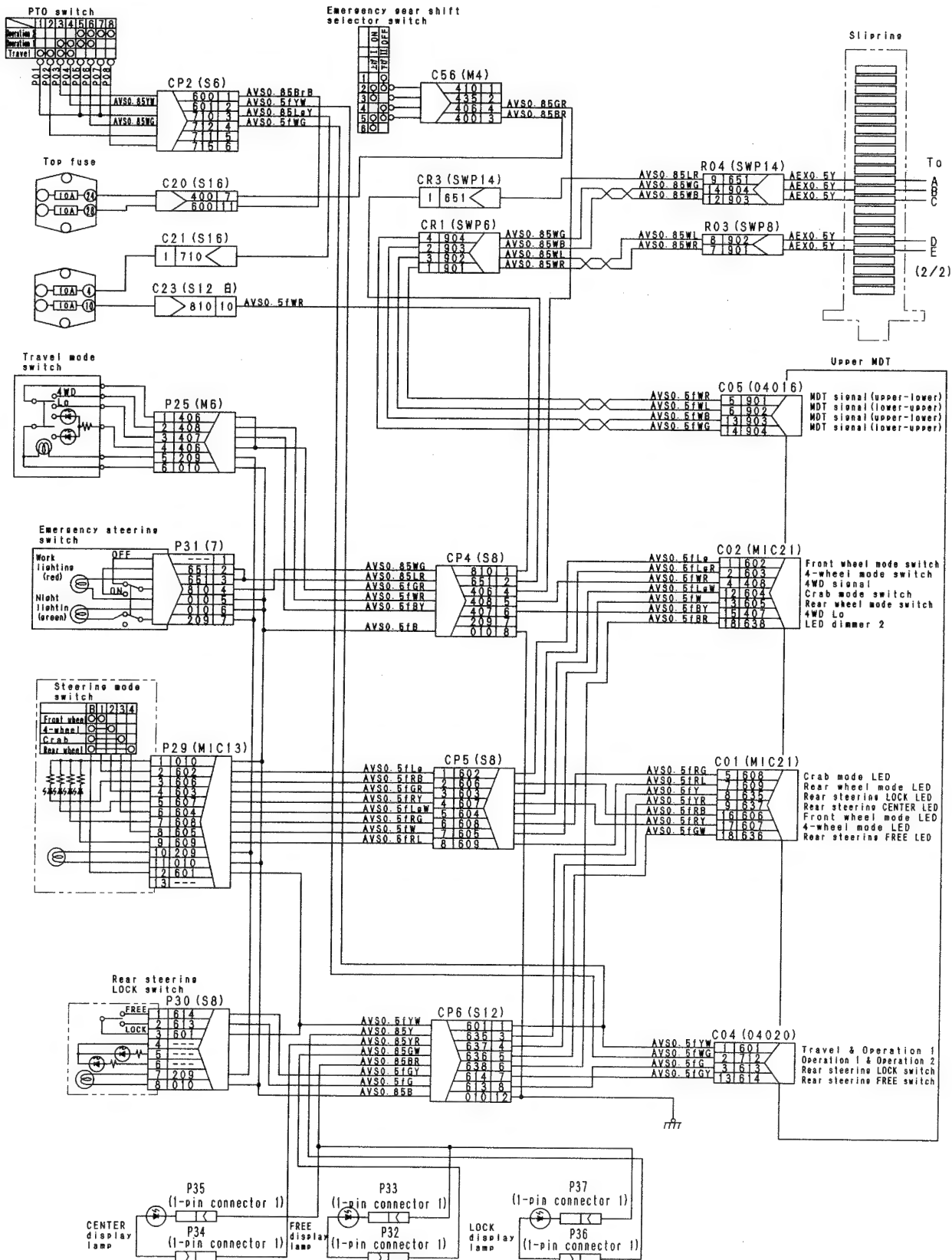
ELECTRICAL CIRCUIT DIAGRAM OF BRAKE SYSTEM



TKL00409

023S02

ELECTRICAL CIRCUIT DIAGRAM OF STEERING SYSTEM

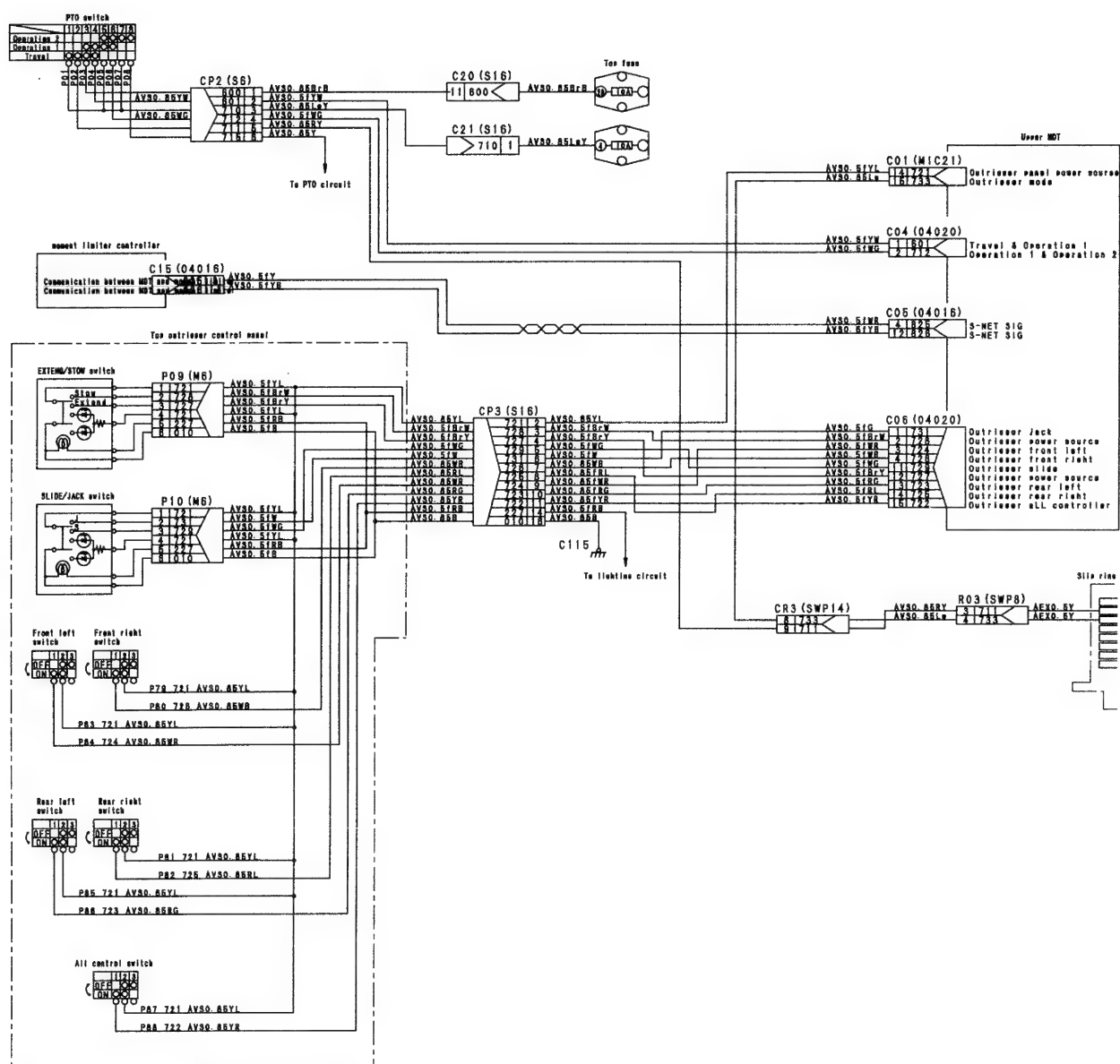


023502

TKL00410



ELECTRICAL CIRCUIT DIAGRAM OF OUTRIGGER SYSTEM

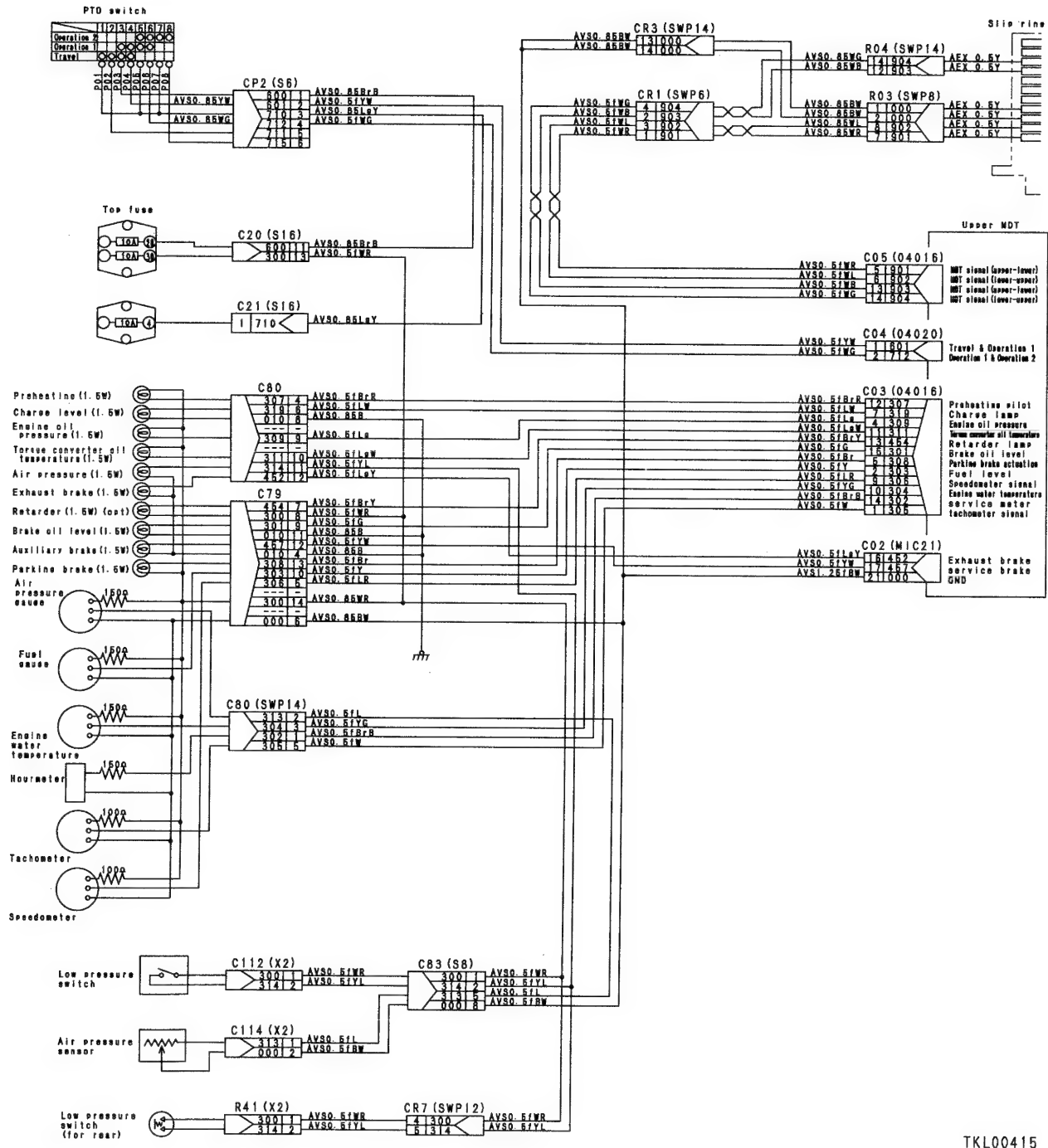


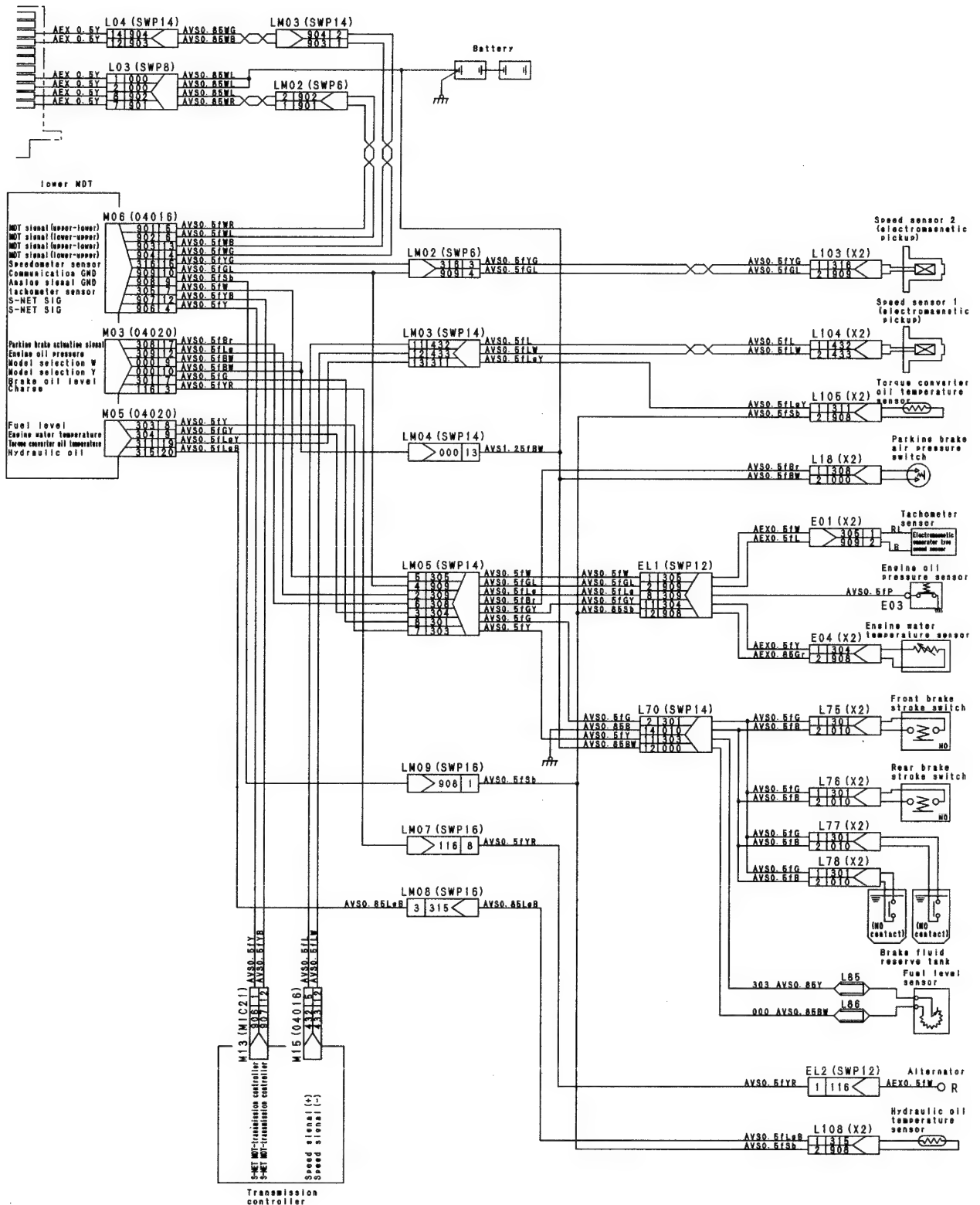
023S02

TKL00413

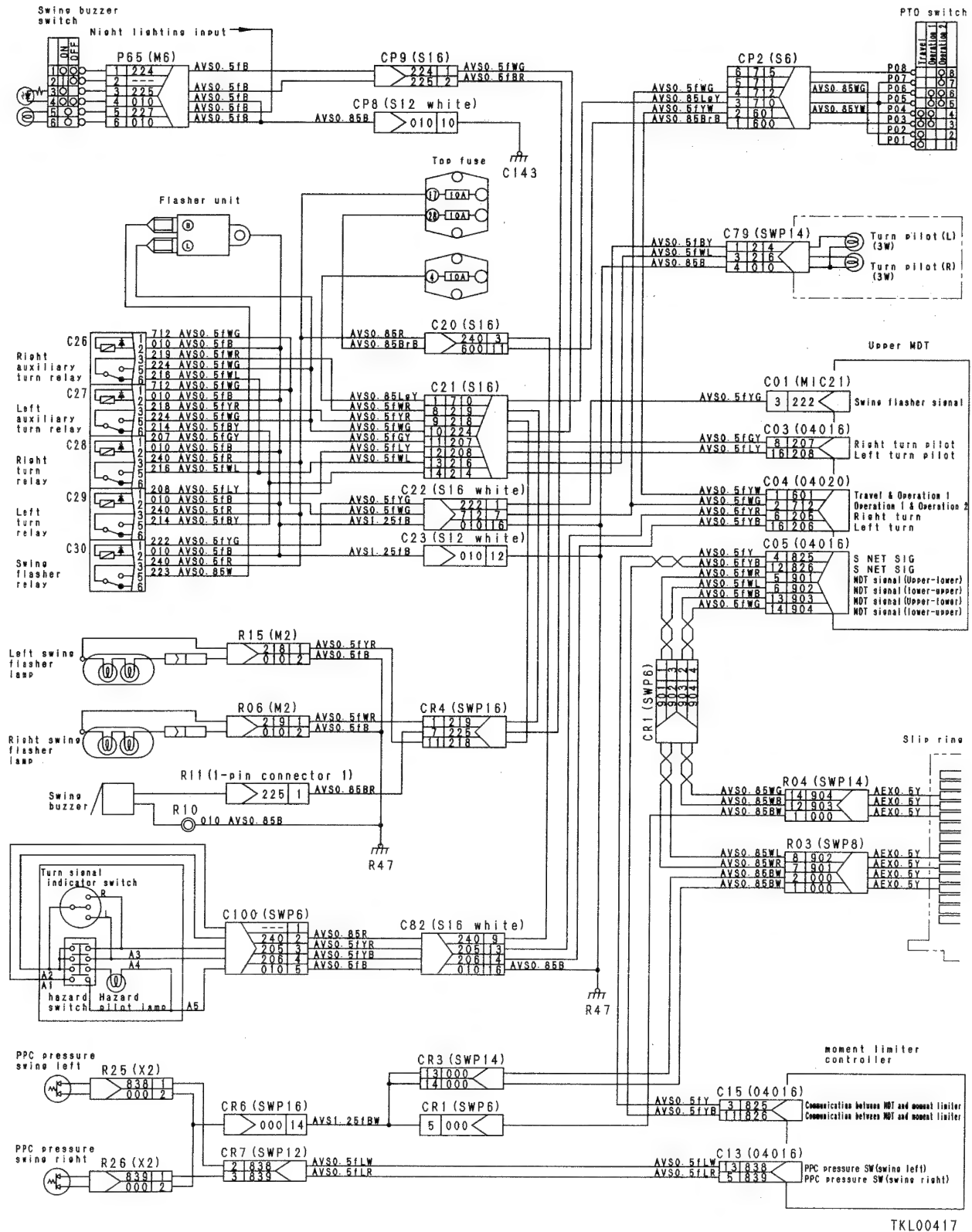


ELECTRICAL CIRCUIT DIAGRAM OF MACHINE MONITOR SYSTEM





TKL00416

ELECTRICAL CIRCUIT DIAGRAM OF TURN SIGNAL AND SWING
FLASHER SYSTEMS

023S02

The diagram illustrates the electrical system for the vehicle's lighting, centered around the Lower MDT (Master Data Terminal) and various relays and fuses.

Lower MDT Components:

- M03 (04020):** Right turn pilot, Left turn pilot.
- M04 (04016):** Right turn, Left turn.
- M06 (04016):** MDT signal (Upper-lower), MDT signal (lower-upper), MDT signal (Upper-lower), MDT signal (lower-upper).

Front Lamp Assembly (L.H.):

- L51 (CN4):** Side turn signal lamp (25W), Turn signal lamp (25W), Parking lamp (4W), Side lamp (10W).

Front Lamp Assembly (R.H.):

- L46 (CN4):** Side turn signal lamp (25W), Turn signal lamp (25W), Parking lamp (4W), Side lamp (10W).

Rear Lamp Assembly (L.H.):

- L55 (M6):** Back-up lamp (25W), Turn signal lamp (25W), Stop lamp (25W), Tail & parking (10W).

Rear Lamp Assembly (R.H.):

- L52 (M6):** Back-up lamp (25W), Turn signal lamp (25W), Stop lamp (25W), Tail & parking (10W).

Relays and Fuses:

- LM03 (SWP14), LM02 (SWP6), LM04 (SWP14), LM05 (SWP14), M19 (S16 white), M20 (S16), M28, M29, M44 (Flasher unit).**
- Fuses:** Bottom fuse (10A).

Wiring Details:

- The diagram shows the wiring for the front and rear lamp assemblies, including the combination lamp, side turn signal lamp, turn signal lamp, parking lamp, and back-up lamp.
- The wiring is color-coded and labeled with part numbers and pin numbers.
- The diagram includes a battery connection and a bottom fuse.

TKL00418

023S02





EL-1 MDTU error E00 (MDT system error) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
		Defective lower MDT	Repair or replace

EL-2 MDTU error E10 (Shut off when low voltage) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
		Drop in battery voltage (Max. 18 V)	Repair or replace

023S02

EL-3 MDTU error E11 (Shut off when high temperature) is displayed

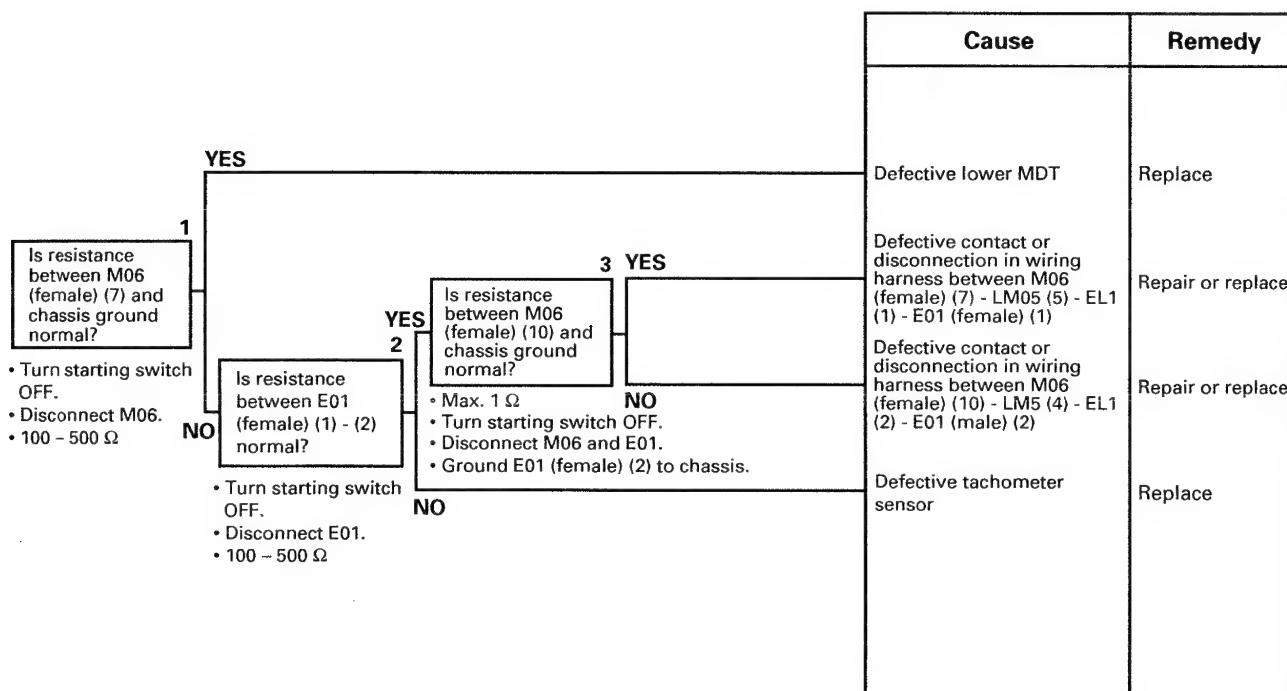
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
		Overheat inside upper MDT	Stop operations (wait for temperature inside lower MDT to go down)

023S02

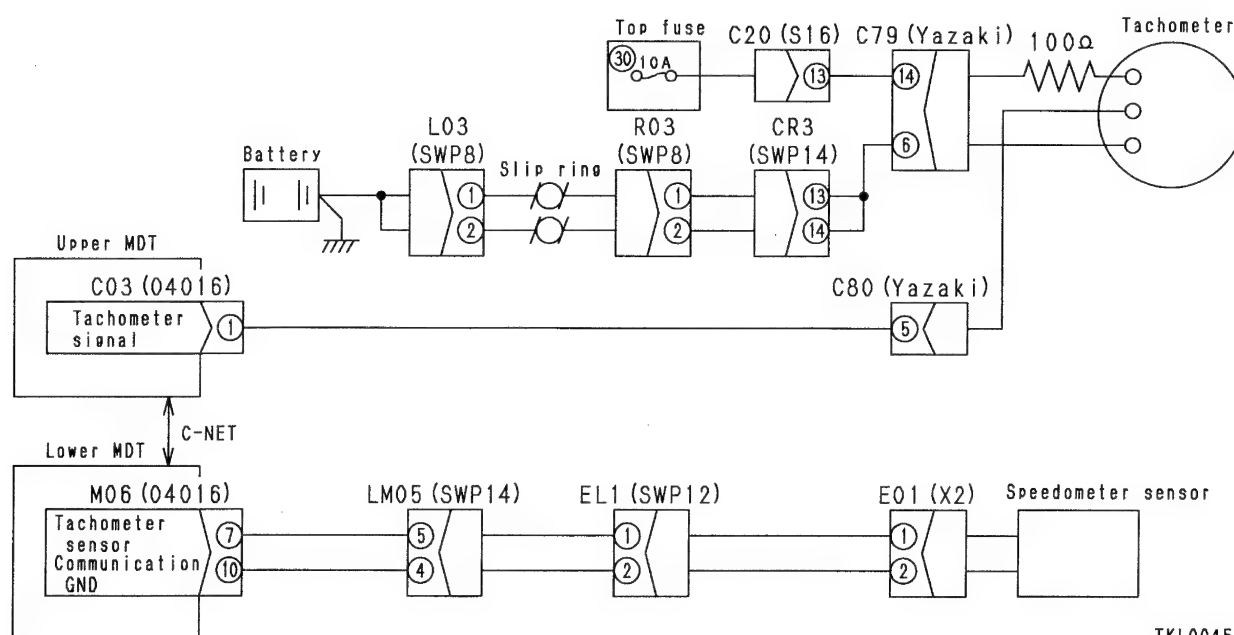
EL-4 MDTL error E18 (Disconnection in tachometer sensor) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EL-4 Related electric circuit diagram



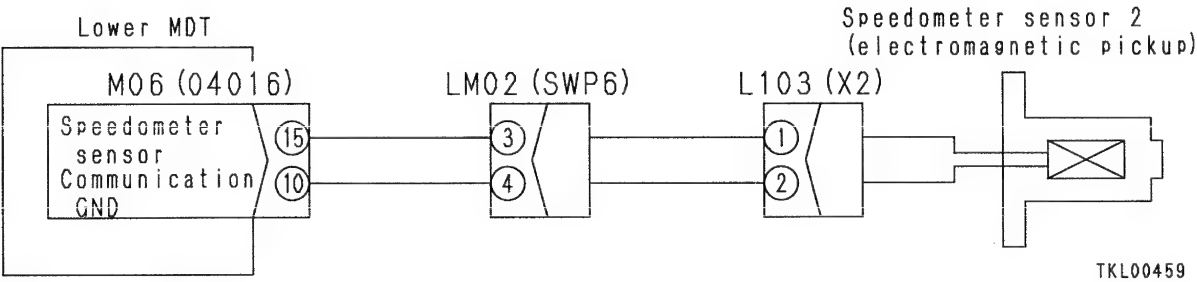
TKL00458

EL-5 MDTL error E19 (Disconnection in speedometer sensor 2) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div> <div>1</div> <div>Is resistance between M06 (female) (15) and chassis ground normal?</div> <div> <div>• 500 – 1000 Ω</div> <div>• Turn starting switch OFF</div> <div>• Disconnect M06</div> </div> </div> <div> <div>2</div> <div>Is resistance between L103 (male) (1) and (2) normal?</div> <div> <div>• 500 – 1000 Ω</div> <div>• Turn starting switch OFF</div> <div>• Disconnect L103</div> </div> </div> </div> <div> <div>YES</div> <div>NO</div> </div>	YES	Defective lower MDT	Replace
	YES	Defective contact or disconnection in wiring harness between M06 (female) (15) - LM02 (3) - L103 (female) (1)	Repair or replace
	NO	Defective contact or disconnection in wiring harness between M06 (female) (10) - LM02 (4) - L103 (male) (2)	Repair or replace
	NO	Defective speedometer sensor 2	Replace

EL-5 Related electric circuit diagram



EL-6 MDTL error E20 (Top, bottom don't match (application stopped)) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adaptor is inserted, or when the T-adaptor is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error is also detected as OSS error E20.

1

Is voltage between C04 (8), (18) and C02 (11), (21) as shown in Table 1?

• Turn starting switch ON.

2

Is voltage between M03 (8), (18) and M02 (11), (21) as shown in Table 2?

• Turn starting switch ON.

YES

NO

YES

NO

Cause	Remedy
Defective lower MDT	Replace
Defective contact or disconnection in wiring harness between M03 (18) and connecting point between M02 (11), (21) and LM04 (male) (13), LM03 (female) (10), or contact of M03 (8) with GND	Repair or replace
Defective contact or disconnection in wiring harness between C04 (8) and CR3 (13), (14) - R03 (2), (1) - (slip ring) - L03 (2), (1), or contact of C04 (18) with GND	Repair or replace

EL-7 MDTL error E21 (Top, bottom selection warning) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adaptor is inserted, or when the T-adaptor is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Is voltage between C04 (8), (18) and C02 (11), (21) as shown in Table 1?

• Turn starting switch ON.

2

Is voltage between M03 (8), (18) and M02 (11), (21) as shown in Table 2?

• Turn starting switch ON.

YES

NO

YES

NO

Cause	Remedy
Defective upper MDT	Replace
Defective contact or disconnection in wiring harness between M03 (18) and connecting point between M02 (11), (21) and LM04 (male) (13), LM03 (female) (10)	Repair or replace
Defective contact or disconnection in wiring harness between C04 (8) and CR3 (13), (14) - R03 (2), (1) - (slip ring) - L03 (2), (1), or contact of C04 (18) with GND	Repair or replace

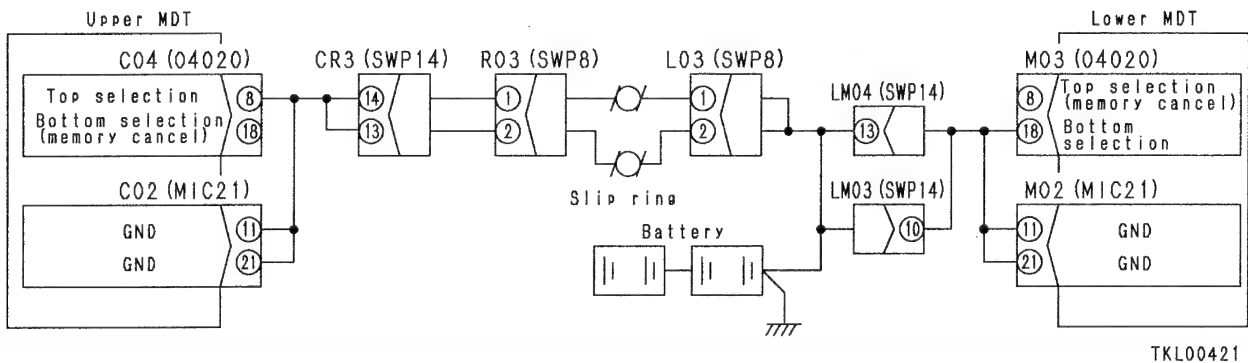
Table 1

Connector	Voltage (V)
Between C04 (8) - C02 (11), (21)	Max. 1 V
Between C04 (18) - C02 (11), (21)	15 – 30 V

Table 2

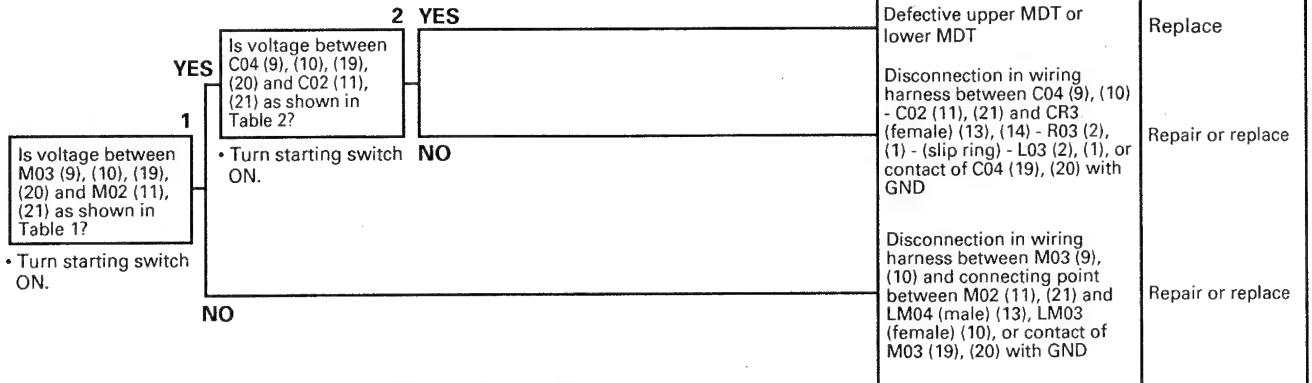
Connector	Voltage (V)
Between M03 (8) - M02 (11), (21)	15 – 30 V
Between M03 (18) - M02 (11), (21)	Max. 1 V

EL-4, EL-7 Related electric circuit diagram



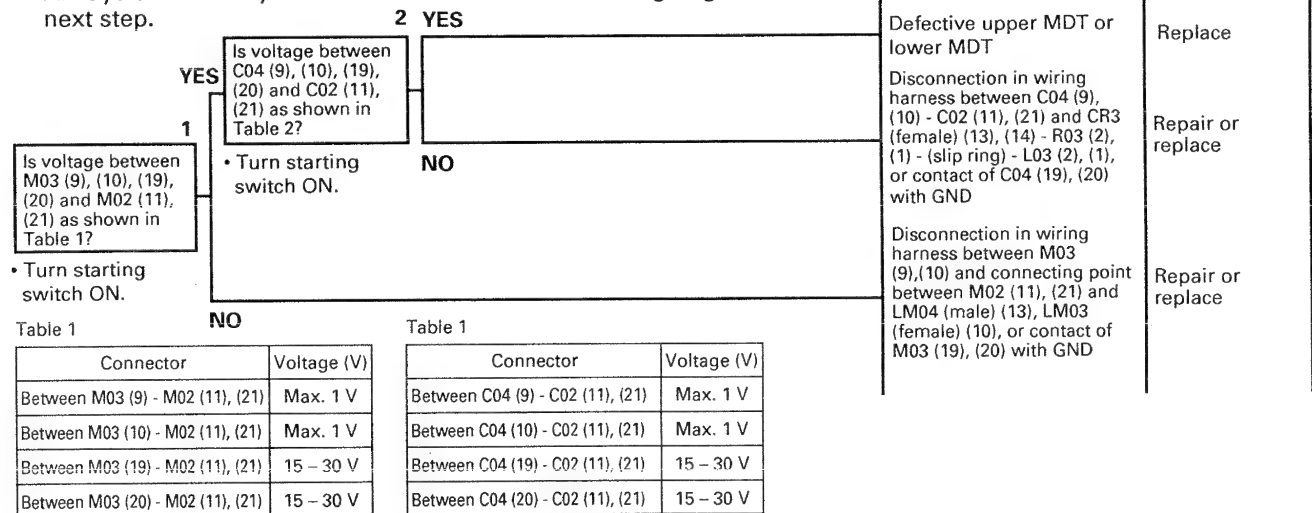
EL-8 MDTL error E24 (Model doesn't match (application stopped)) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error is also detected as OSS error E20.

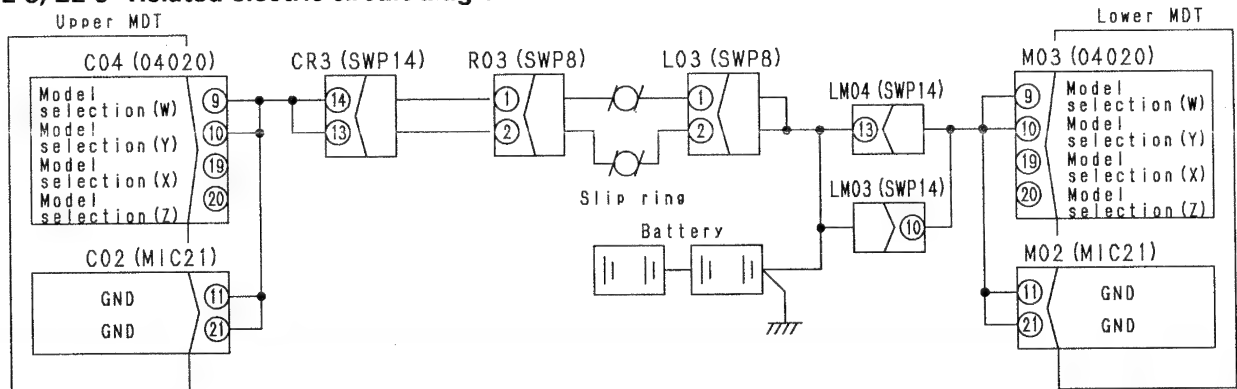


EL-9 MDTL error E25 (Model selection warning) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



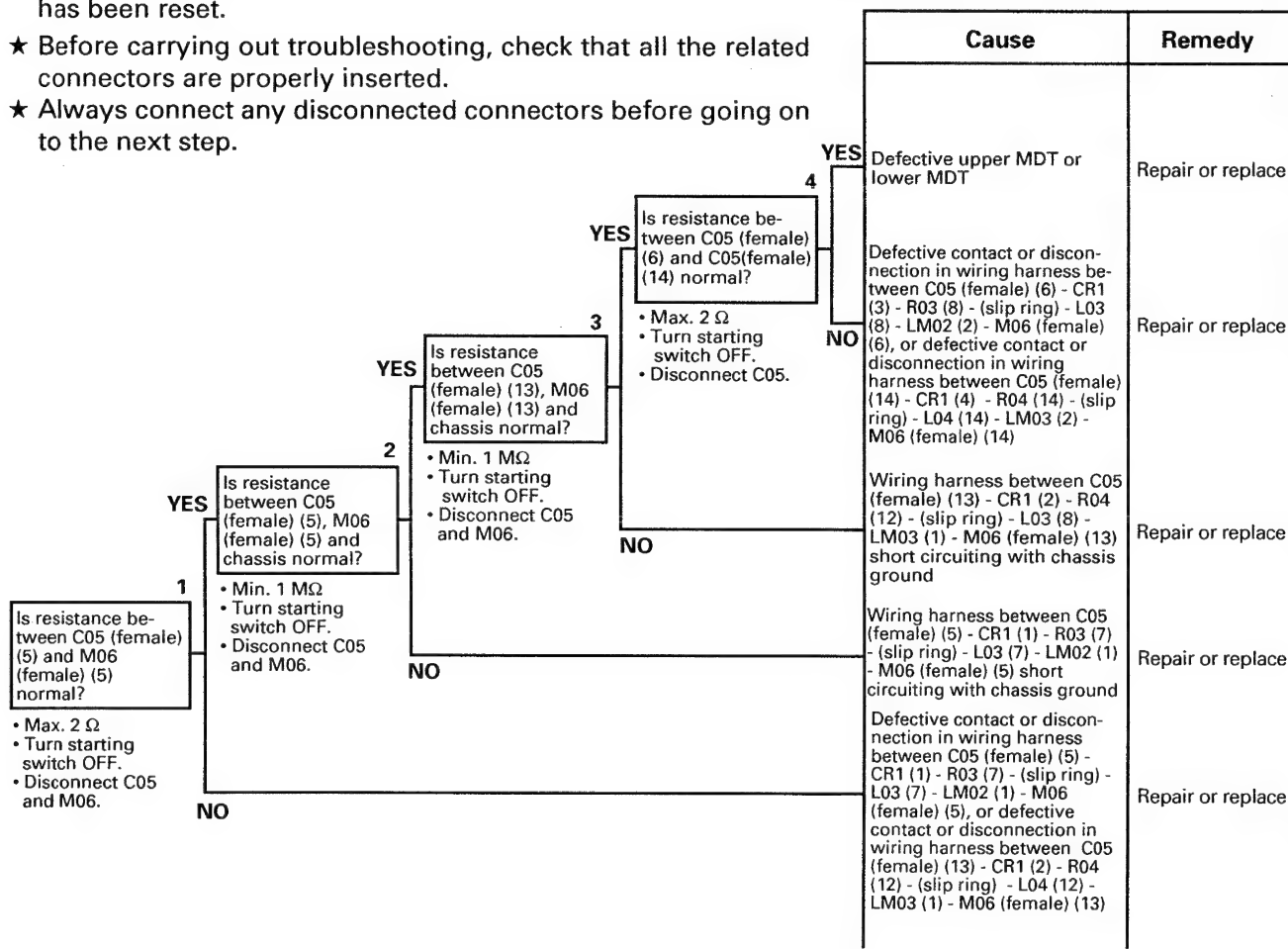
EL-8, EL-9 Related electric circuit diagram



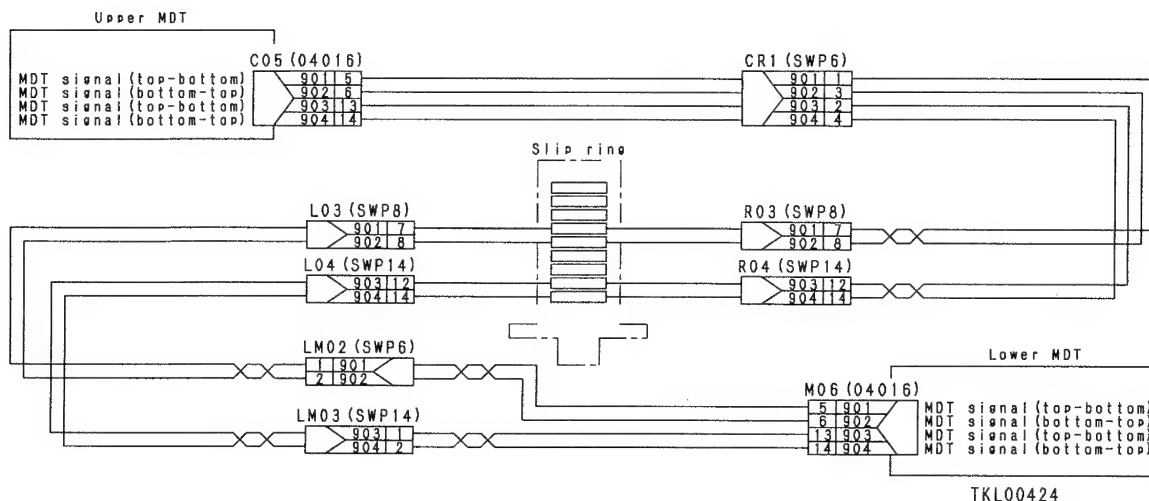
TKL00422

EL-10 MDTL error E28 (Abnormality in C-NET communication between MDTs [output stopped]) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- | | Cause | Remedy |
|-----|-------|--------|
| YES | | |

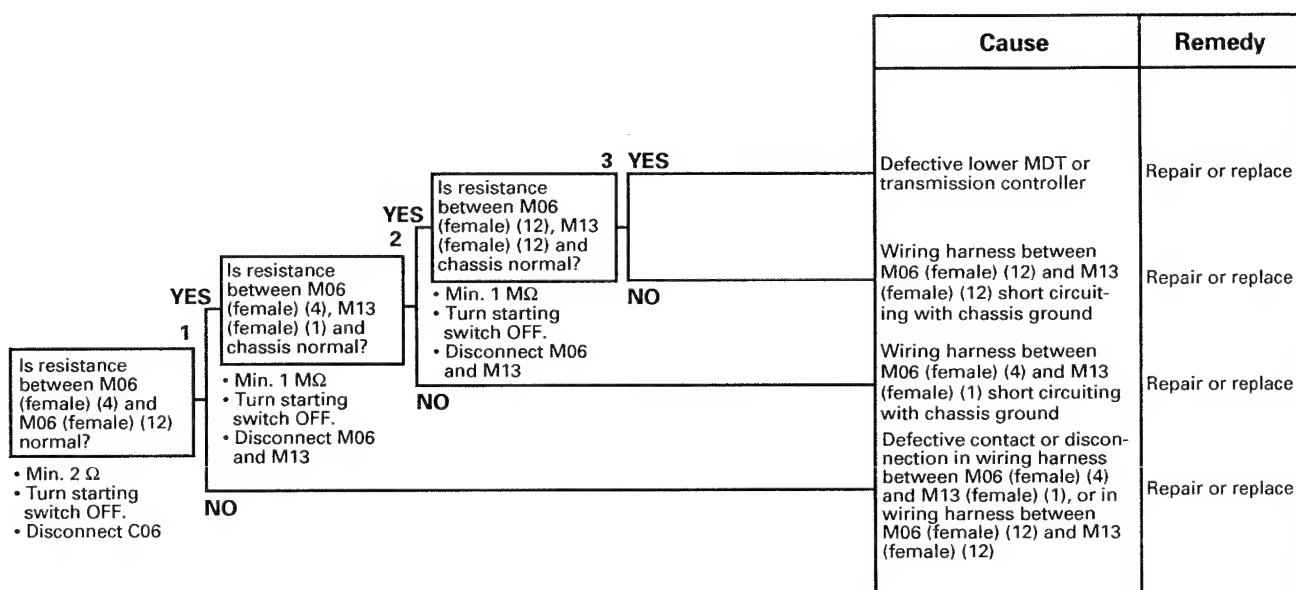


EL-10 Related electric circuit diagram

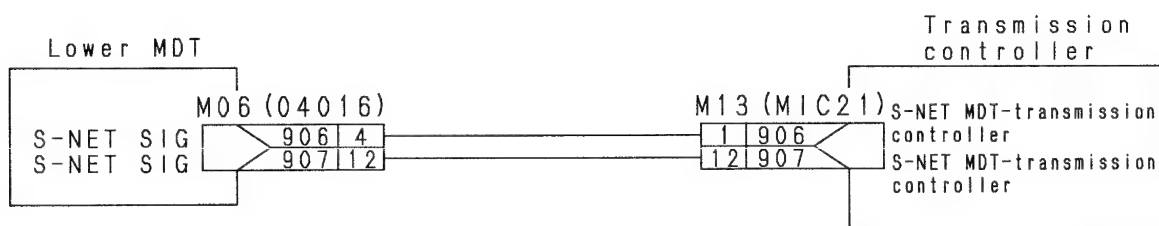


EL-11 MDTL error E29 (Abnormality in S-NET communication between MDT and transmission controller) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error is also detected as OSS error E20.



EL-11 Related electric circuit diagram

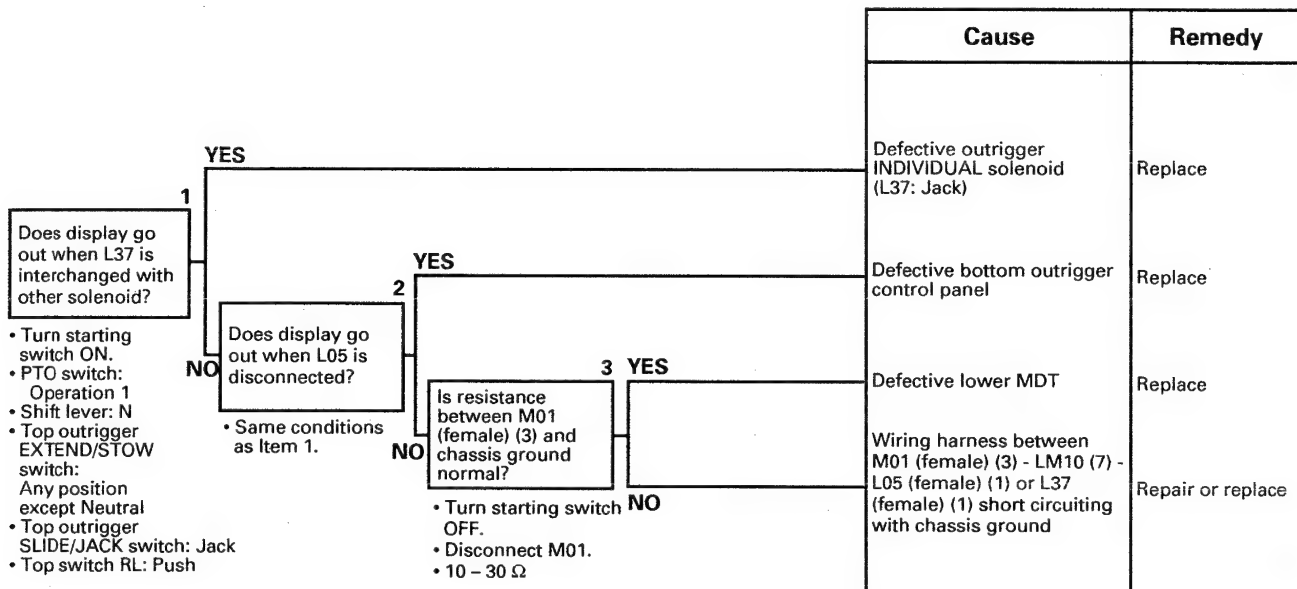


TKL00460

EL-22 MDTL error E40 (Outrigger jack RL short circuited with ground) is displayed

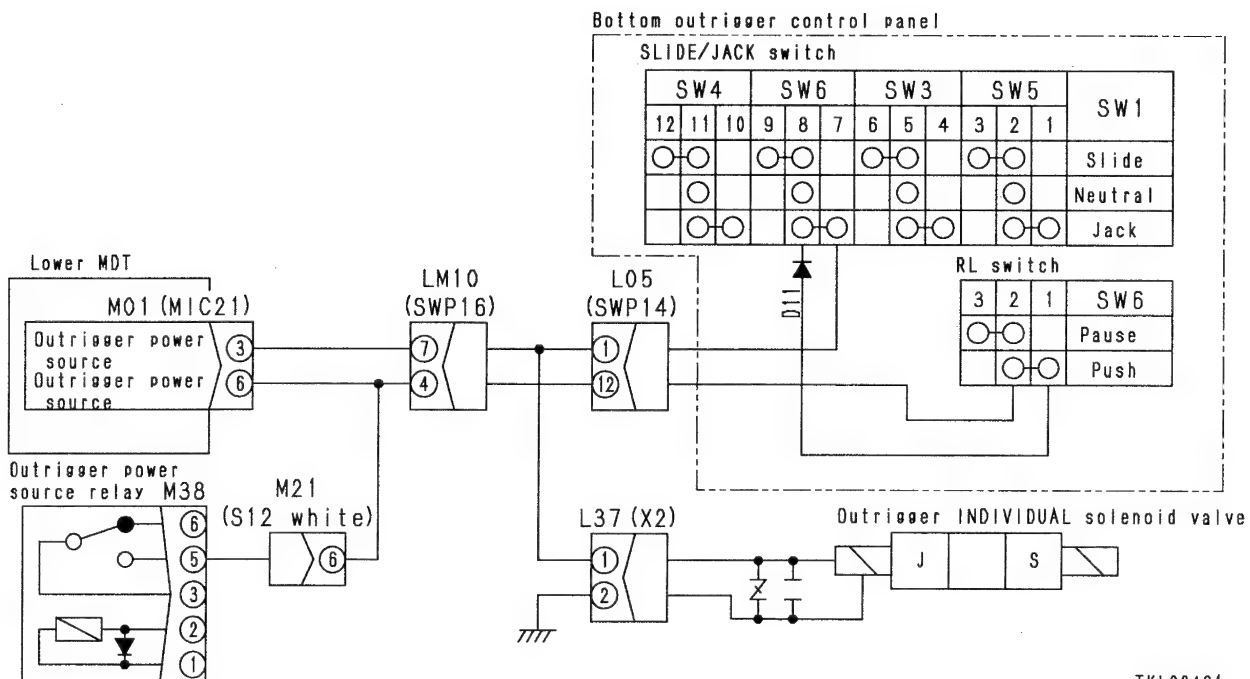
X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

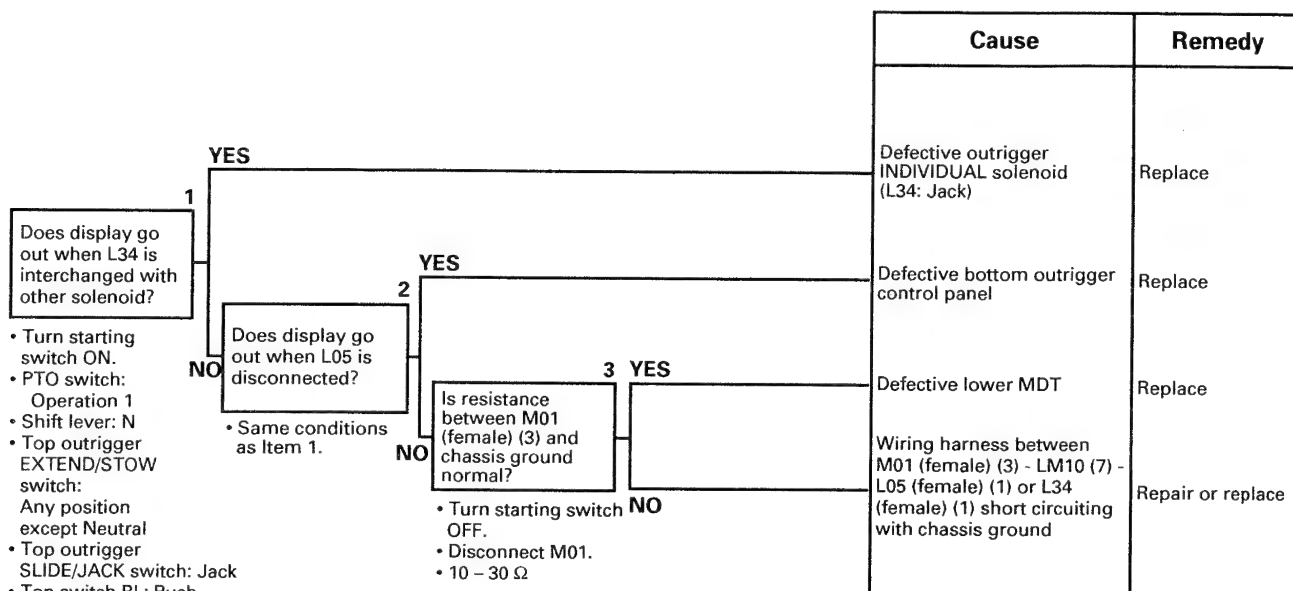
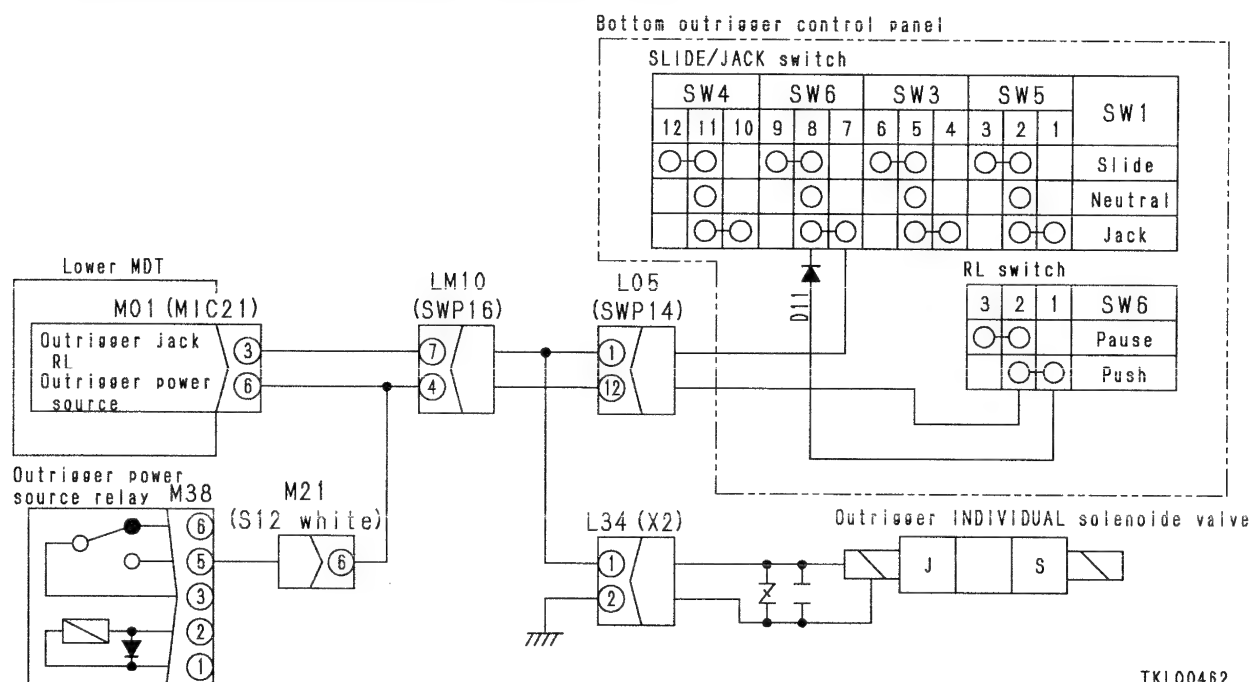
EL-22 Related electric circuit diagram (X-shaped outrigger)



TKL00461

H-shaped outrigger specification

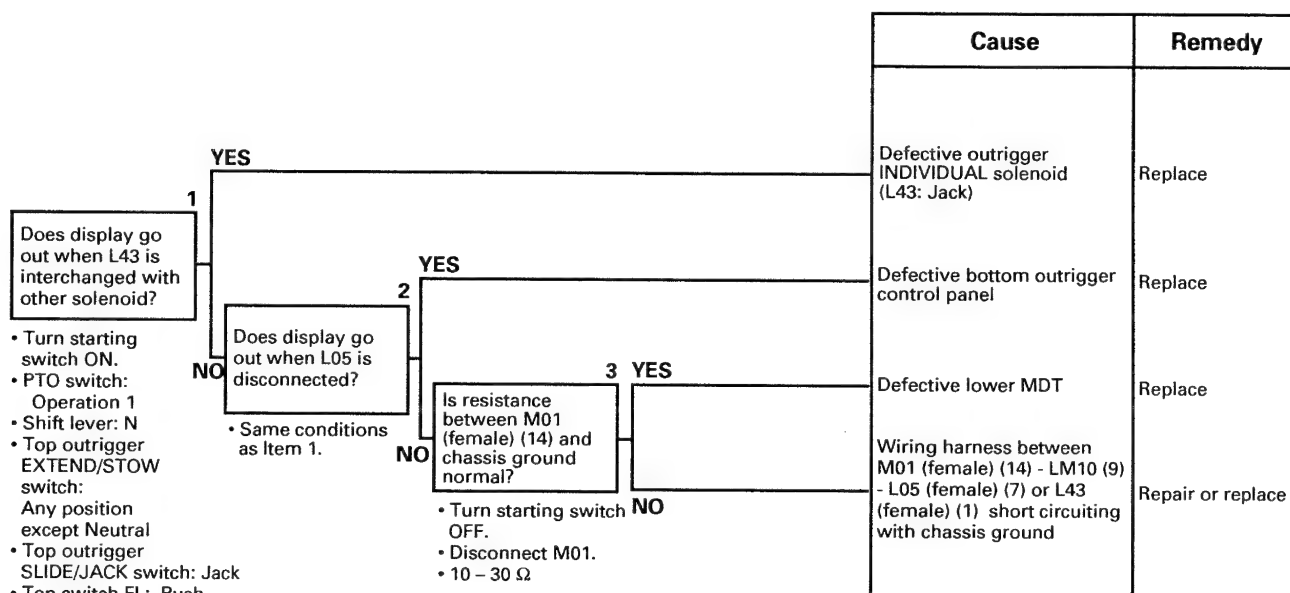
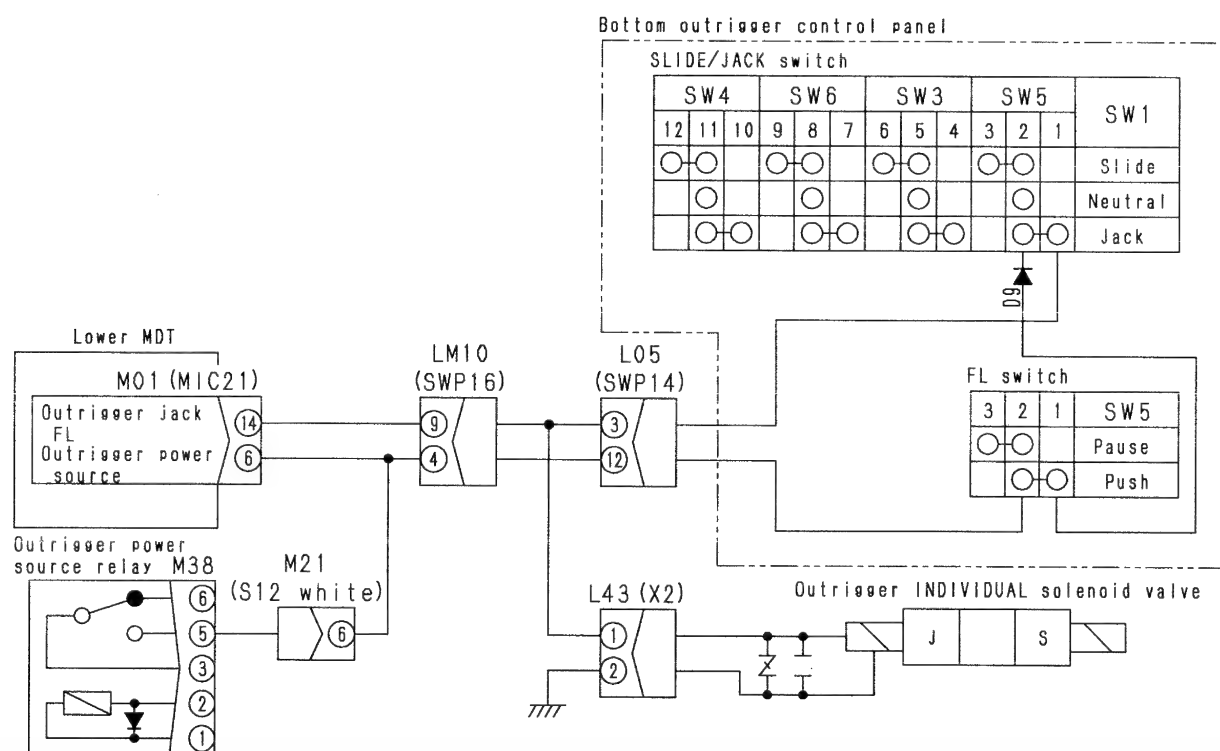
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

**EL-22 Related electric circuit diagram (H-shaped outrigger)**

TKL00462

H-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

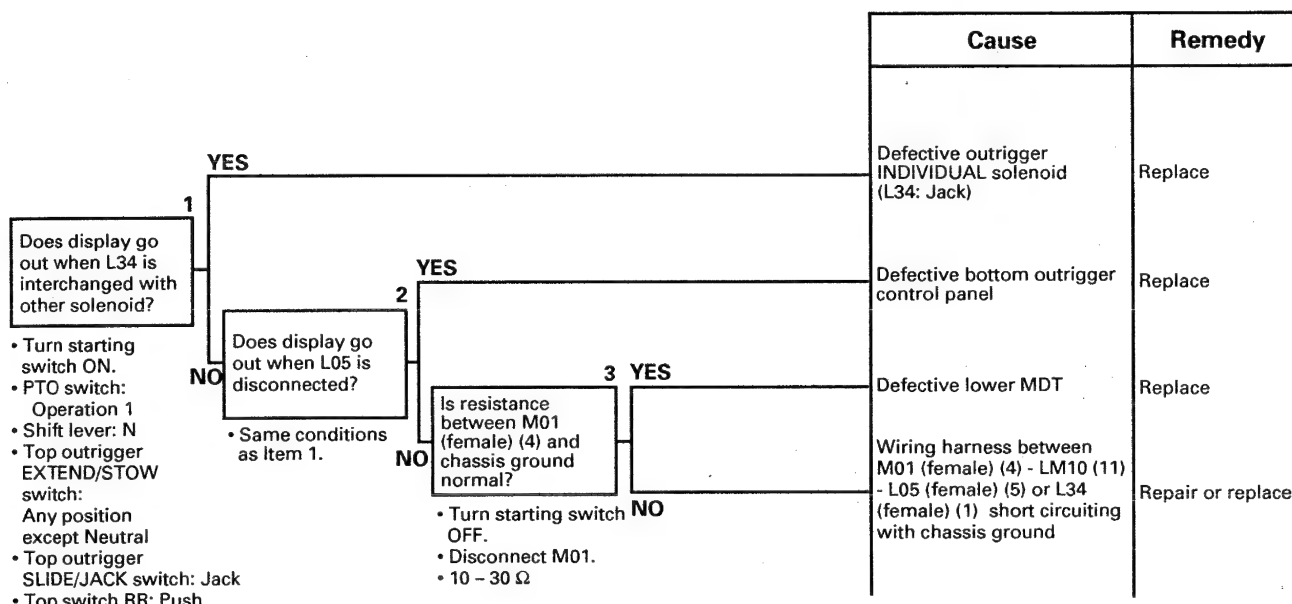
**EL-23 Related electric circuit diagram (H-shaped outrigger)**

TKL00464

EL-24 MDTL error E42 (Outtrigger jack RR short circuited with ground) is displayed

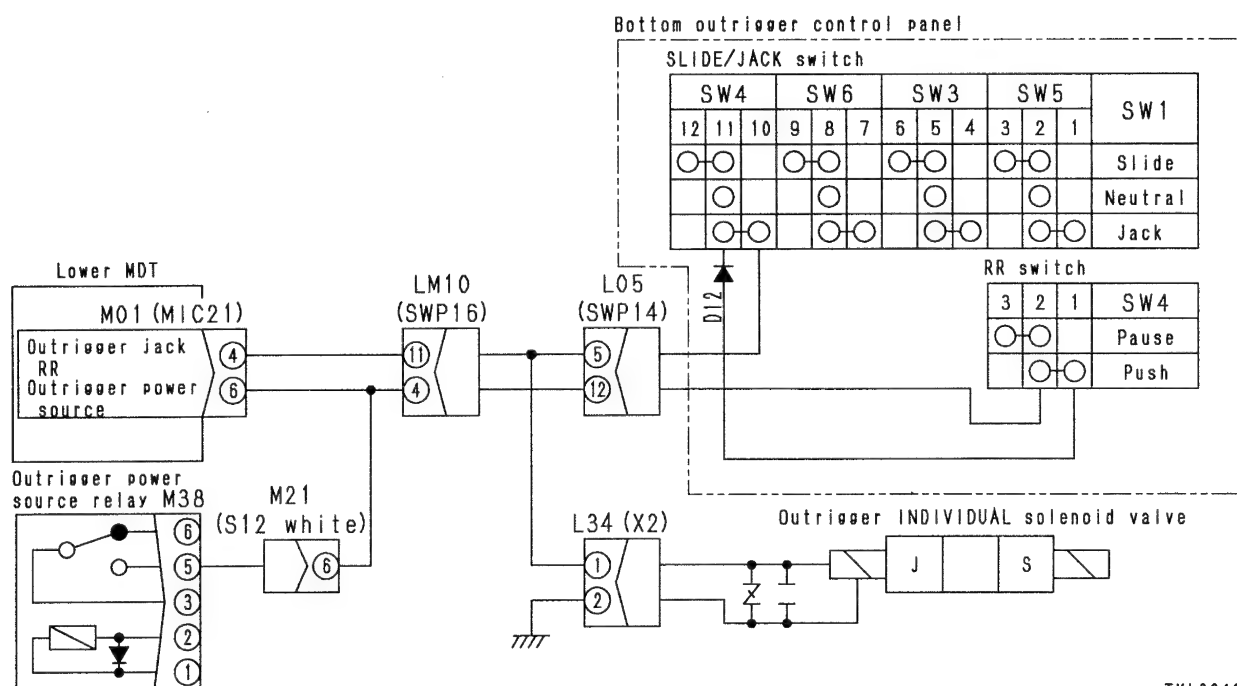
X-shaped outrigger specification

- ★ Before carrying out any troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

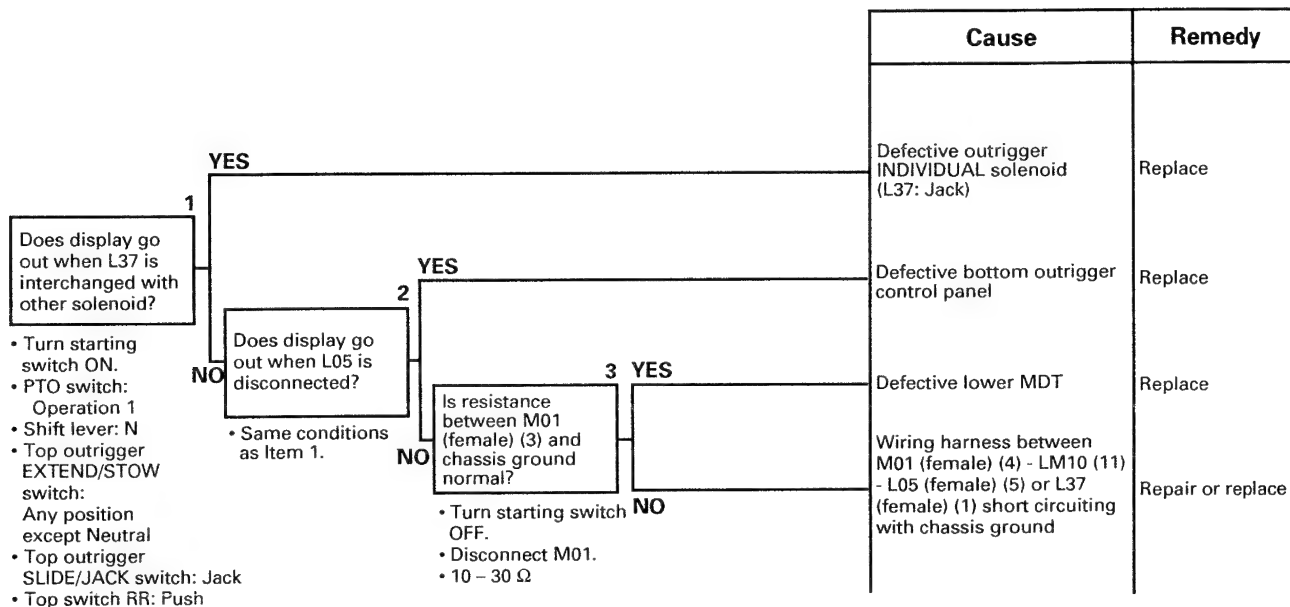
EL-24 Related electric circuit diagram (X-shaped outrigger)



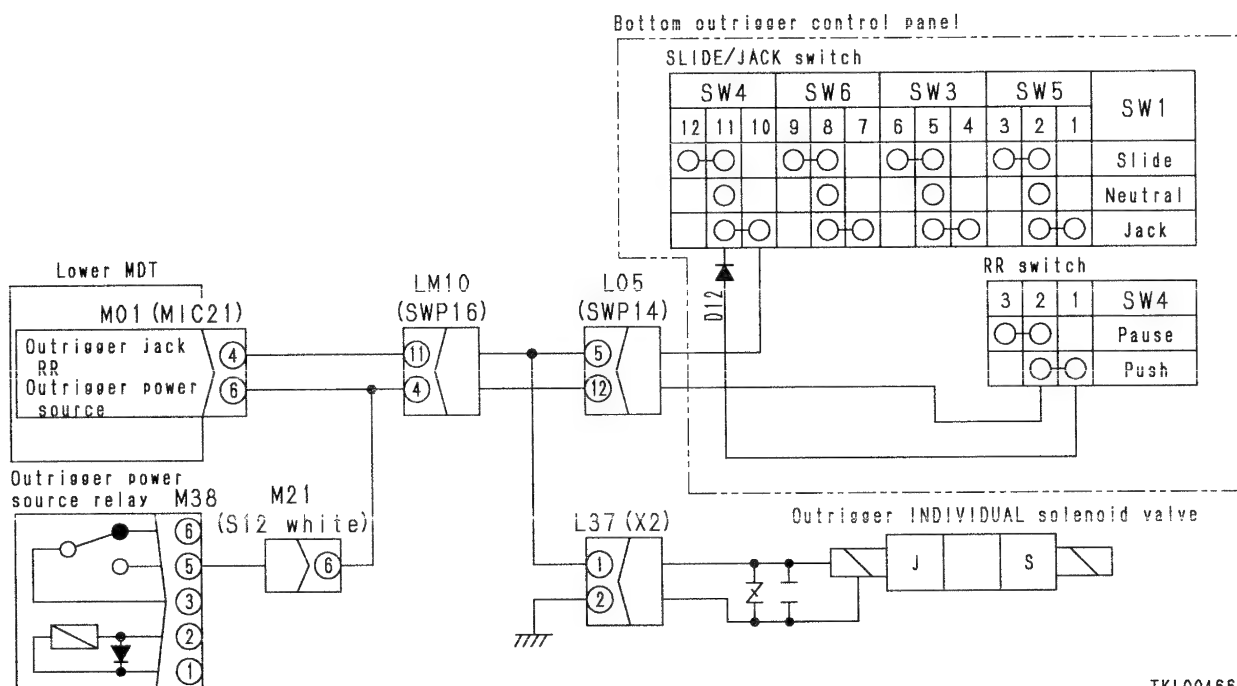
TKL00465

H-shaped outrigger specification

- ★ Before carrying out any troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



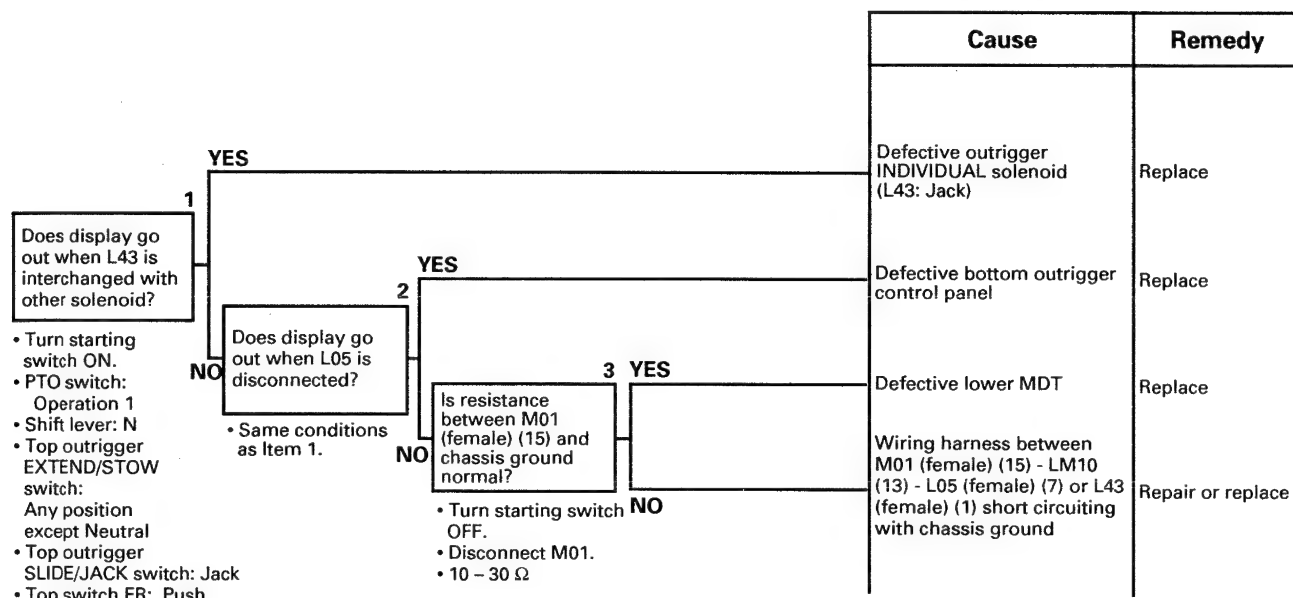
EL-24 Related electric circuit diagram (H-shaped outrigger)



EL-25 MDTL error E43 (Outtrigger jack FR short circuited with ground) is displayed

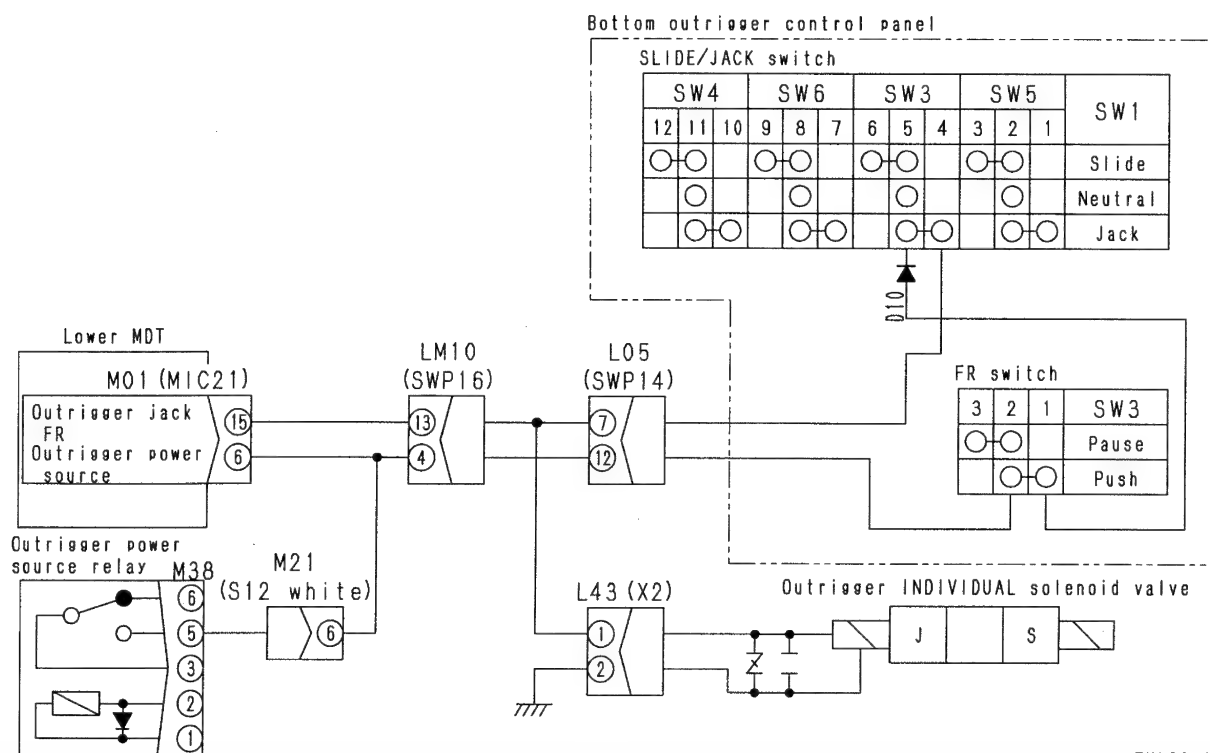
X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

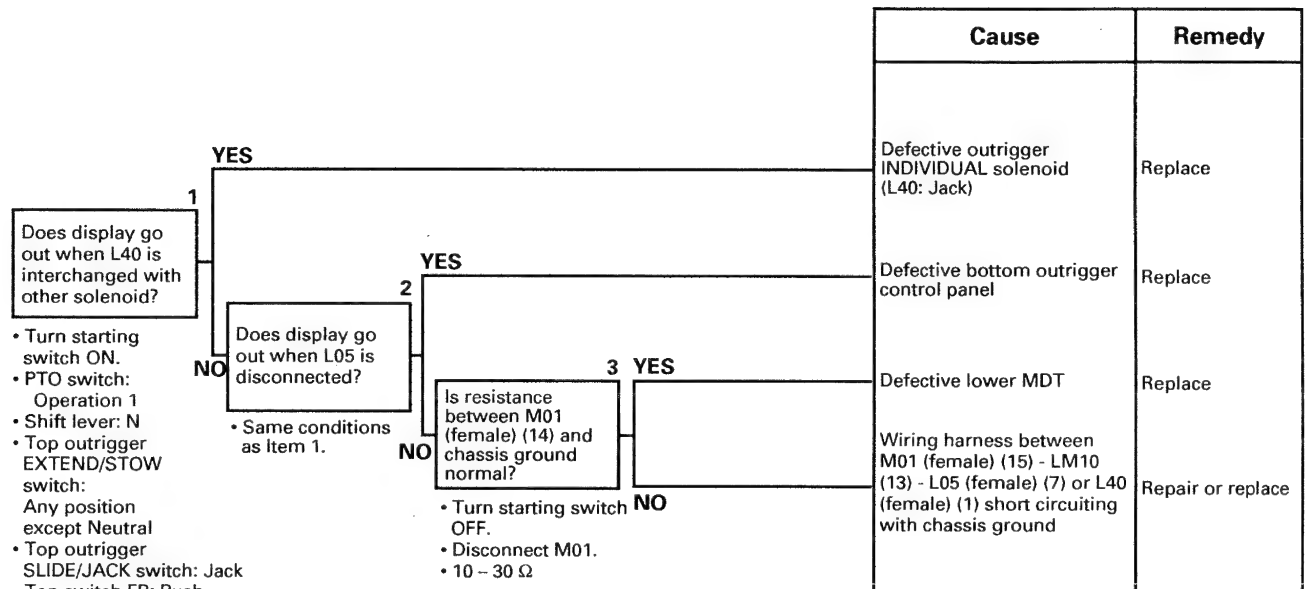
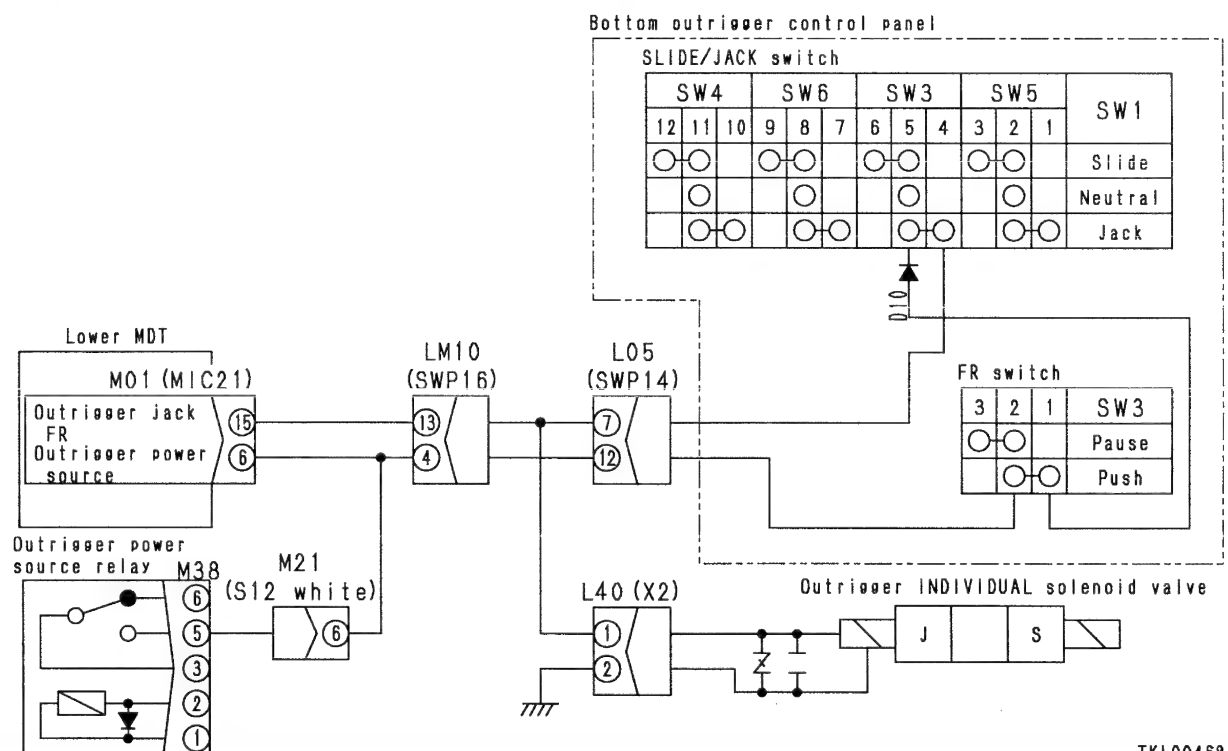
EL-25 Related electric circuit diagram (X-shaped outrigger)



TKL00467

H-shaped outrigger specification

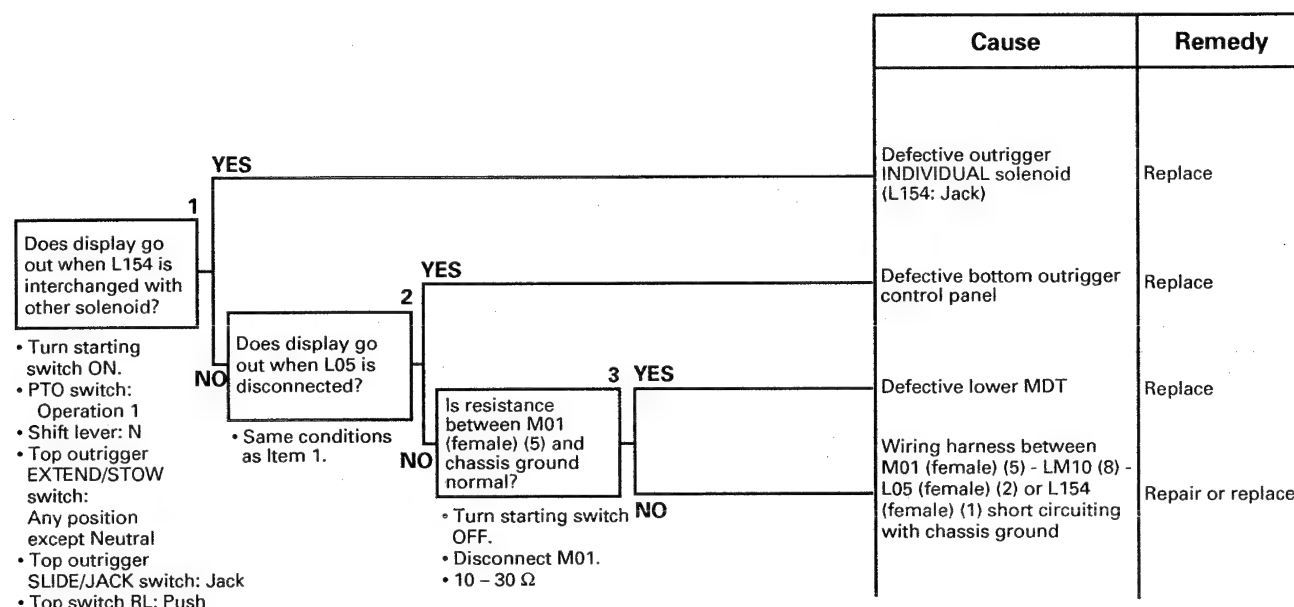
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

**EL-25 Related electric circuit diagram (H-shaped outrigger)**

TKL00468

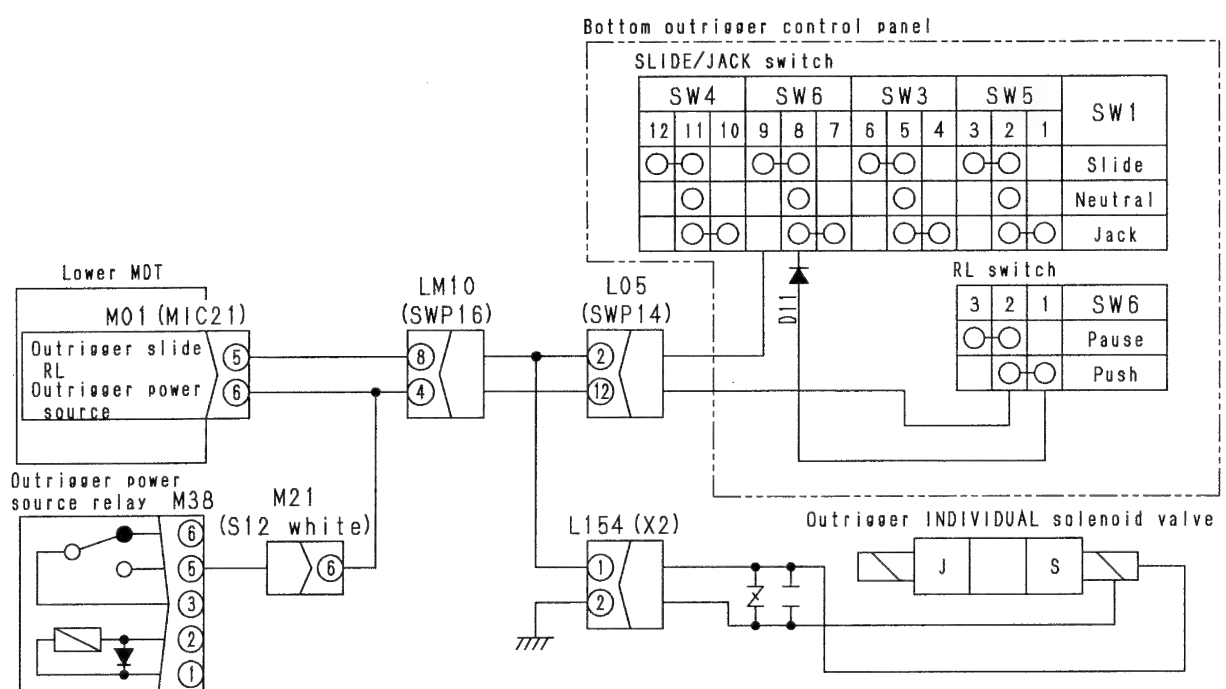
EL-26 MDTL error E44 (Outtrigger slide RL short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EL-26 Related electric circuit diagram



TKL00469

EL-27 MDTL error E45 (Outrigger slide FL short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Does display go out when L152 is interchanged with other solenoid?

YES

Defective outrigger INDIVIDUAL solenoid (L152: Slide)

Replace

NO

- Turn starting switch ON.
- PTO switch: Operation 1
- Shift lever: N
- Top outrigger EXTEND/STOW switch: Any position except Neutral
- Top outrigger SLIDE/JACK switch: Jack
- Top switch FL: Push

2

Does display go out when L05 is disconnected?

YES

Defective bottom outrigger control panel

Replace

NO

• Same conditions as Item 1.

3

Is resistance between M01 (female) (16) and chassis ground normal?

YES

Defective lower MDT

Replace

NO

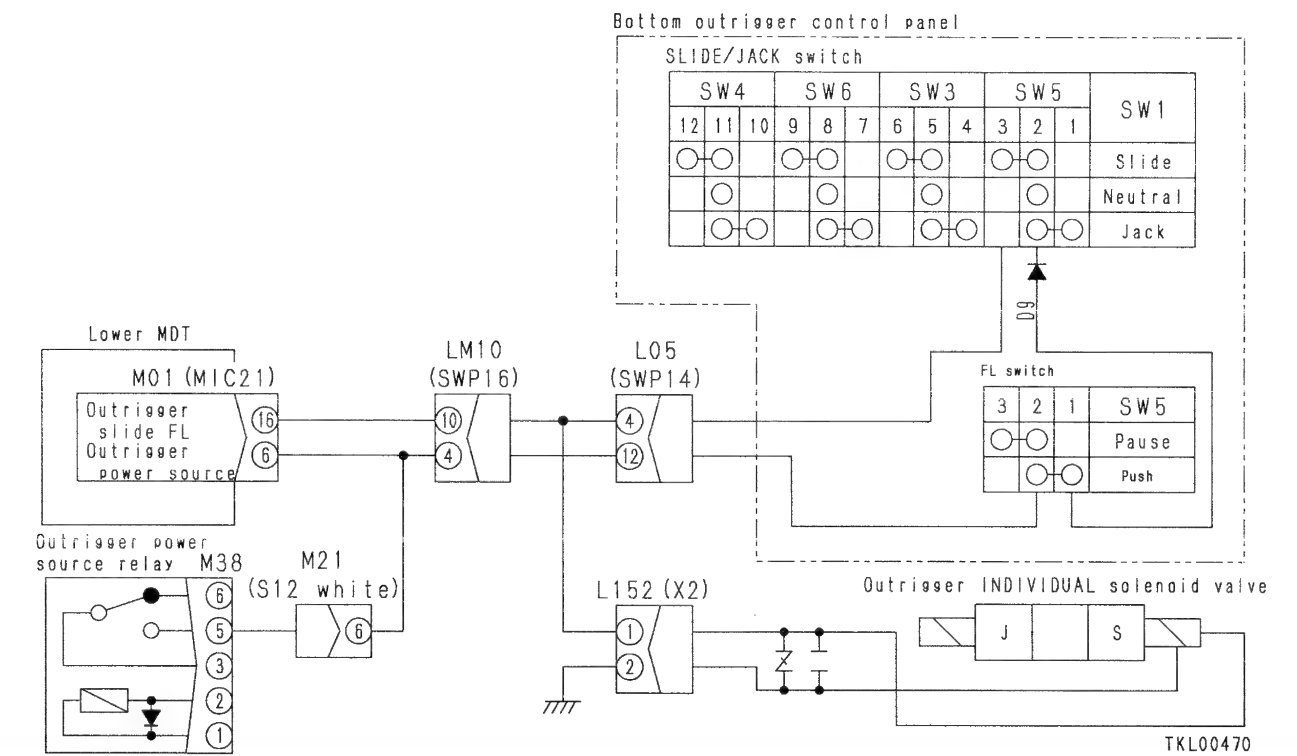
- Turn starting switch OFF.
- Disconnect M01.
- 10 – 30 Ω

Wiring harness between M01 (female) (16) - LM10 (10) - L05 (female) (4) or L152 (female) (1) short circuiting with chassis ground

Repair or replace

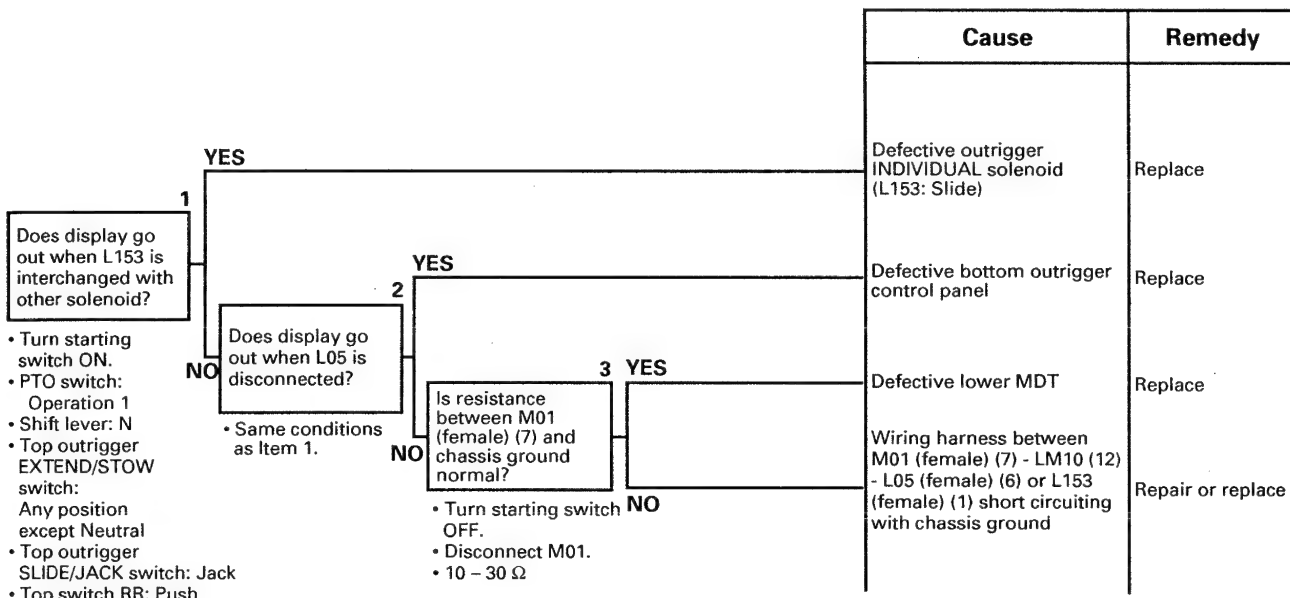
Cause		Remedy
Defective outrigger INDIVIDUAL solenoid (L152: Slide)		Replace
Defective bottom outrigger control panel		Replace
Defective lower MDT		Replace
Wiring harness between M01 (female) (16) - LM10 (10) - L05 (female) (4) or L152 (female) (1) short circuiting with chassis ground		Repair or replace

EL-27 Related electric circuit diagram



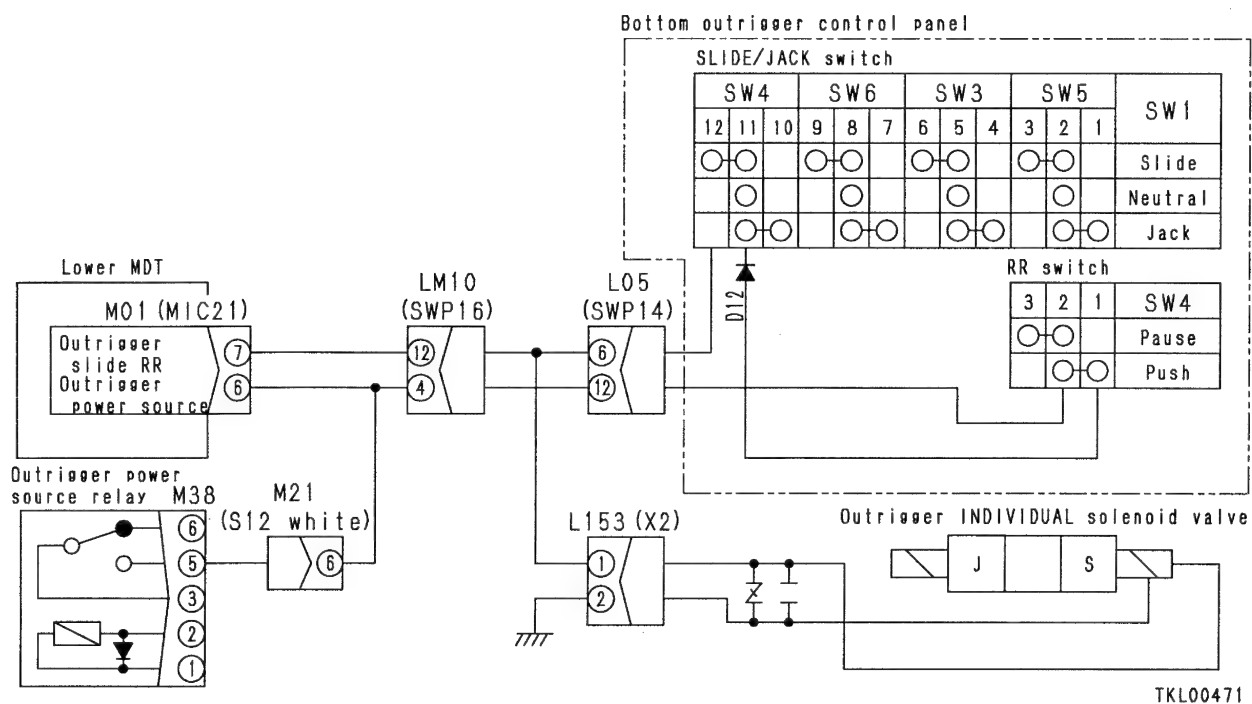
EL-28 MDTL error E46 (Outtrigger slide RR short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



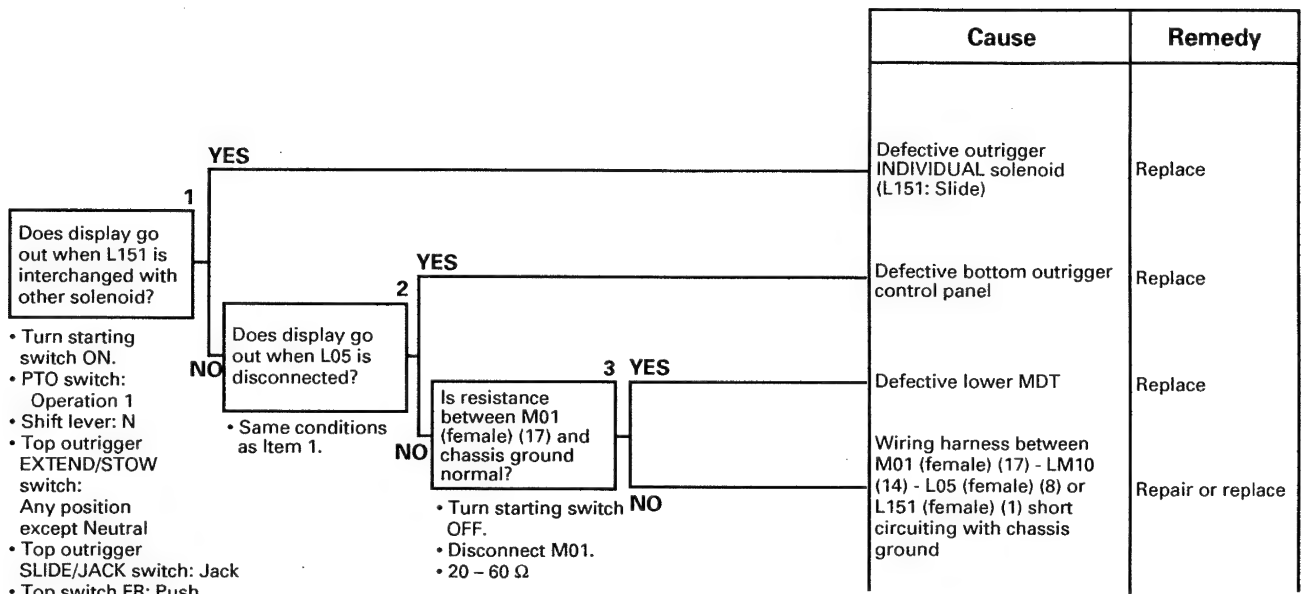
023S02

EL-28 Related electric circuit diagram

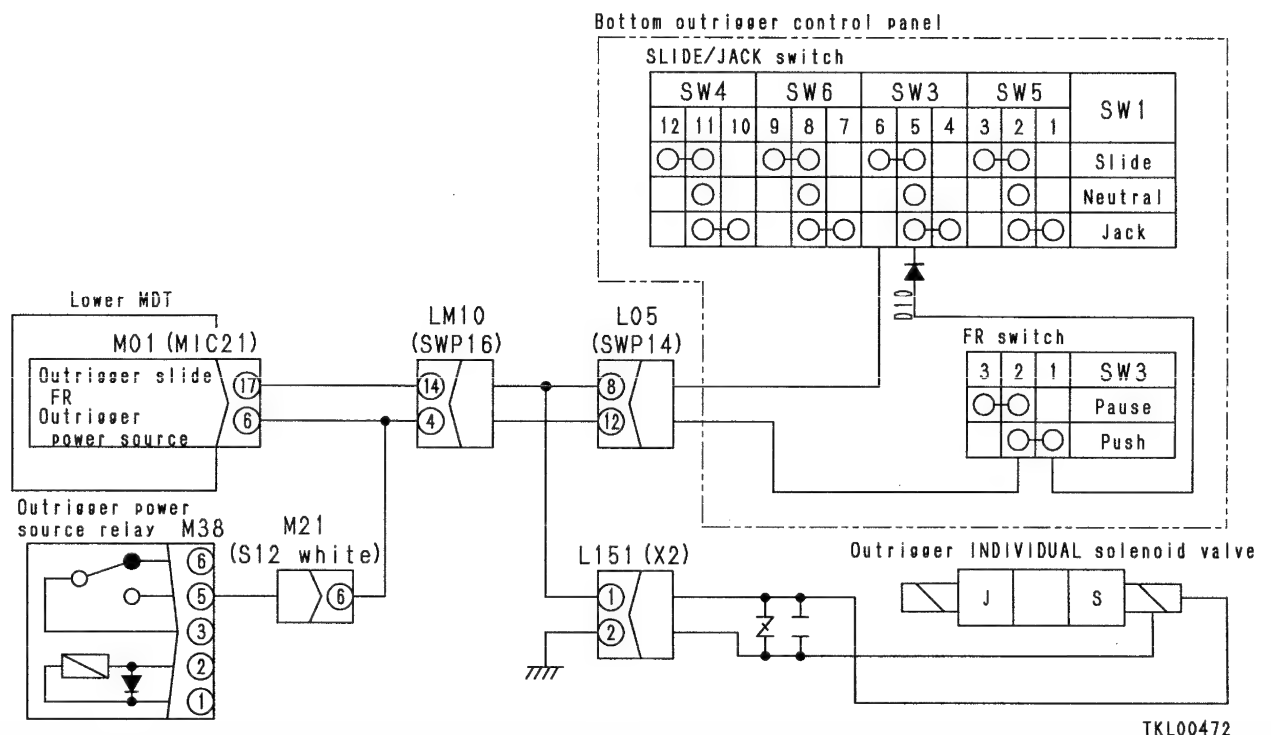


EL-29 MDTL error E47 (Outrigger slide FR short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-29 Related electric circuit diagram



EL-30 MDTL error E48 (Outrigger selector EXTEND short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Does display go out when L16 is interchanged with L140?

• Turn starting switch ON.

• PTO switch: Operation 1

• Top outrigger EXTEND/STOW switch: STOW

• Top INDIVIDUAL switch: Push

YES

NO

2

Does display go out when relay M37 is interchanged with other relay?

• Same conditions as Item 1.

YES

NO

3

Does display go out when L05 is disconnected?

• Same conditions as Item 1.

YES

NO

4

Is resistance between M01 (female) (8) and chassis ground normal when M37 is disconnected?

• Turn starting switch OFF.

• Disconnect M01.

• Min. 1 MΩ

YES

NO

5

Is resistance between M37 (female) (2) and chassis ground normal when M02 is disconnected?

• Turn starting switch OFF.

• Disconnect M37.

• 30 – 80 Ω

YES

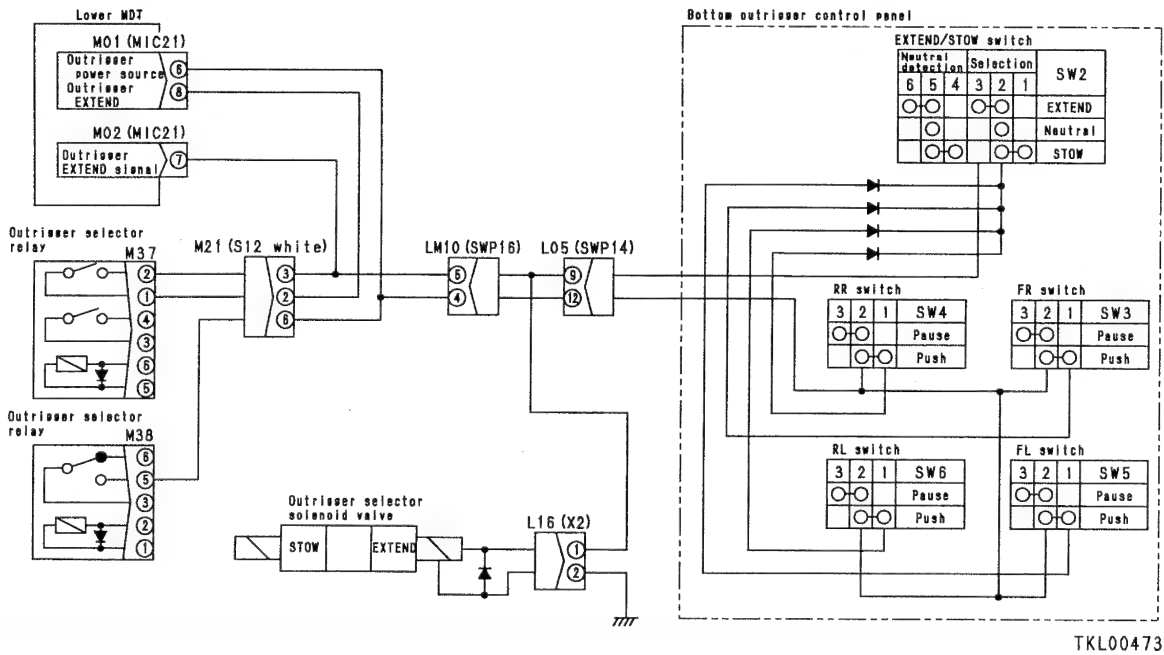
NO

A

Cause	Remedy
Defective outrigger selector solenoid (L16: EXTEND)	Replace
Defective outrigger selector relay	Replace
Defective bottom outrigger control panel	Replace
Go to A	
Wiring harness between M01 (female) (8) - M21 (2) - M37 (female) (1) short circuiting with chassis ground	Repair or replace
Defective lower MDT	Replace
Wiring harness between M37 (female) (2) - M21 (3) - M02 (female) (7) or LM10 (5) - L05 (female) (9) or L16 (female) (1) short circuiting with chassis ground	Repair or replace

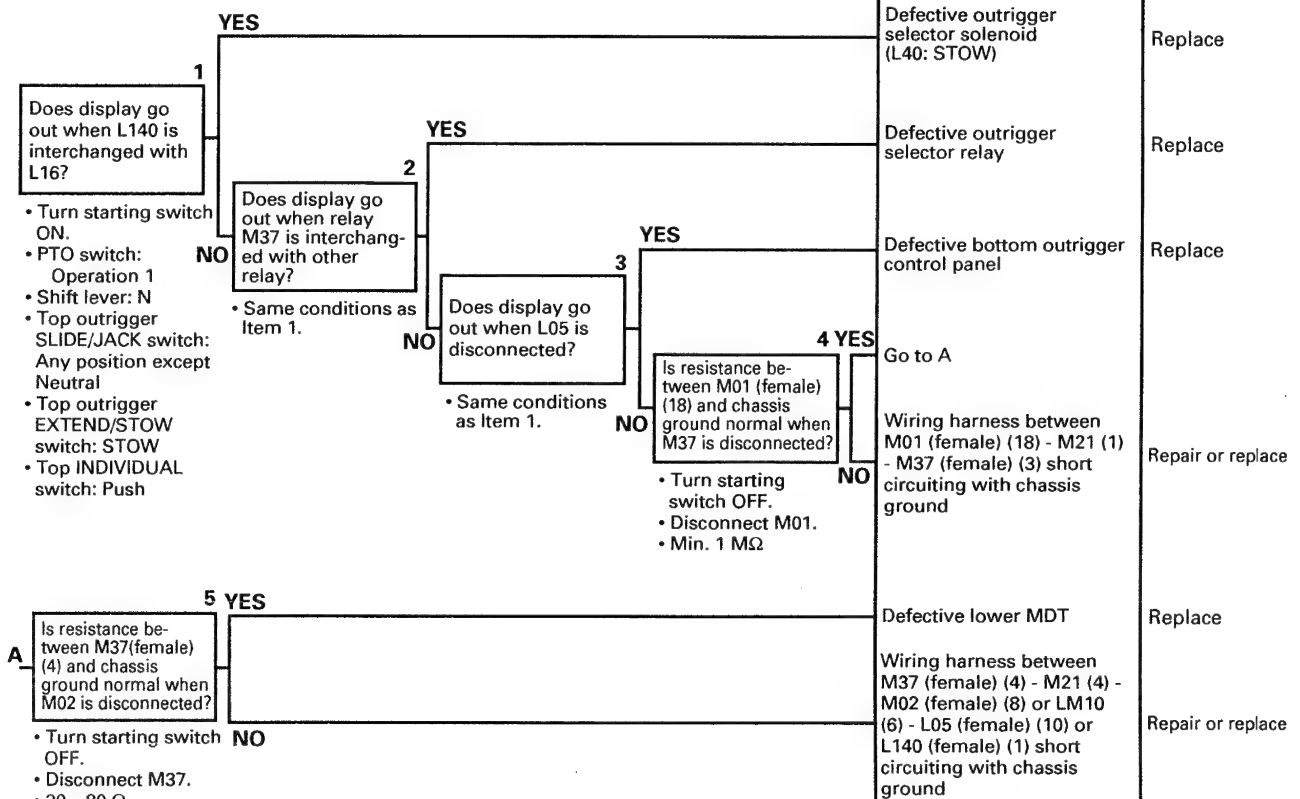
023S02

EL-30 Related electric circuit diagram

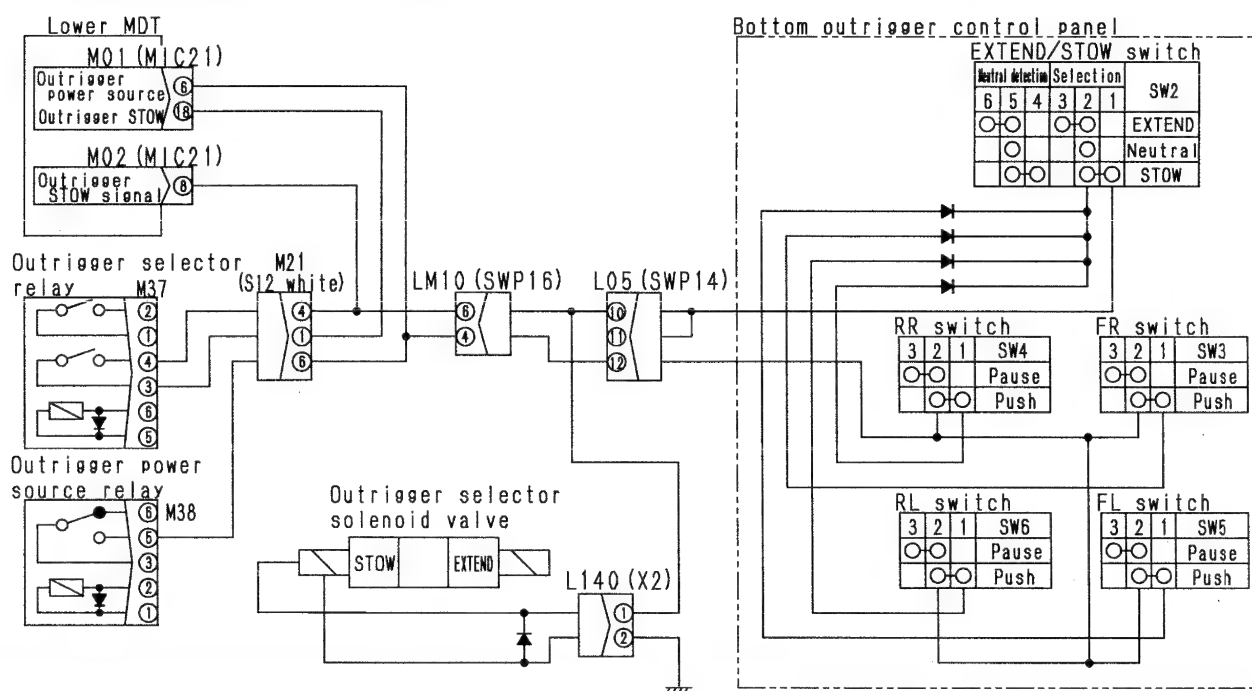


EL-31 MDTL error E49 (Outrigger selector STOW short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



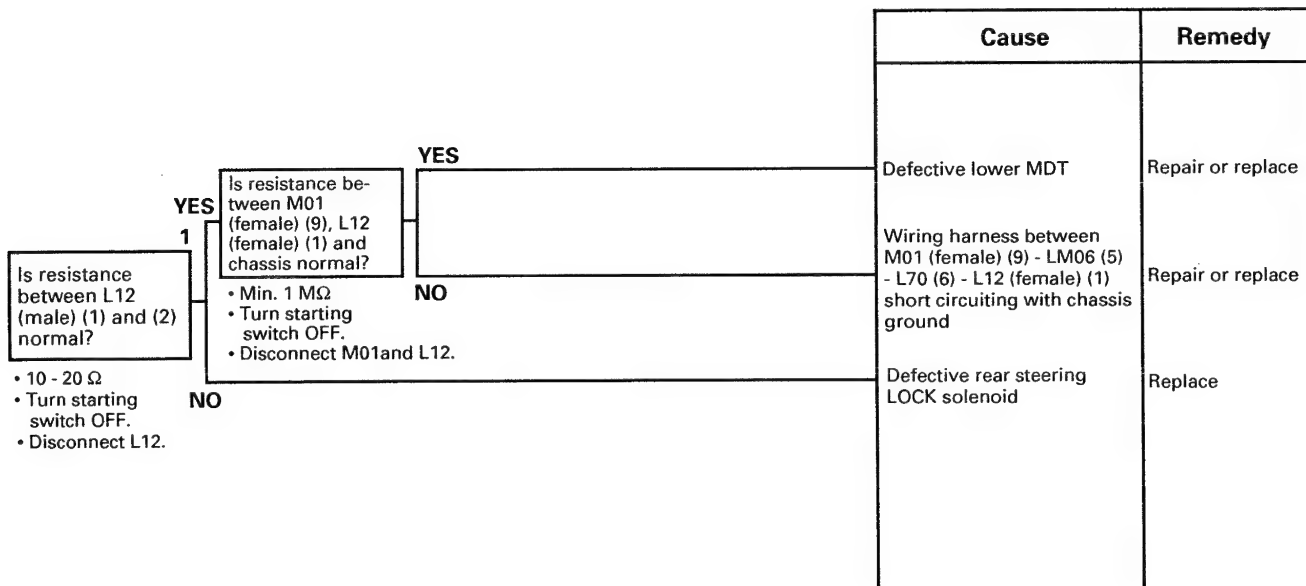
EL-31 Related electric circuit diagram



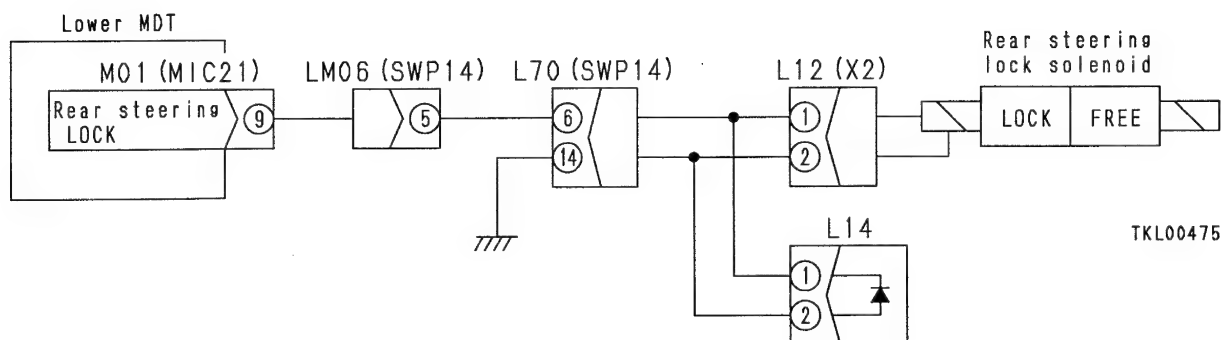
TKL00691

EL-32 MDTL error E4A (Rear steering LOCK solenoid short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-32 Related electric circuit diagram

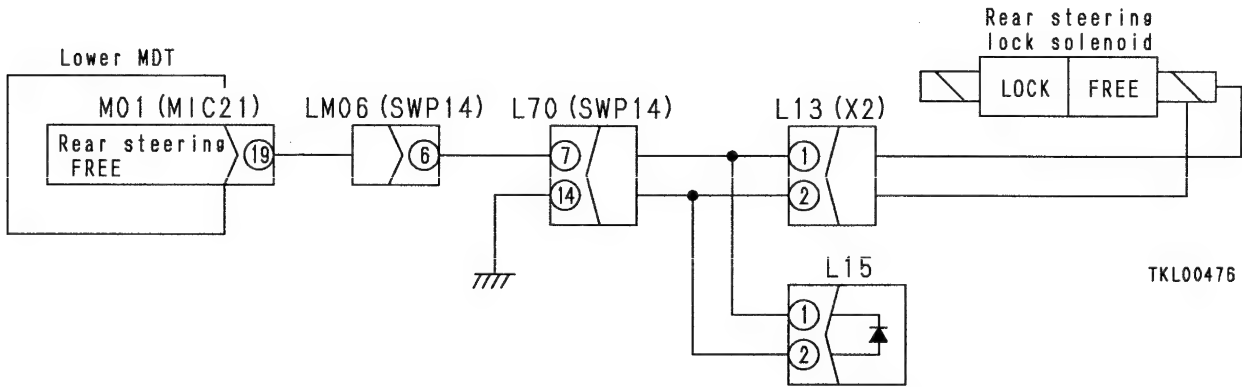


EL-33 MDTL error E4B (Rear steering FREE solenoid short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

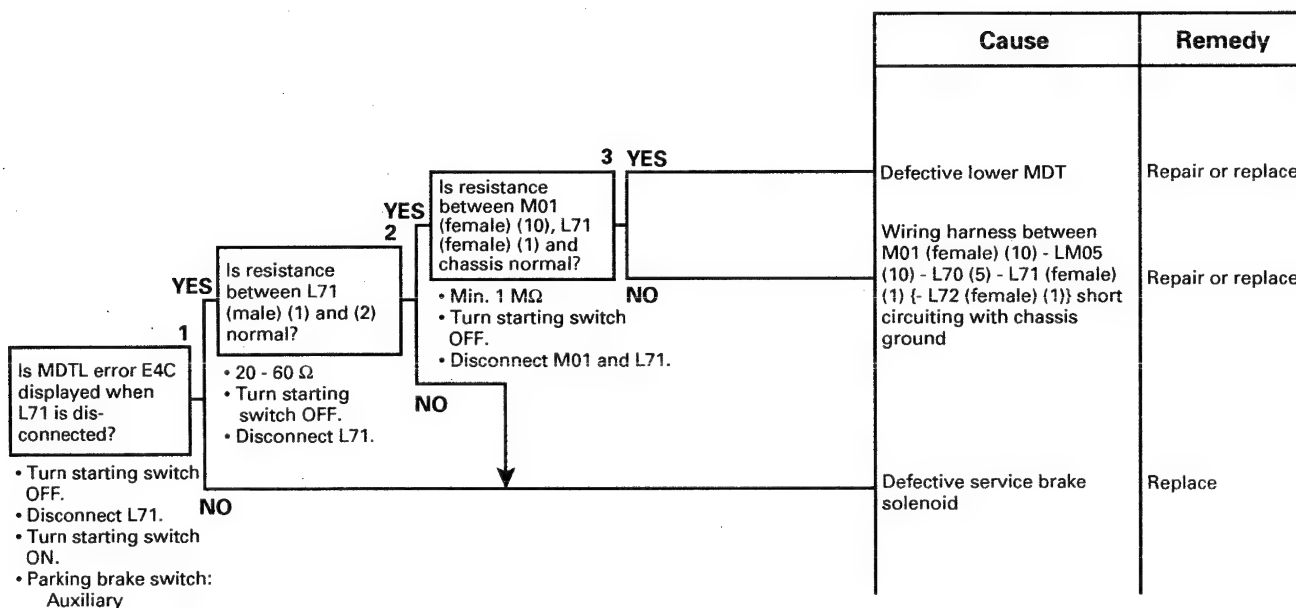
		Cause	Remedy
<div><div>Is resistance between L13 (male) (1) and (2) normal?</div><div>YES</div><div>1</div><div><div>Is resistance between M01 (female) (19), L13 (female) (1) and chassis normal?</div><div>YES</div><div>NO</div><div><div>• Min. 1 MΩ</div><div>• Turn starting switch OFF</div><div>• Disconnect M01 and L13</div></div></div><div><div>• 10 - 20 Ω</div><div>• Turn starting switch OFF.</div><div>• Disconnect L13.</div></div></div>	Defective lower MDT	Repair or replace	
	Wiring harness between M01 (female) (19) - LM06 (6) - L70 (7) - L13 (female) (1) short circuiting with chassis ground	Repair or replace	
	Defective rear steering FREE solenoid	Replace	

EL-33 Related electric circuit diagram



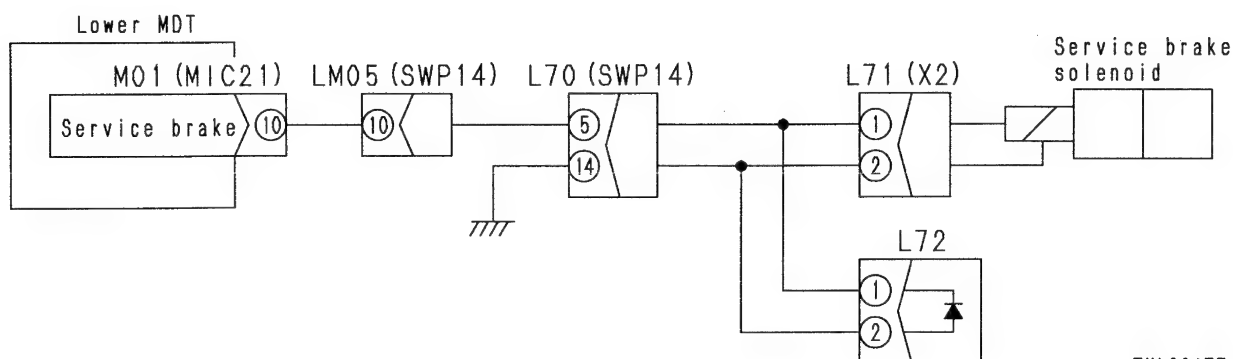
EL-34 MDTL error E4C (Service brake solenoid short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

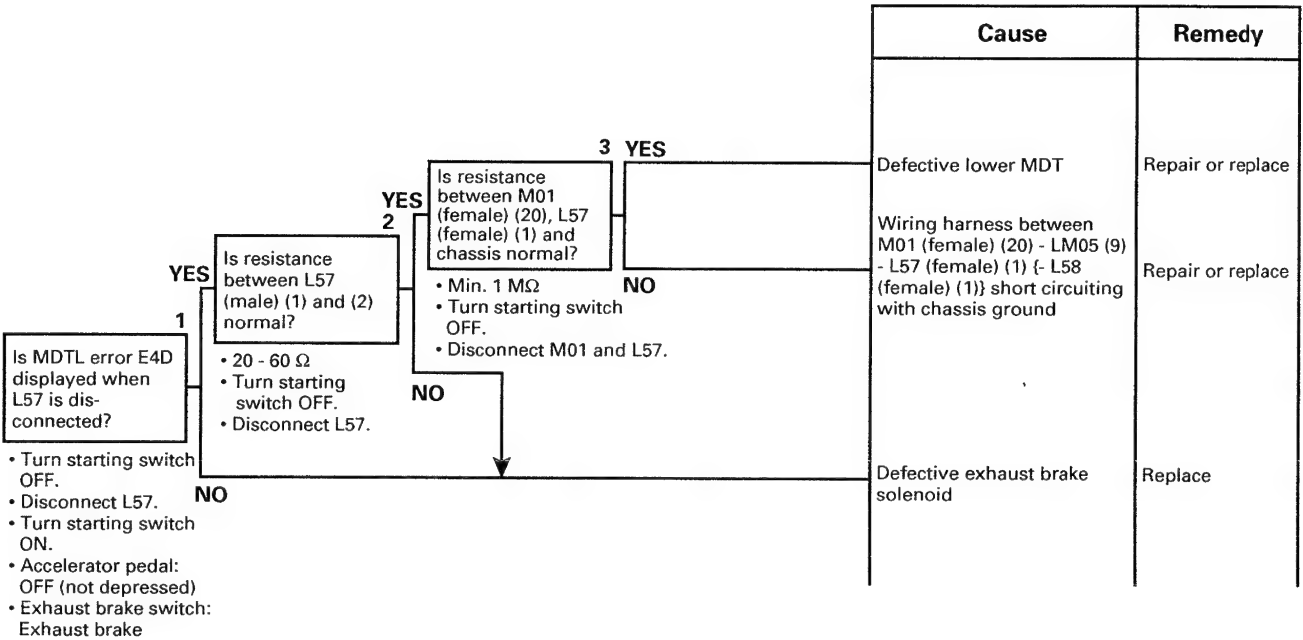
EL-34 Related electric circuit diagram



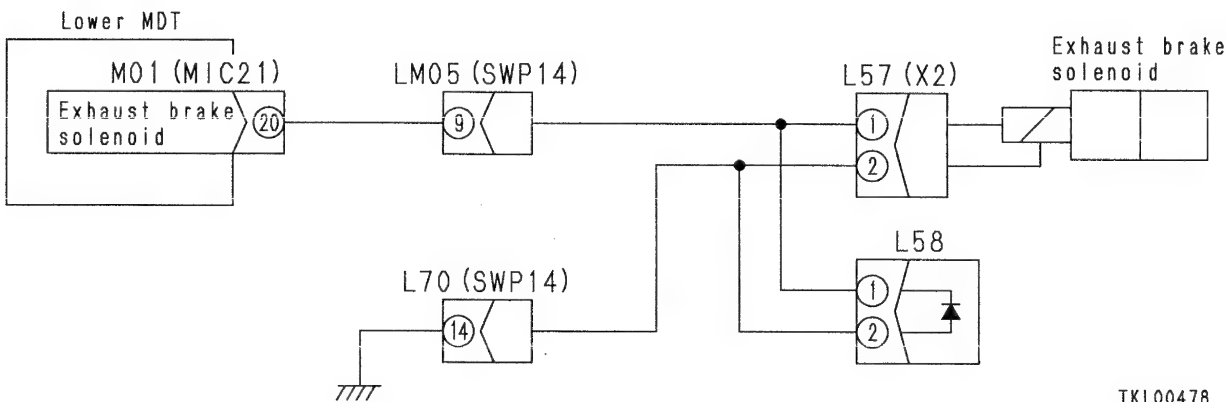
TKL00477

EL-35 MDTL error E4D (Exhaust brake solenoid short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-35 Related electric circuit diagram



TKL00478

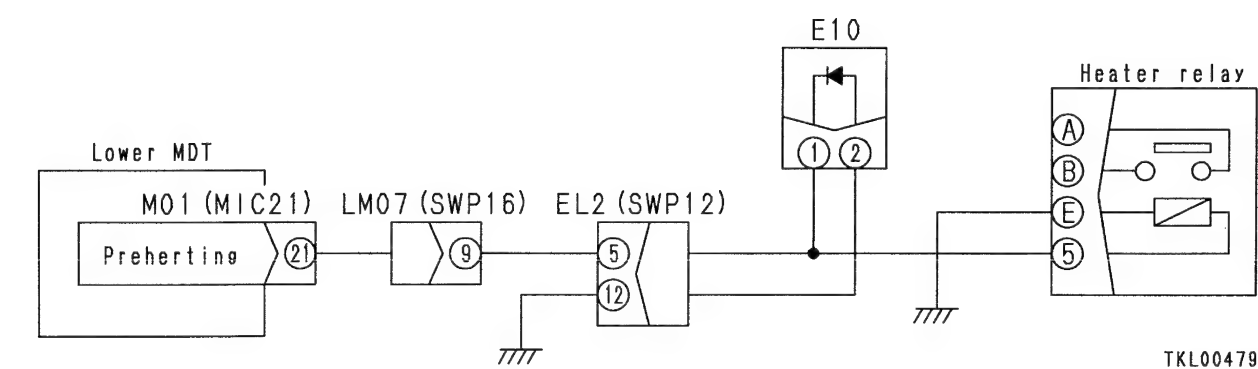
EL-37 MDTL error E4F (Preheating [heater relay circuit] short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div> <div>1</div> <div>Is MDTL error E4F displayed when heater relay terminal is disconnected?</div> </div> <div> <div>YES</div> <div> <div>2</div> <div>Is resistance between M01(female) (21) - heater relay terminal (5) and chassis normal?</div> </div> </div> <div> <div>NO</div> <div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect M01 and heater relay terminal.</div> </div> </div> </div> <div> <div>• Turn starting switch OFF.</div> <div>• Disconnect heater relay terminal.</div> <div>• Turn starting switch to HEAT.</div> </div>	YES	Defective lower MDT	Repair or replace
	2 YES	Wiring harness between M01 (female) (21) - LM07 (9) - EL2 (5) - heater relay terminal (5) short circuiting with chassis ground	Repair or replace
	NO	Defective heater relay	Replace

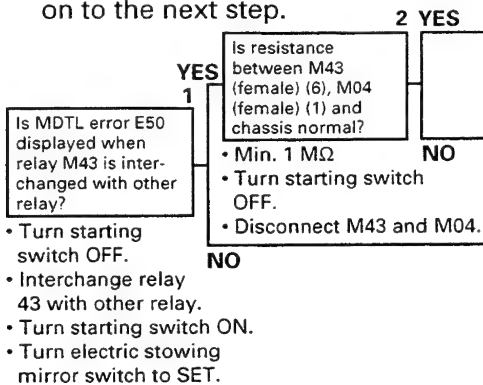
023S02

EL-37 Related electric circuit diagram



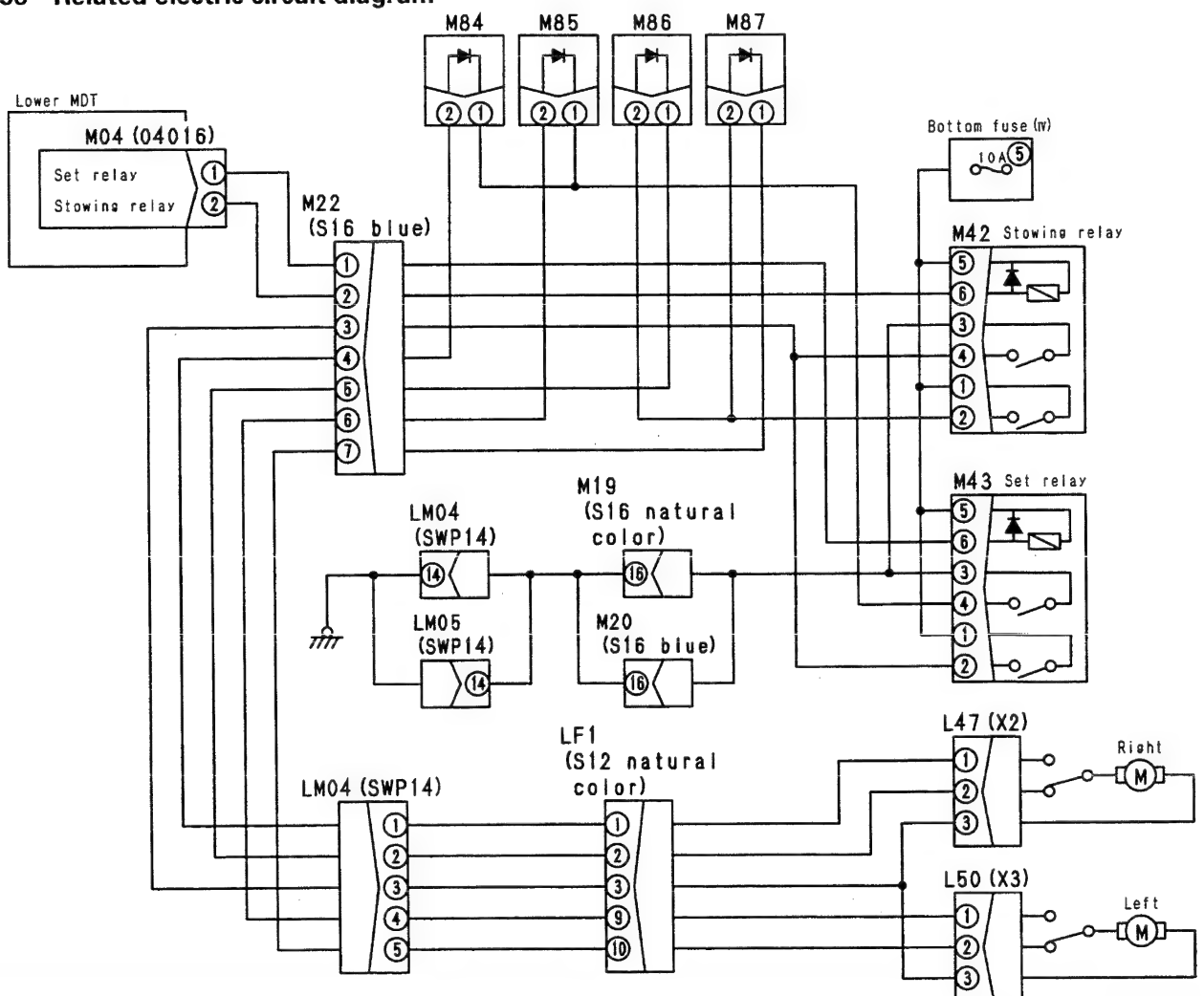
ET-38 MDTL error E50 (Electric stowing mirror set relay short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Cause	Remedy
Defective lower MDT	Replace
Wiring harness between M43 (female) (6) and M04 (female) (1) short circuiting with chassis ground	Repair or replace
Defective electric stowing mirror set relay	Replace

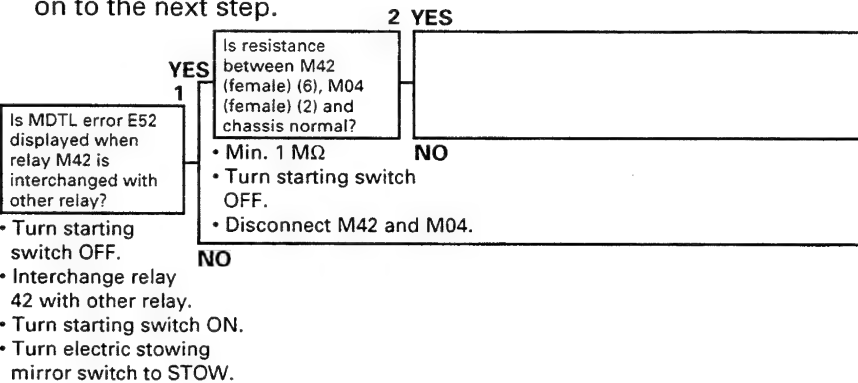
ET-38 Related electric circuit diagram



TWL00945

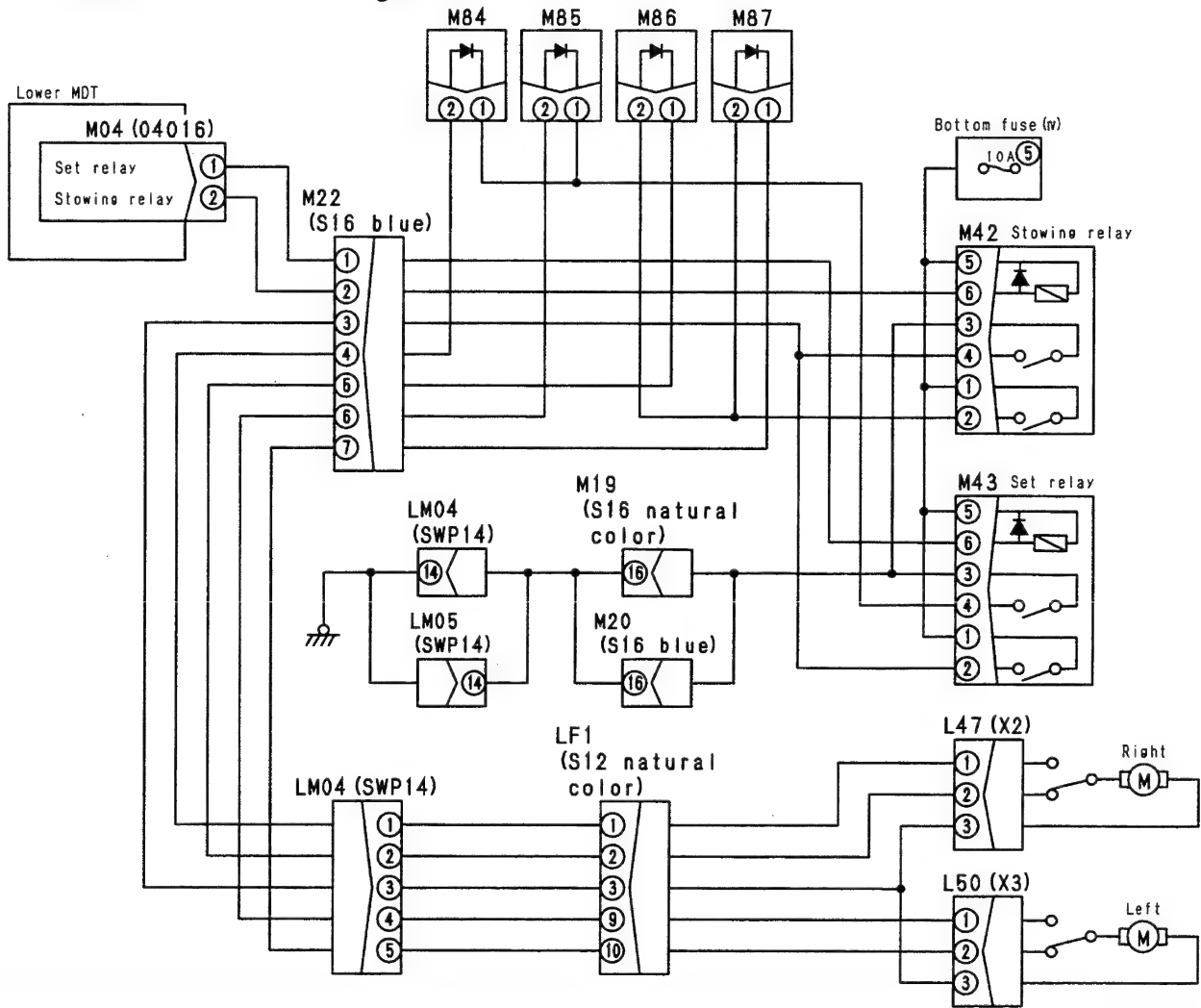
ET-40 MDTL error E52 (Electric stowing mirror stowing relay short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Cause	Remedy
Defective lower MDT	Replace
Wiring harness between M42 (female) (6) and M04 (female) (2) short circuiting with chassis ground	Repair or replace
Defective electric stowing mirror stowing relay	Replace

ET-40 Related electric circuit diagram



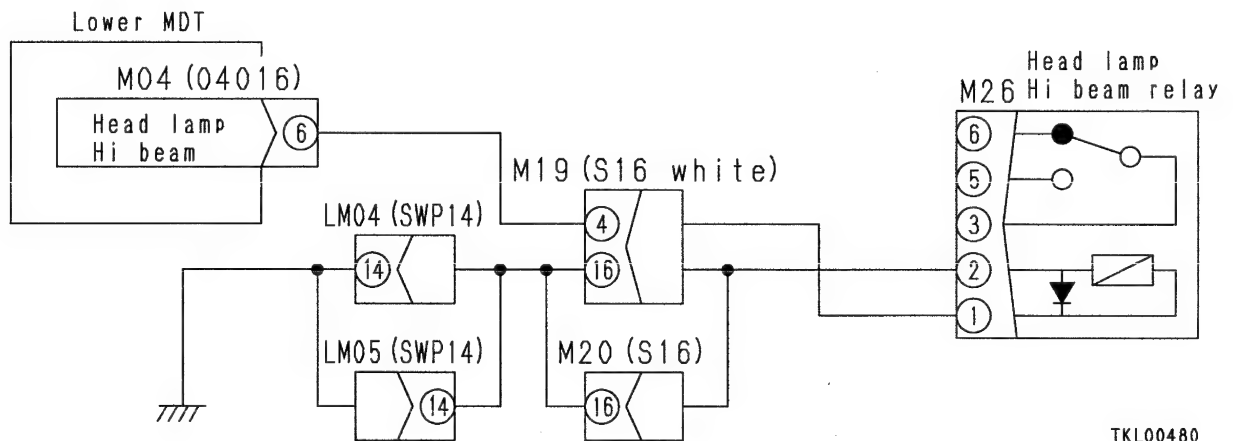
TWL00945

EL-43 MDTL error E5A (Head lamp Hi relay short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>Is MDTL error E5A displayed when relay M26 is interchanged with other relay of same type?</p> <p>1</p> <p>YES</p> <p>2 YES</p> <p>NO</p> <p>NO</p> <p>• Turn starting switch OFF.</p> <p>• Interchange M26 with other relay.</p> <p>• Turn starting switch ON.</p> <p>• Lamp switch stage 2: ON</p> <p>• Dimmer switch pressed odd number of times</p>	<p>Is resistance between M04(female) (6), M26 (female) (1) and chassis normal?</p> <p>• Min. 1 MΩ</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M04 and M26.</p>	Defective lower MDT	Replace
		Wiring harness between M04 (female) (6) - M19 (4) - M26 (female) (1) short circuiting with chassis ground	Repair or replace
		Defective head lamp Hi relay	Replace

EL-43 Related electric circuit diagram



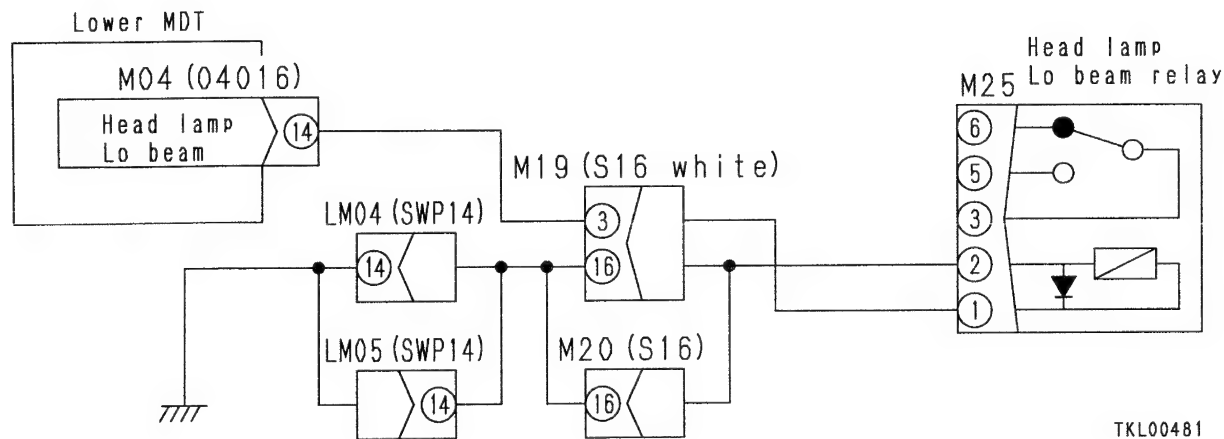
EL-44 MDTL error E5B (Head lamp Lo relay short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div> <div>1</div> <div>Is MDTL error E5B displayed when relay M25 is interchanged with other relay of same type?</div> </div> <div> <div>YES</div> <div> <div>Is resistance between M04 (female) (14), M25 (female) (1) and chassis normal?</div> <div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect M04 and M25.</div> </div> </div> </div> <div> <div>2 YES</div> <div></div> </div> <div> <div>NO</div> <div></div> </div> </div> <div> <div>NO</div> <div> <div>• Turn starting switch OFF.</div> <div>• Interchange M25 with other relay.</div> <div>• Turn starting switch ON.</div> <div>• Lamp switch stage 2: ON</div> <div>Dimmer switch pressed even number of times</div> </div> </div>		Defective lower MDT	Replace
		Wiring harness between M04 (female) (14) - M19 (3) - M25 (female) (1) short circuiting with chassis ground	Repair or replace
		Defective head lamp Lo relay	Replace

023S02

EL-44 Related electric circuit diagram

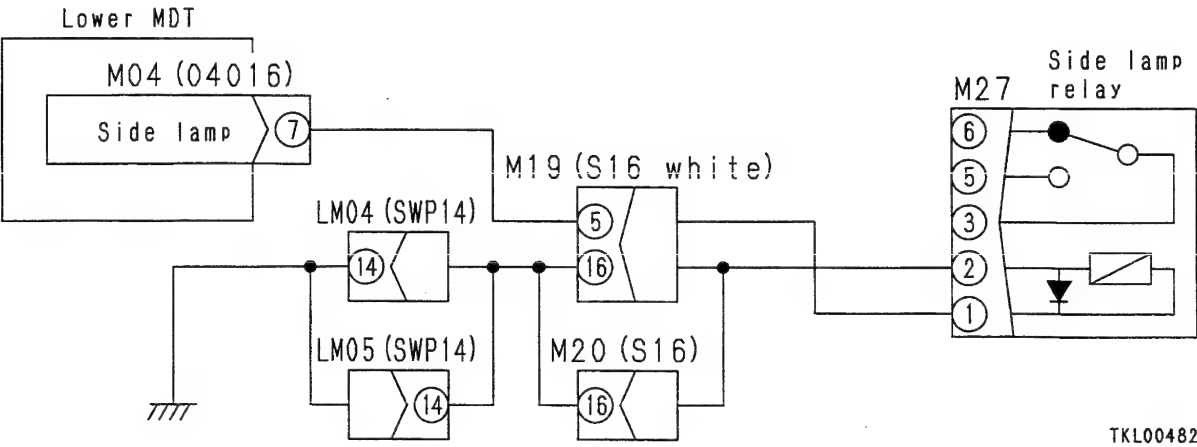


EL-45 MDTL error E5C (Side lamp relay short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

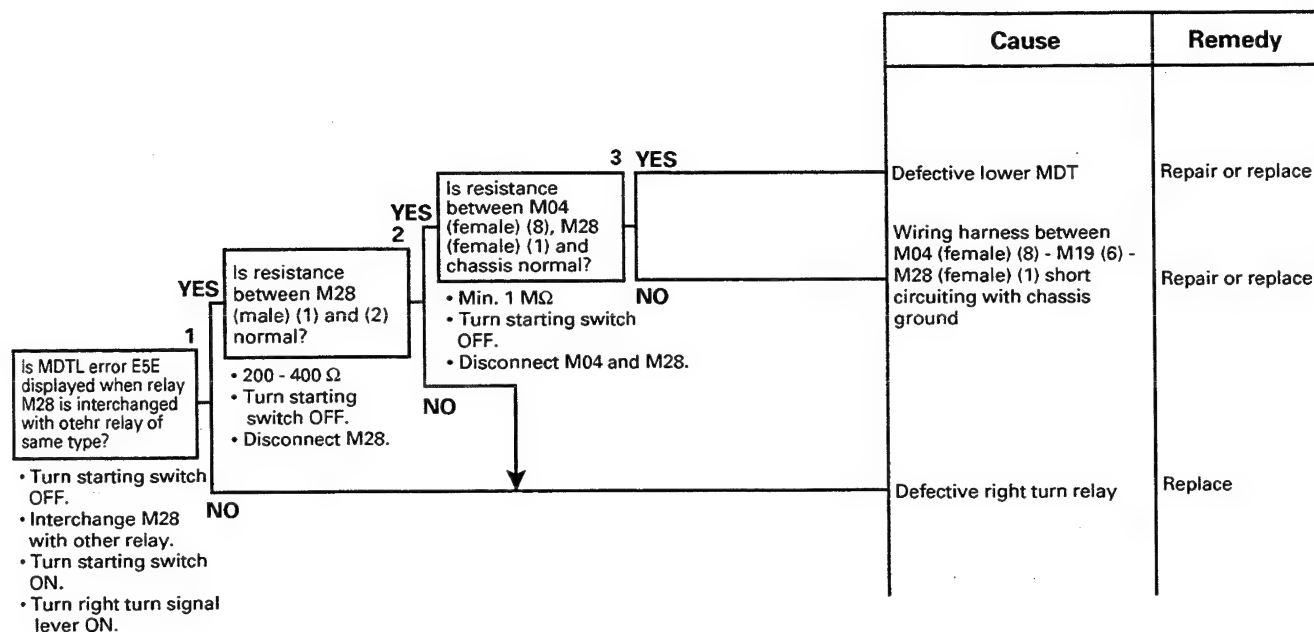
		Cause	Remedy
<div> <div> <div>1</div> <div>Is MDTL error E5C displayed when relay M27 is interchanged with other relay of same type?</div> </div> <div> <div>YES</div> <div>Is resistance between M04 (female) (7), M27 (female) (1) and chassis normal?</div> <div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect M04 and M27.</div> </div> </div> <div> <div>NO</div> <div> <div>• Turn starting switch OFF.</div> <div>• Interchange M27 with other relay.</div> <div>• Turn starting switch ON.</div> <div>• Lamp switch stage 1: ON</div> </div> </div> </div>	2 YES	Defective lower MDT	Replace
	NO	Wiring harness between M04 (female) (7) - M19 (5) - M27 (female) (1) short circuiting with chassis ground	Repair or replace
		Defective side lamp relay	Replace

EL-45 Related electric circuit diagram



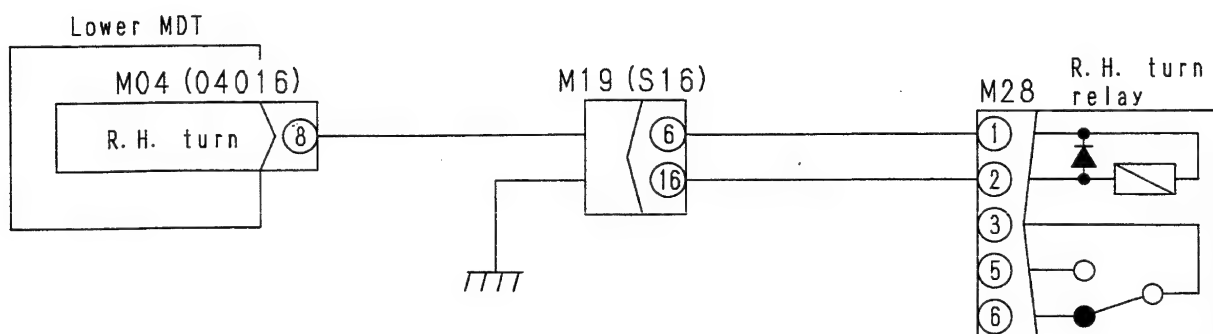
EL-47 MDTL error E5E (Right turn relay short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

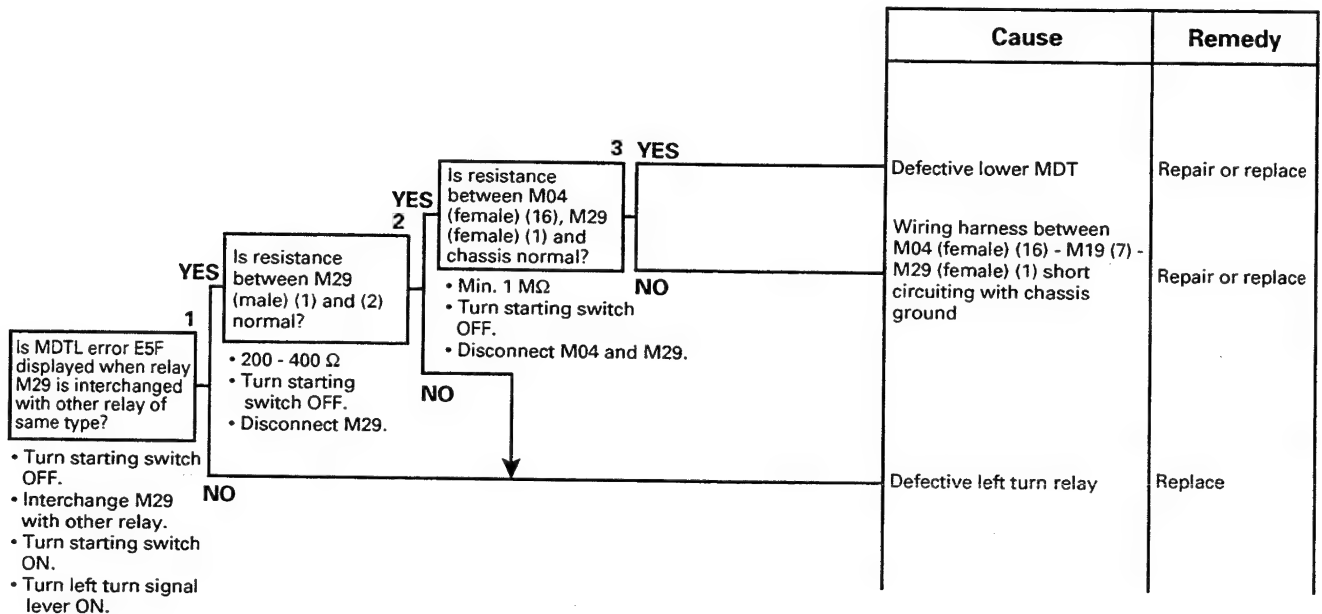
EL-47 Related electric circuit diagram



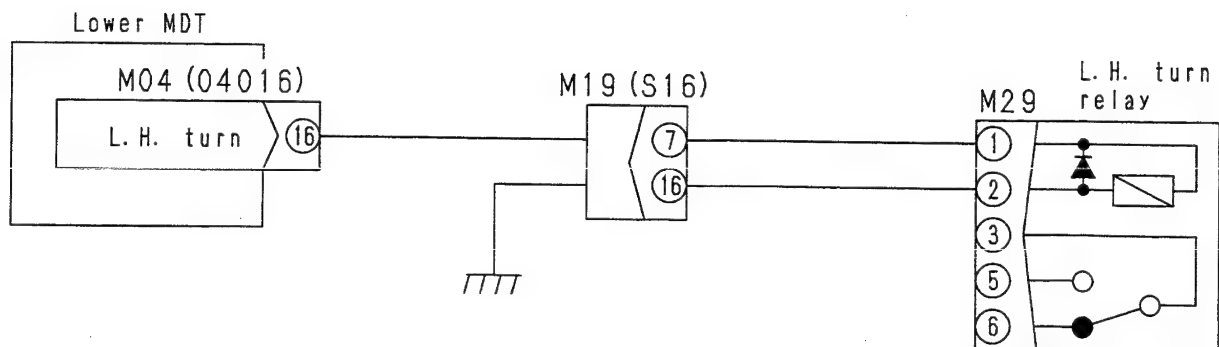
TKL00483

EL-48 MDTL error E5F (Left turn relay short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-48 Related electric circuit diagram



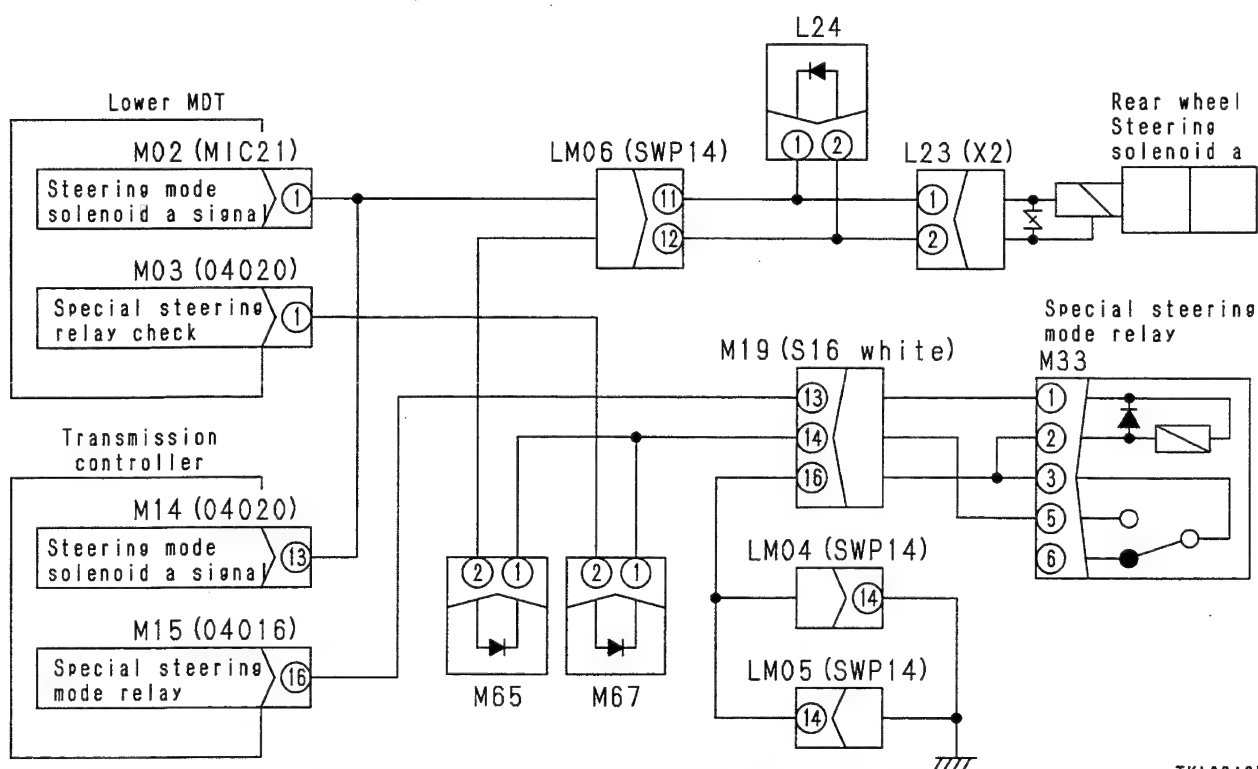
TKL00484

EL-49 MDTL error E60 (Steering mode solenoid a short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1</p> <p>Is resistance between L23 (male) (1) and (2) normal?</p> <p>• 10 – 20Ω • Turn starting switch OFF. • Disconnect L23.</p> <p>YES</p> <p>2 YES</p> <p>Is resistance between M02 (female) (1), L23 (female) (1) and chassis normal?</p> <p>• Min. 1 MΩ • Turn starting switch OFF. • Disconnect M02, M14, and L23.</p> <p>NO</p> <p>NO</p>		Defective lower MDT	Repair or replace
		Wiring harness between M02 (female) (1) - LM06 (11) - L23 (female) (1), or between M14 (female) (13) - intermediate connecting point of M02 (female) (1) and LM06 (male) (11) short circuiting with chassis ground	Repair or replace
		Defective steering mode solenoid a	Replace

EL-49 Related electric circuit diagram



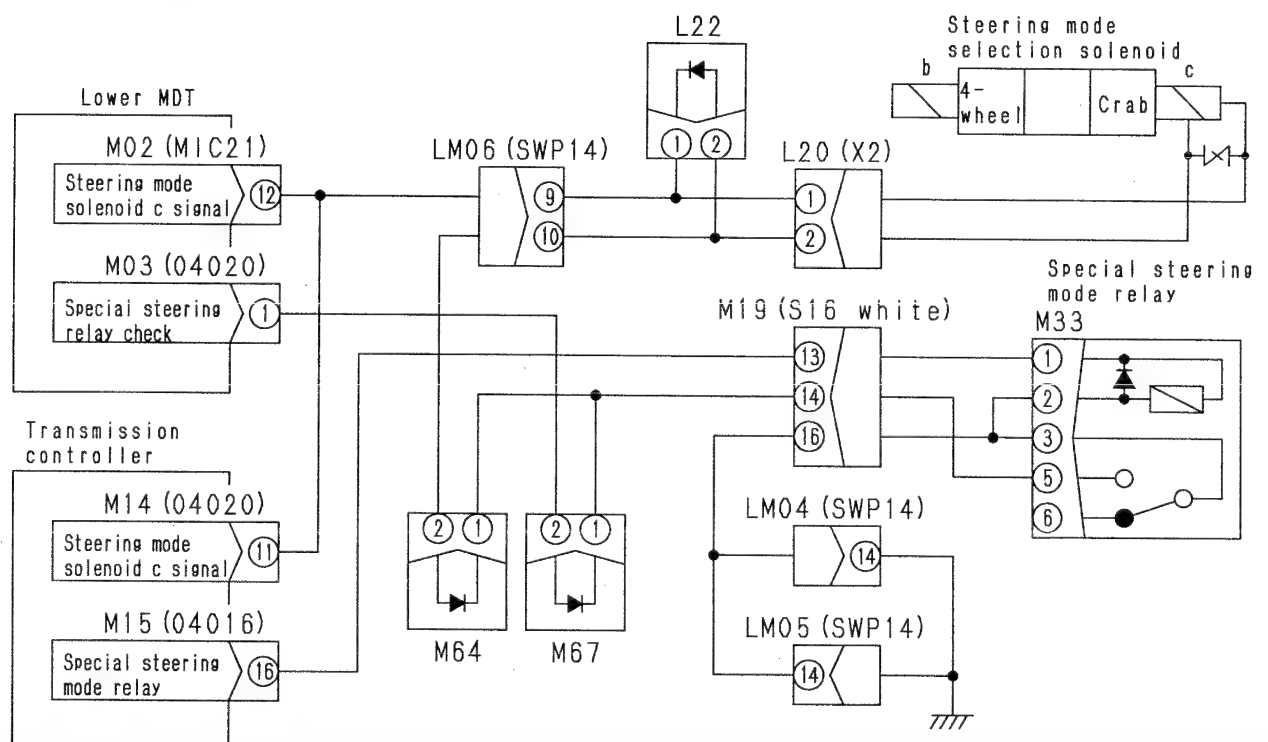
TKL00485

EL-50 MDTL error E61 (Steering mode solenoid c short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1</p> <p>Is resistance between L20 (male) (1) and (2) normal?</p> <p>• 10 - 20 Ω • Turn starting switch NO OFF. • Disconnect L20.</p>	YES	Defective lower MDT	Repair or replace
	2 YES	Wiring harness between M02 (female) (12) - LM06 (9) - L20 (female) (1), or between M14 (female) (11) - intermediate connecting point of M02 (female) (12) and LM06 (male) (9) short circuiting with chassis ground	Repair or replace
	NO	Defective steering mode solenoid c	Replace

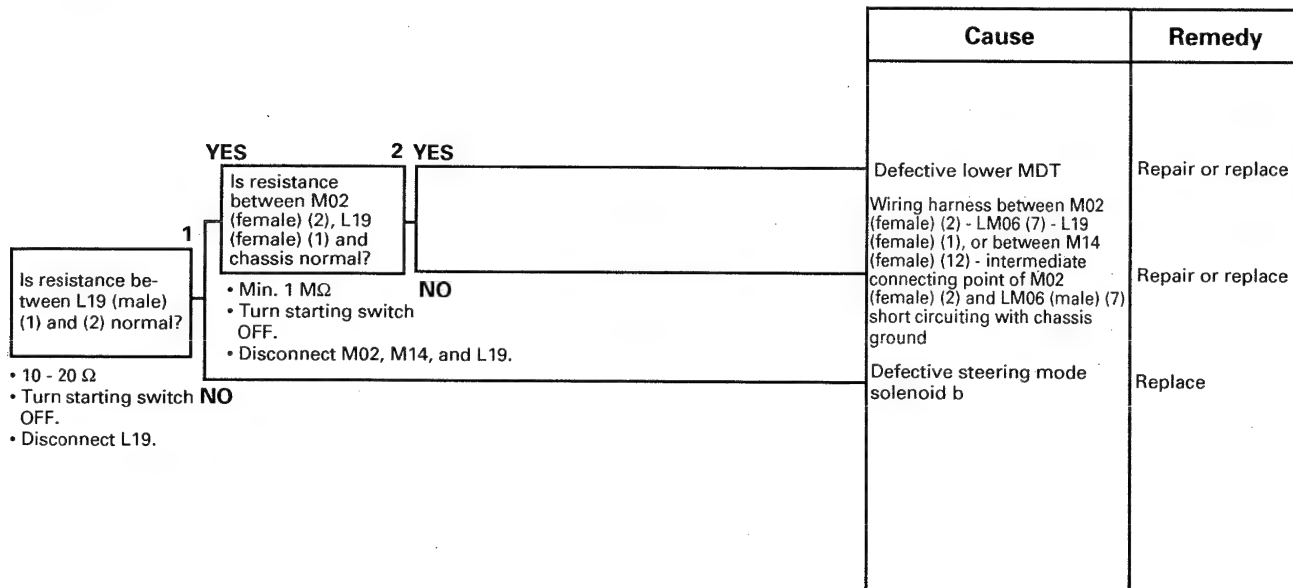
EL-50 Related electric circuit diagram



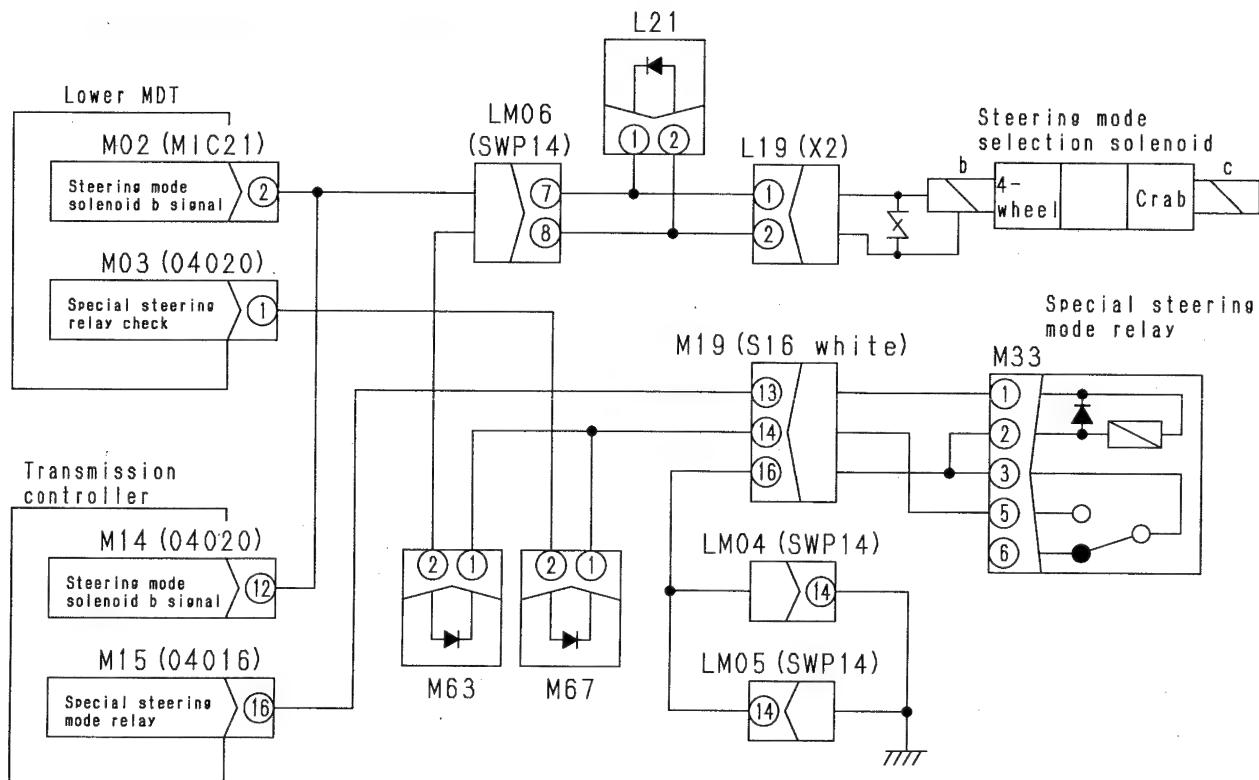
TKL00486

EL-51 MDTL error E62 (Steering mode solenoid b short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-51 Related electric circuit diagram



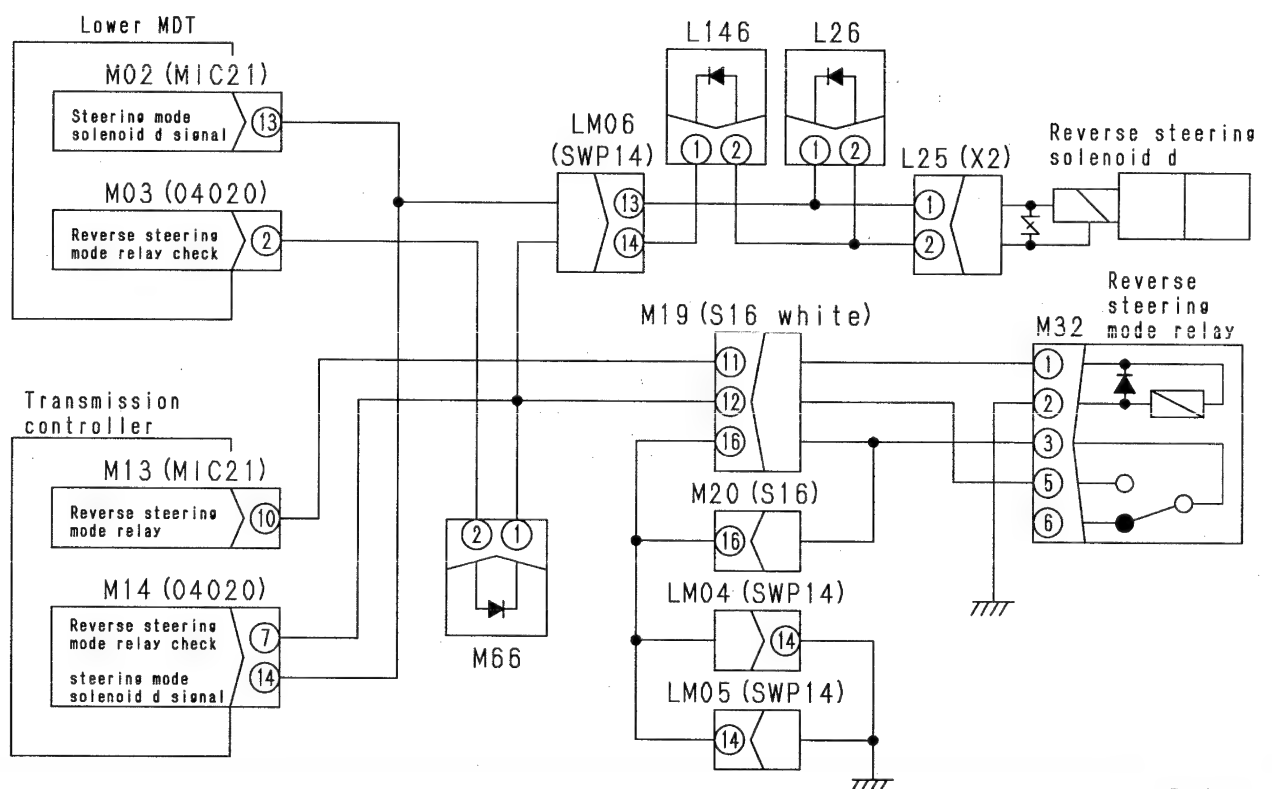
TKL00487

EL-52 MDTL error E63 (Steering mode solenoid d short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<p>YES</p> <p>1 Is resistance between L19 (male) (1) and (2) normal?</p> <p>• 10 - 20 Ω • Turn starting switch OFF. • Disconnect L19.</p>		
<p>2 YES</p> <p>Is resistance between M02 (female) (13), L25 (female) (1) and chassis normal?</p> <p>• Min. 1 MΩ • Turn starting switch OFF. • Disconnect M02, M14, and L19.</p> <p>NO</p>	<p>Defective lower MDT</p>	<p>Repair or replace</p>
	<p>Wiring harness between M02 (female) (13) - LM06 (13) - L25 (female) (1), or between M14 (female) (14) - intermediate connecting point of M02 (female) (13) and LM06 (male) (13) short circuiting with chassis ground</p>	<p>Repair or replace</p>
	<p>Defective steering mode solenoid d</p>	<p>Replace</p>

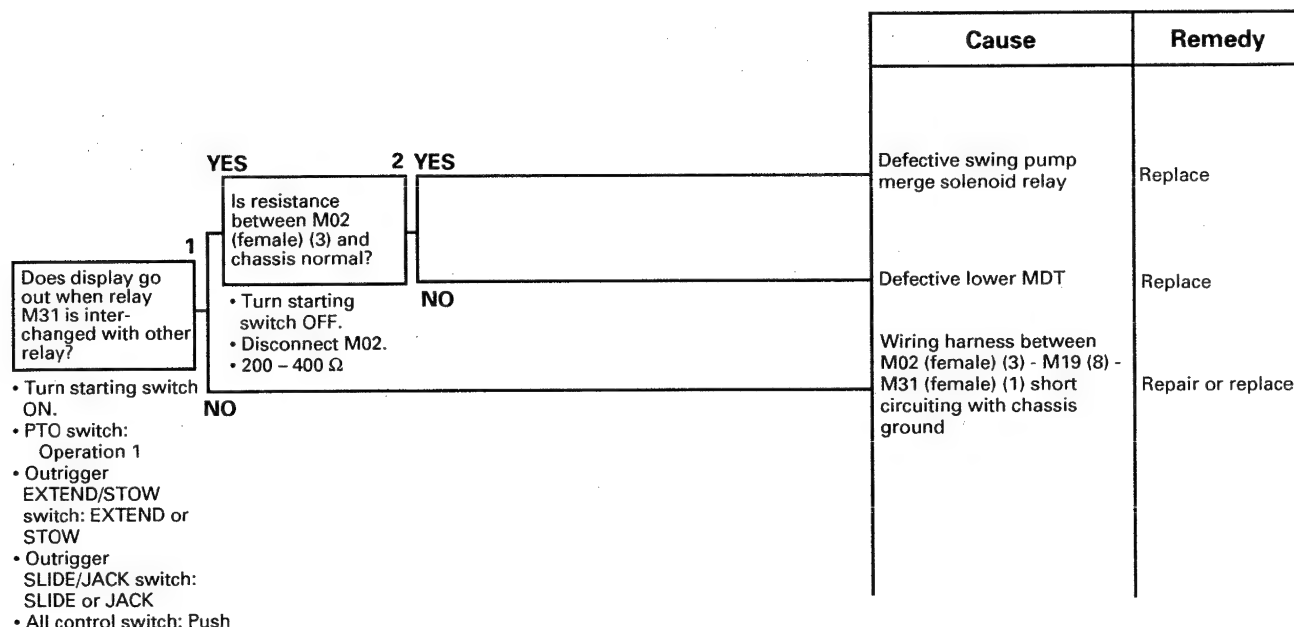
EL-52 Related electric circuit diagram



TKL00488

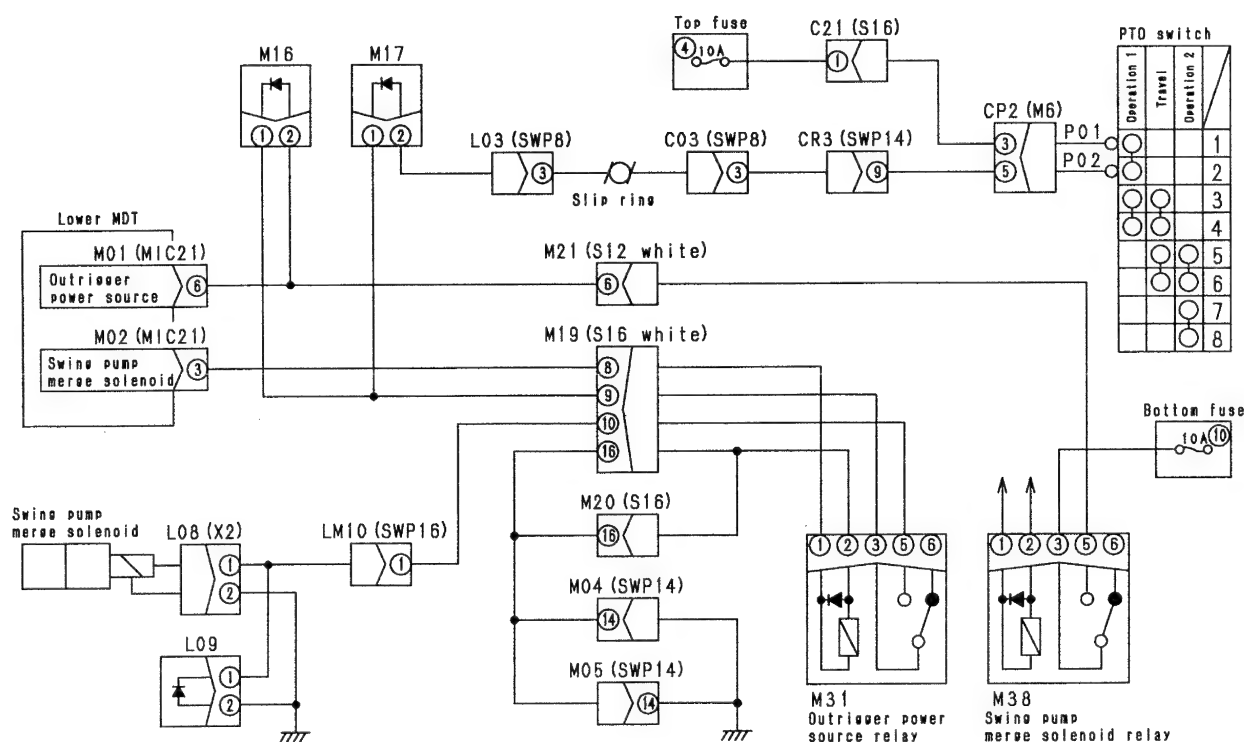
EL-53 MDTL error E64 (Swing pump merge solenoid short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EL-53 Related electric circuit diagram



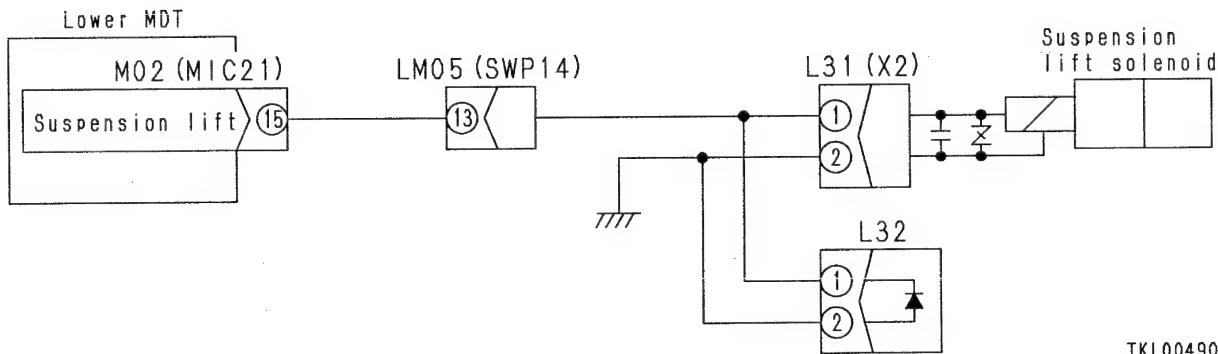
TKL00489

EL-55 MDTL error E67 (Suspension lift solenoid short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>Is resistance between L31 (male) (1) and (2) normal?</div> <div> <div>1</div> <div> <div>YES</div> <div> <div>Is resistance between M02 (female) (15), L31 (female) (1) and chassis normal?</div> <div> <div>2 YES</div> <div></div> </div> </div> </div> <div> <div>NO</div> <div> <div>• Min. 1 MΩ</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect M02 and L31.</div> </div> </div> </div> </div>		Defective lower MDT	Repair or replace
		Wiring harness between M02 (female) (15) - LM05 (13) - L31 (female) (1) short circuiting with chassis ground	Repair or replace
		Defective suspension lift solenoid	Replace

EL-55 Related electric circuit diagram



TKL00490

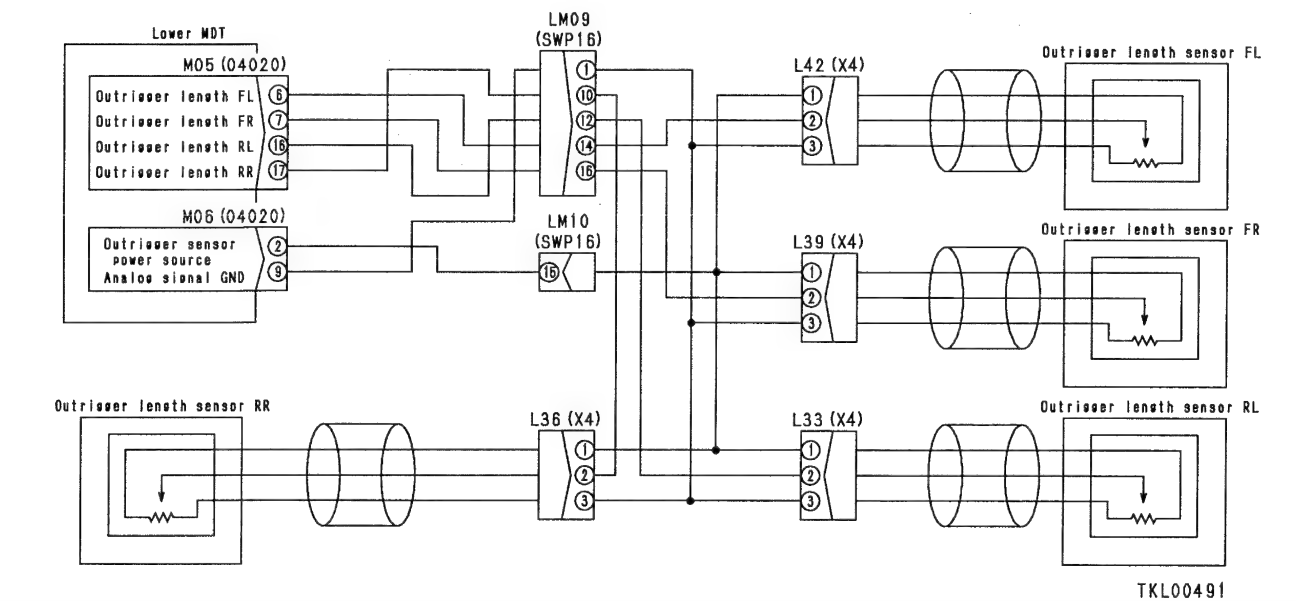
023S02

EL-56 MDTL error E76 (Outrigger length sensor power source [5V] short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1</div> <div>Does display go out when L42 is disconnected?</div> <div> <div>• Turn starting switch ON.</div> <div>• PTO switch: Operation 1</div> </div> <div>YES</div> <div>NO</div> </div>	YES	Defective outrigger length sensor FL	Replace
	2	Defective outrigger length sensor FR	Replace
	3	Defective outrigger length sensor RL	Replace
	4	Defective outrigger length sensor RR	Replace
	5	Go to A	
<div> <div>A</div> <div>Is resistance between M06 (female) (2) and chassis normal when L42, L39, L33, and L36 are disconnected?</div> <div> <div>• Turn starting switch OFF.</div> <div>• Min 1MΩ</div> </div> <div>YES</div> <div>NO</div> </div>	YES	Defective lower MDT	Replace
	NO	Wiring harness between M06 (female) (2) - M10 (15) - L42 (female) (1), L39 (female) (1), L33 (female) (1) or L36 (female) (1) short circuiting with chassis ground	Repair or replace

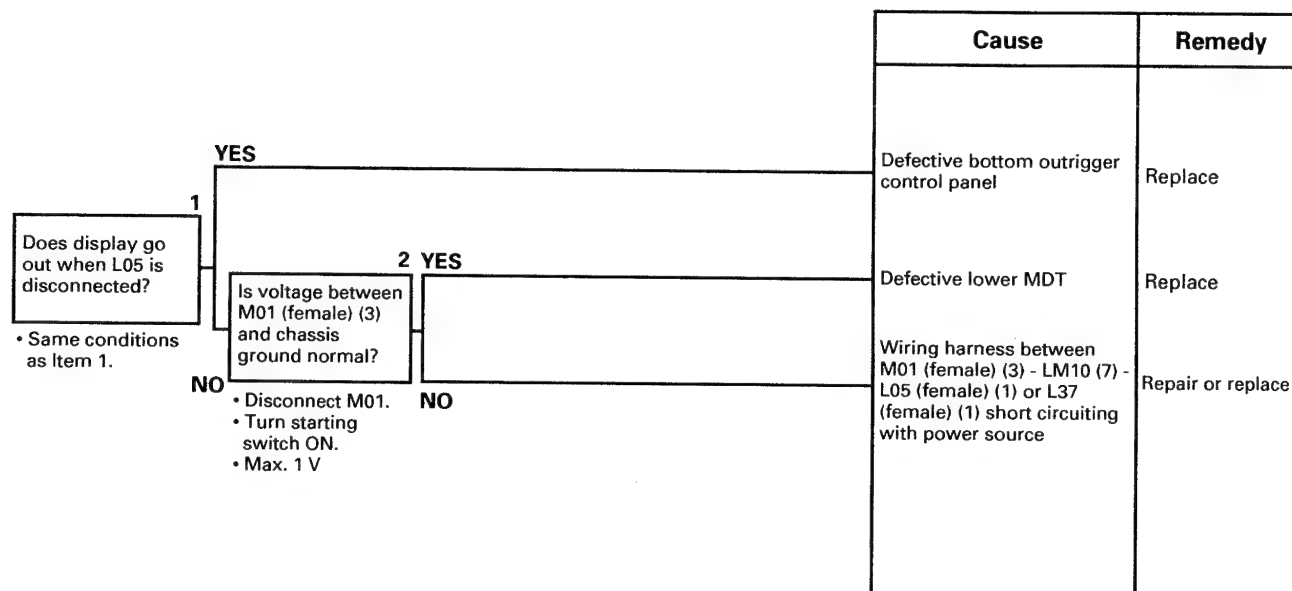
EL-56 Related electric circuit diagram



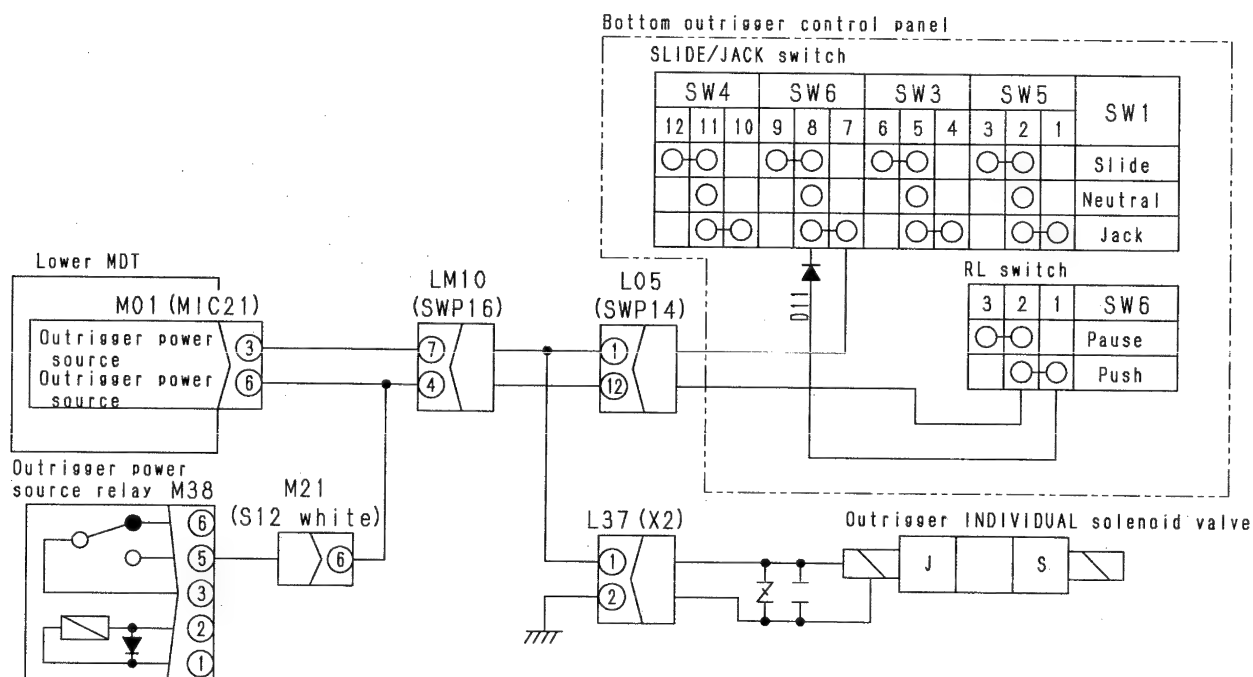
EL-57 MDTL error E80 (Outrigger jack RL short circuited with power source) is displayed

X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-57 Related electric circuit diagram (X-shaped outrigger)

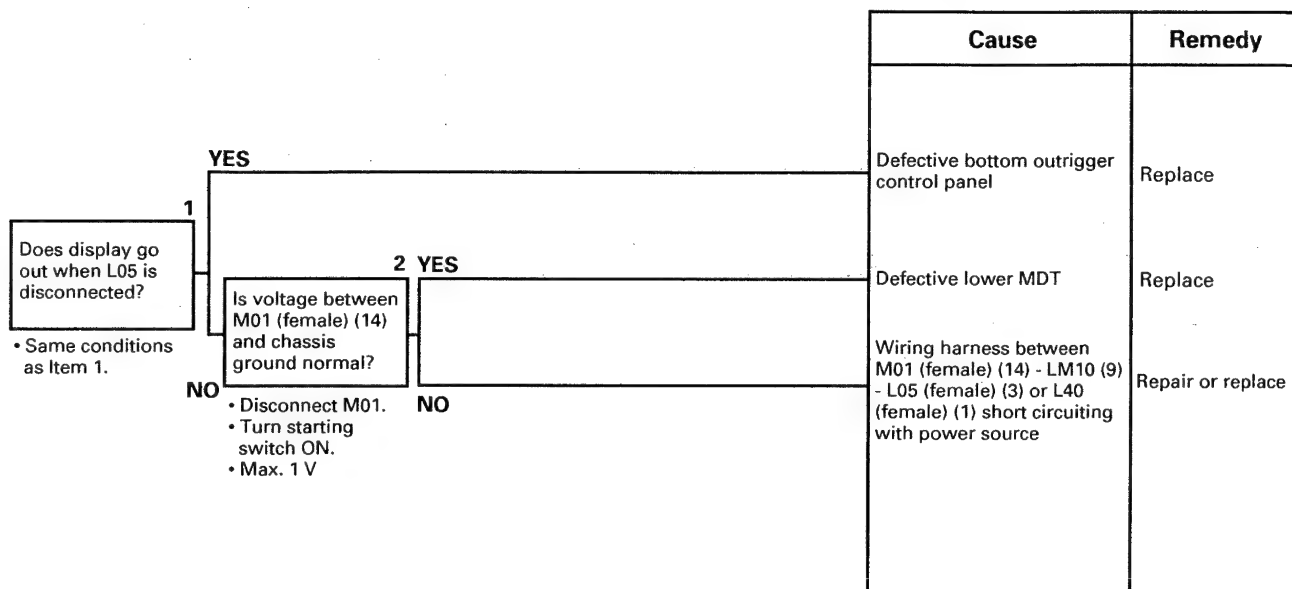


TKL00461

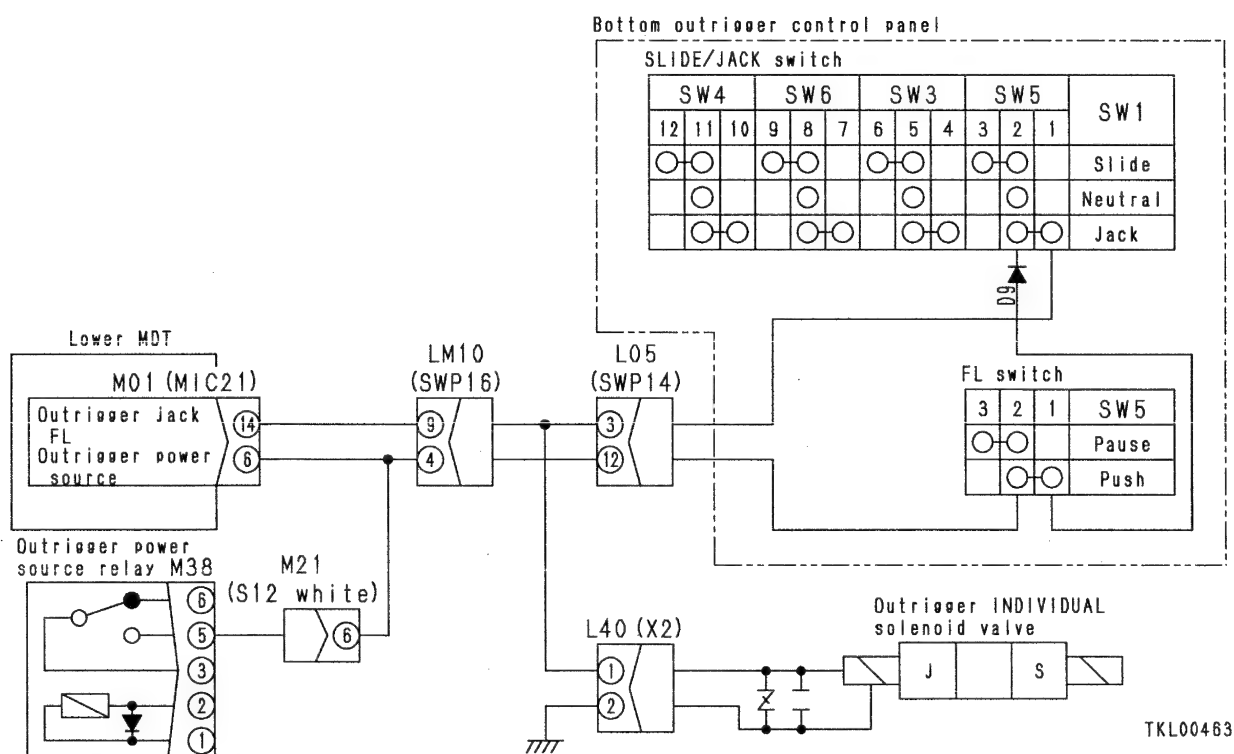
EL-58 MDTL error E81 (Outrigger jack FL short circuited with power source) is displayed

X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

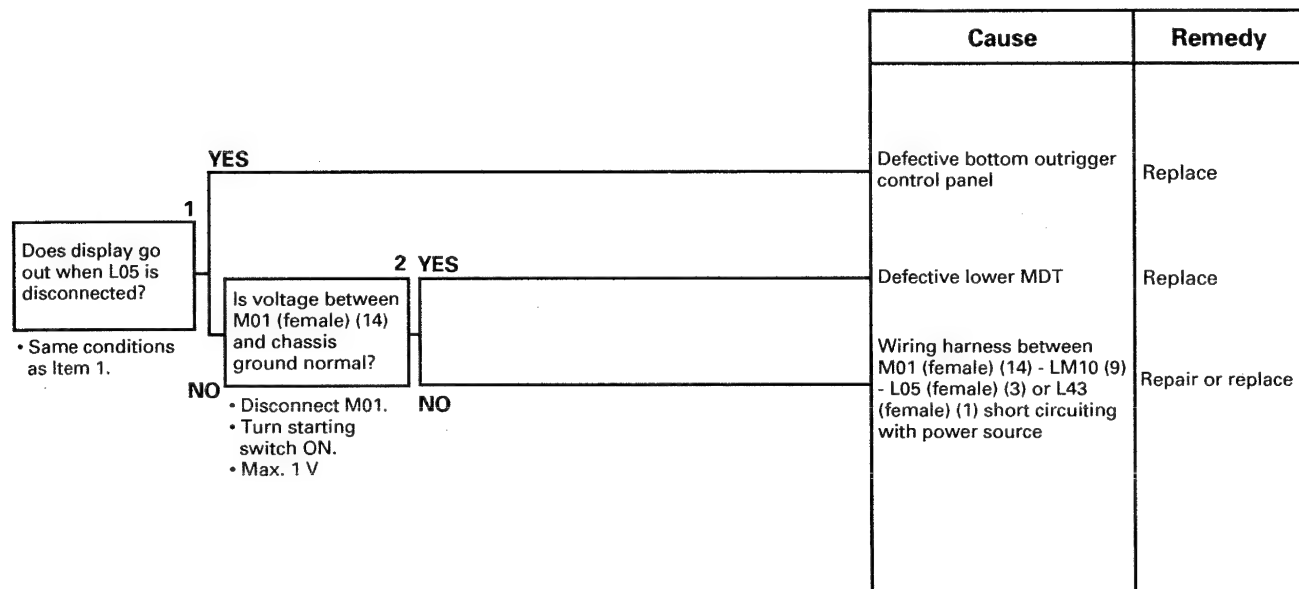


EL-58 Related electric circuit diagram (X-shaped outrigger)

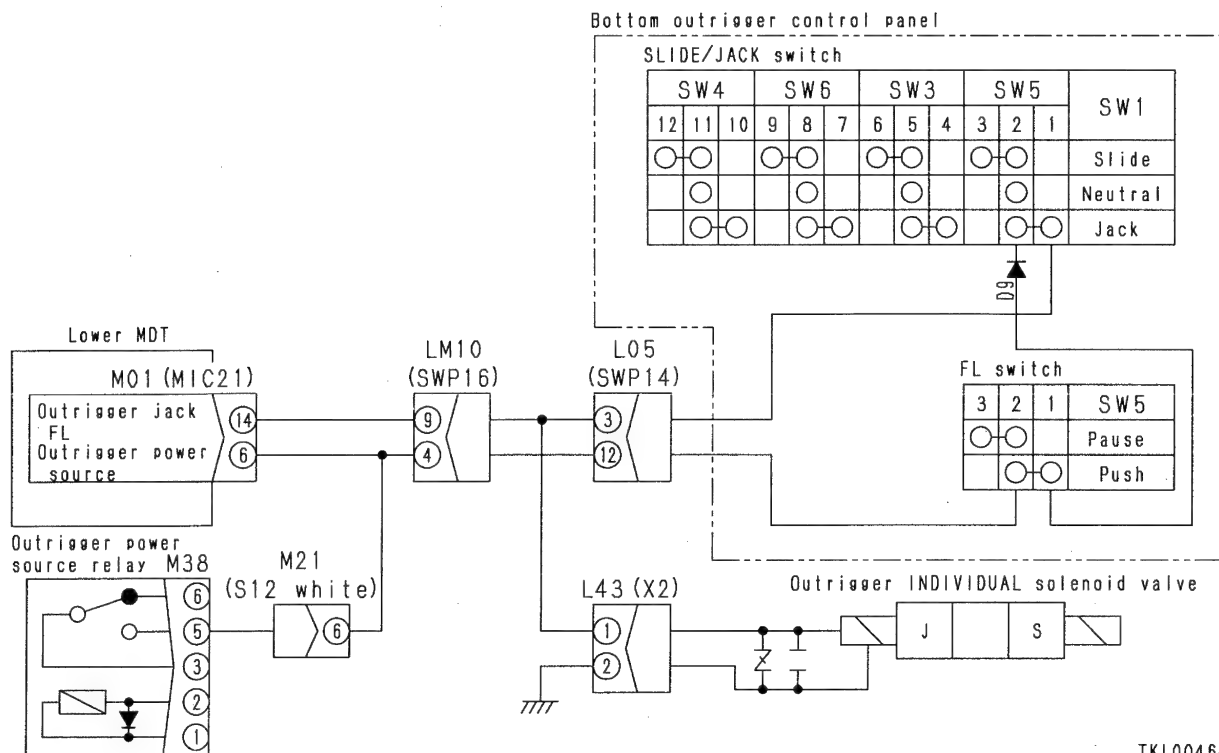


H-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-58 Related electric circuit diagram (H-shaped outrigger)



TKL00464

EL-59 MDTL error E82 (Outrigger jack RR short circuited with power source) is displayed

X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Does display go out when L05 is disconnected?

• Same conditions as Item 1.

2

Is voltage between M01 (female) (4) and chassis ground normal?

• Disconnect M01.
• Turn starting switch ON.
• Max. 1 V

YES

Defective bottom outrigger control panel

Replace

2 YES

Defective lower MDT

Replace

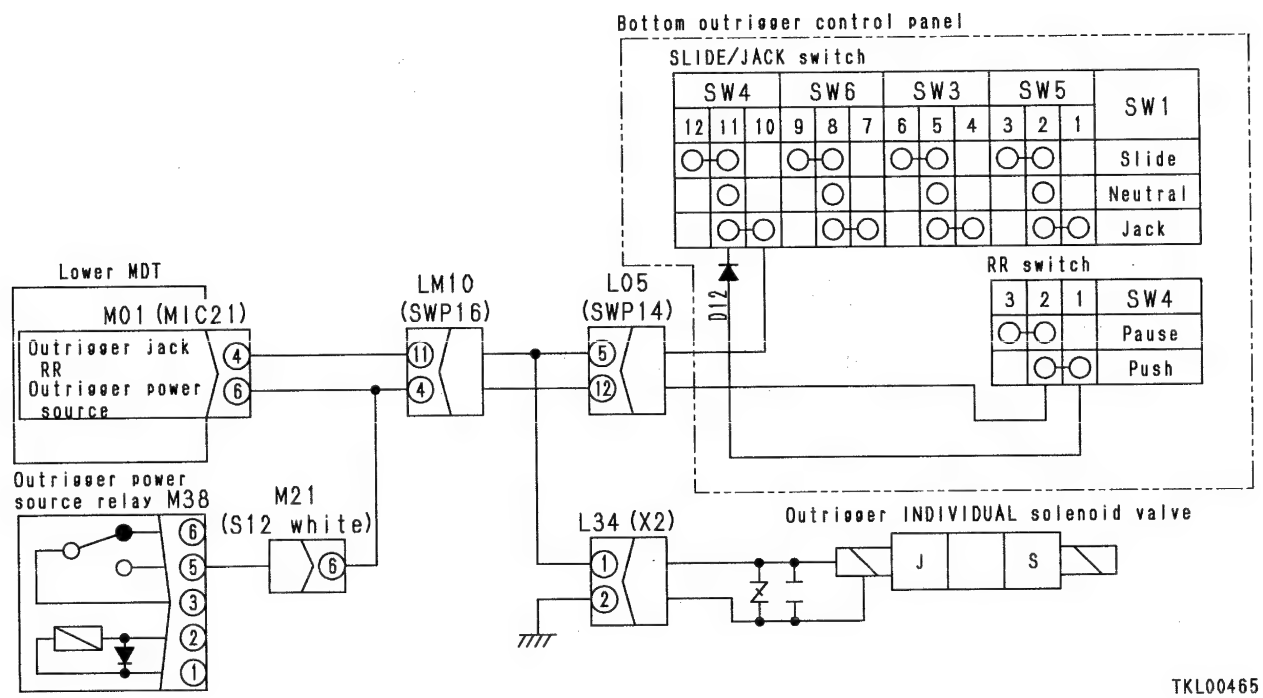
NO

Wiring harness between M01 (female) (4) - LM10 (11) - L05 (female) (5) or L34 (female) (1) short circuiting with power source

Repair or replace

023S02

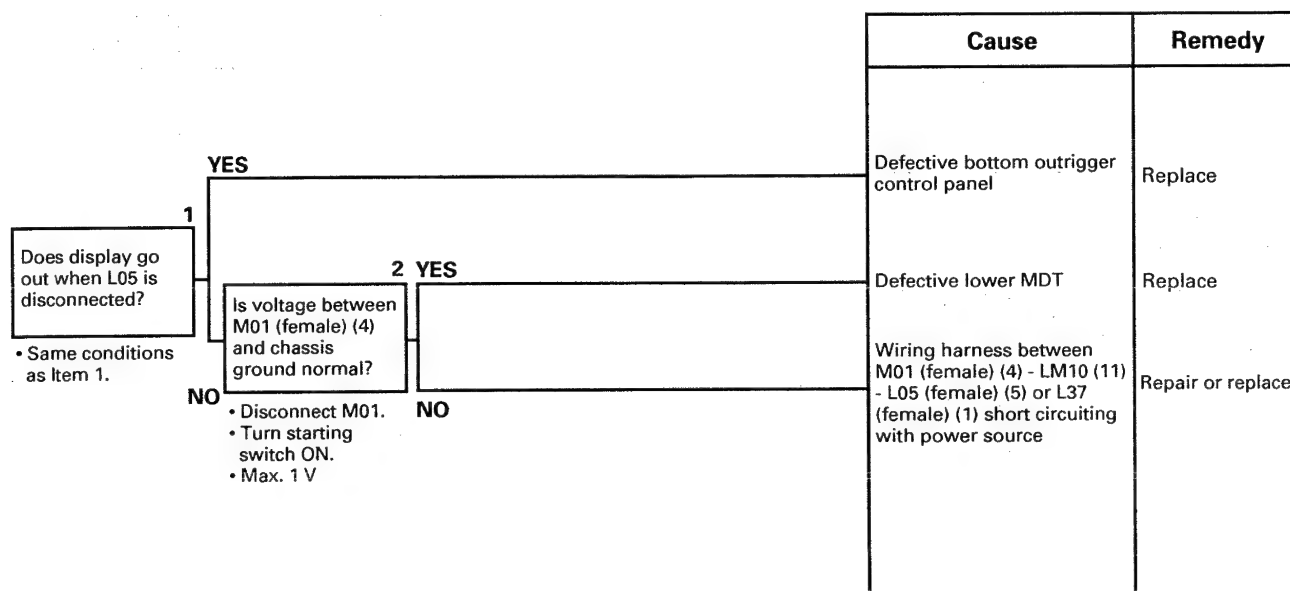
EL-59 Related electric circuit diagram (X-shaped outrigger)



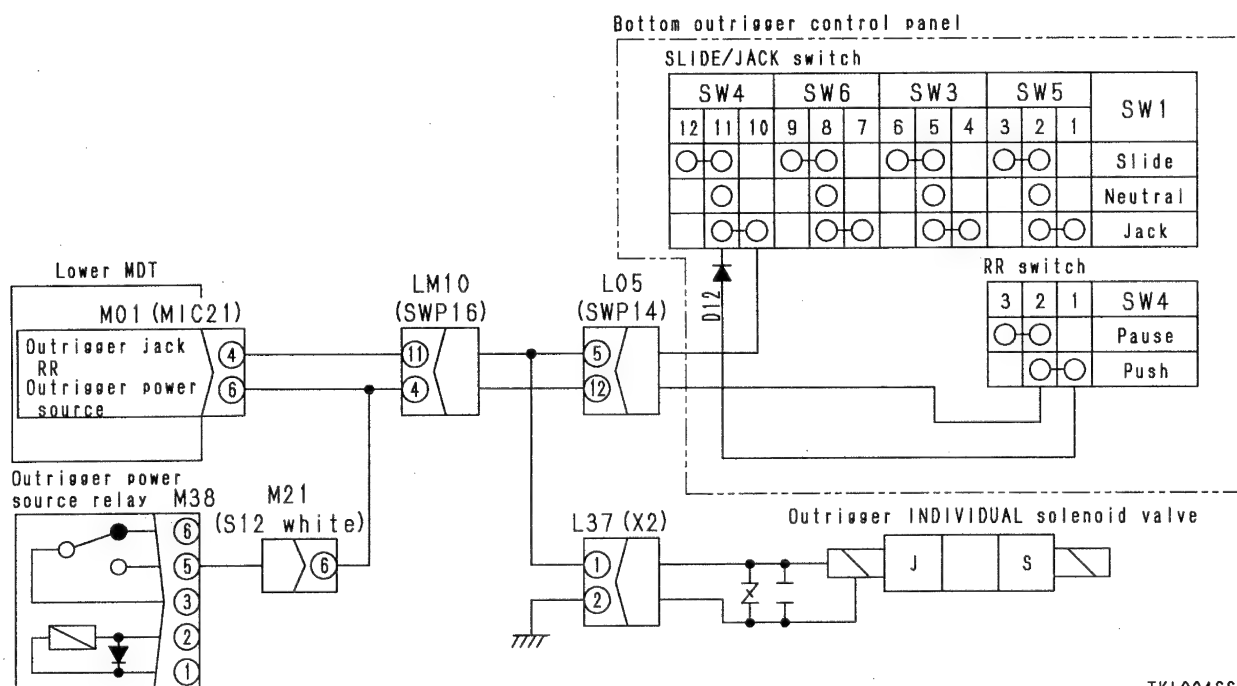
TKL00465

H-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-59 Related electric circuit diagram (H-shaped outrigger)

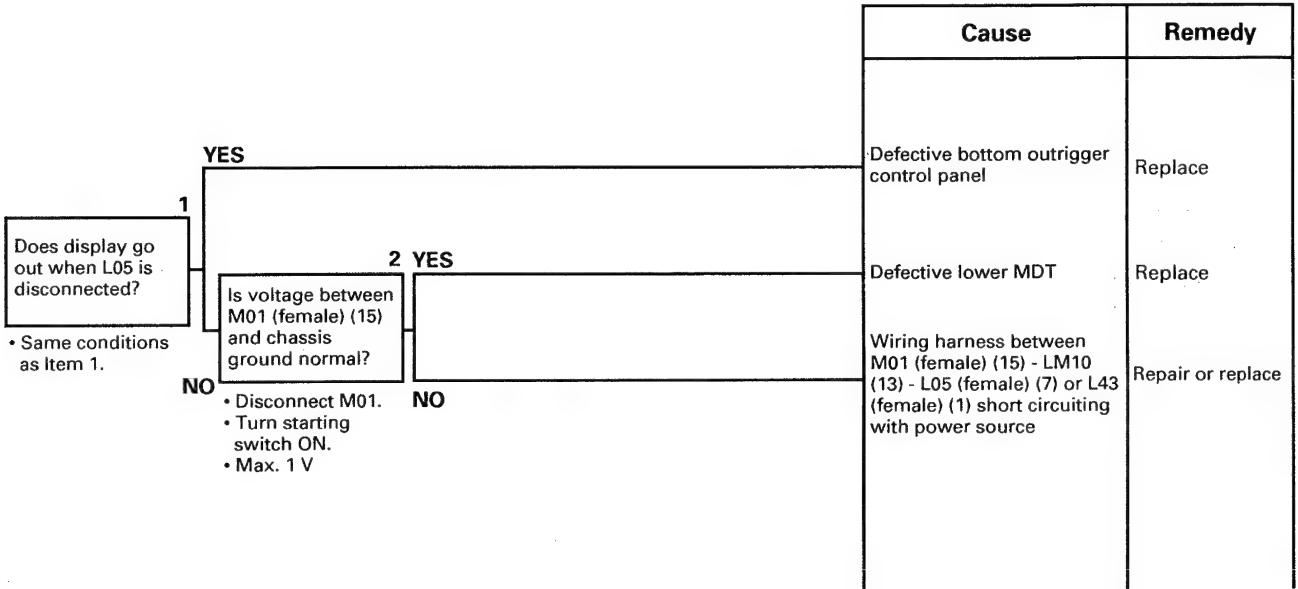


TKL00466

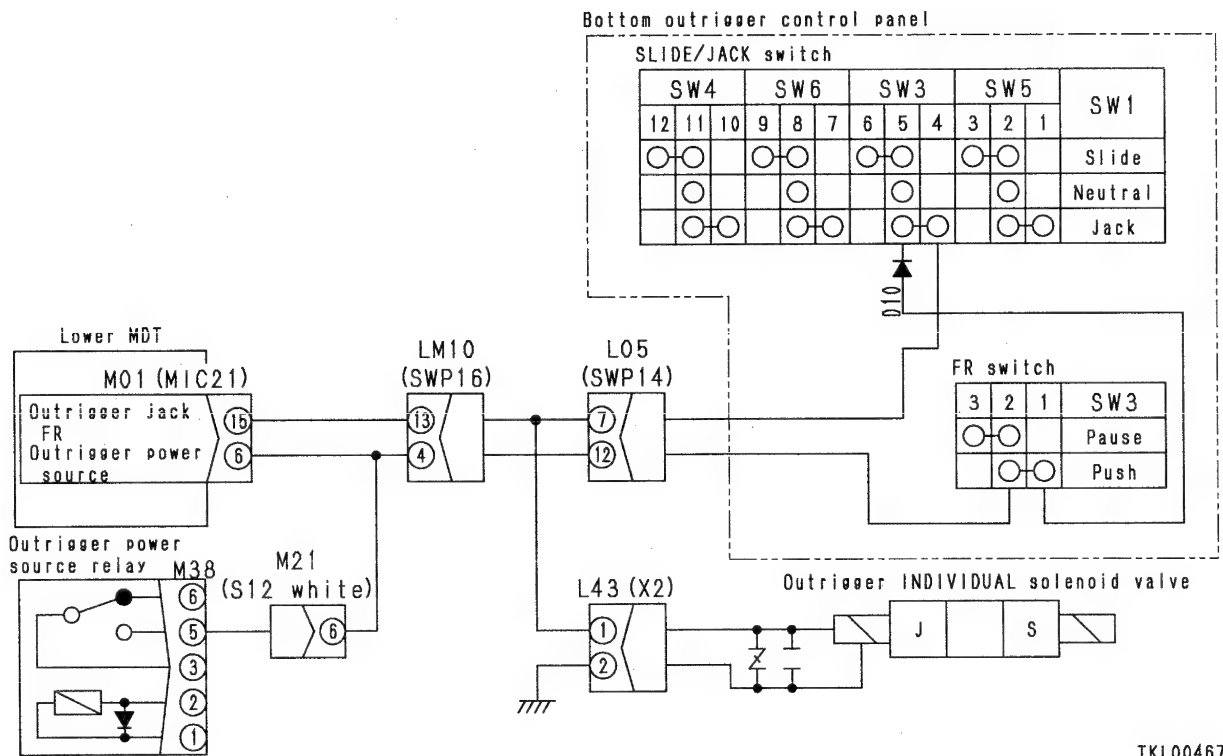
EL-60 MDTL error E83 (Outrigger jack FR short circuited with power source) is displayed

X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

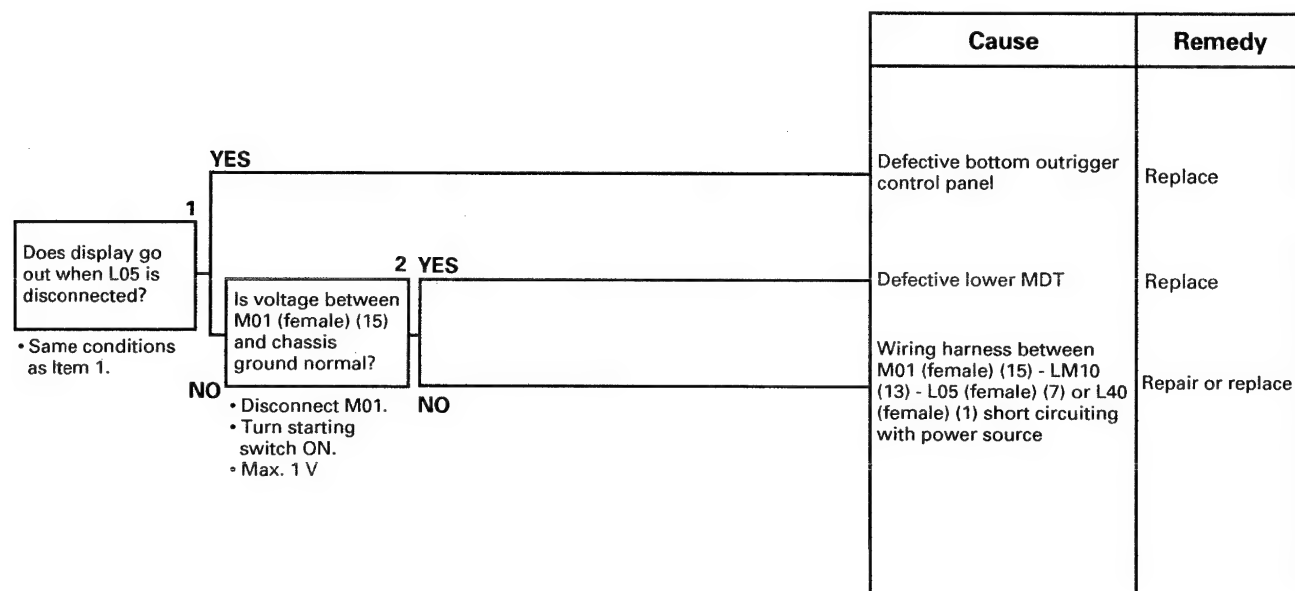


EL-60 Related electric circuit diagram (X-shaped outrigger)

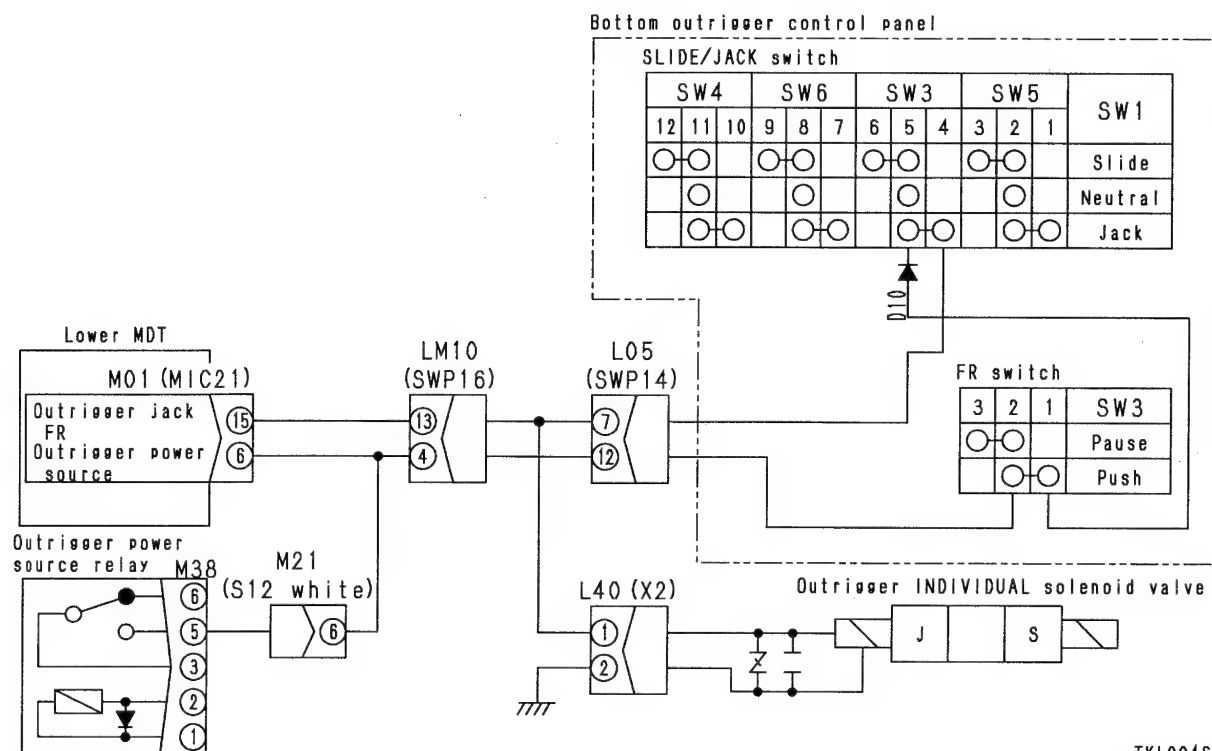


H-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



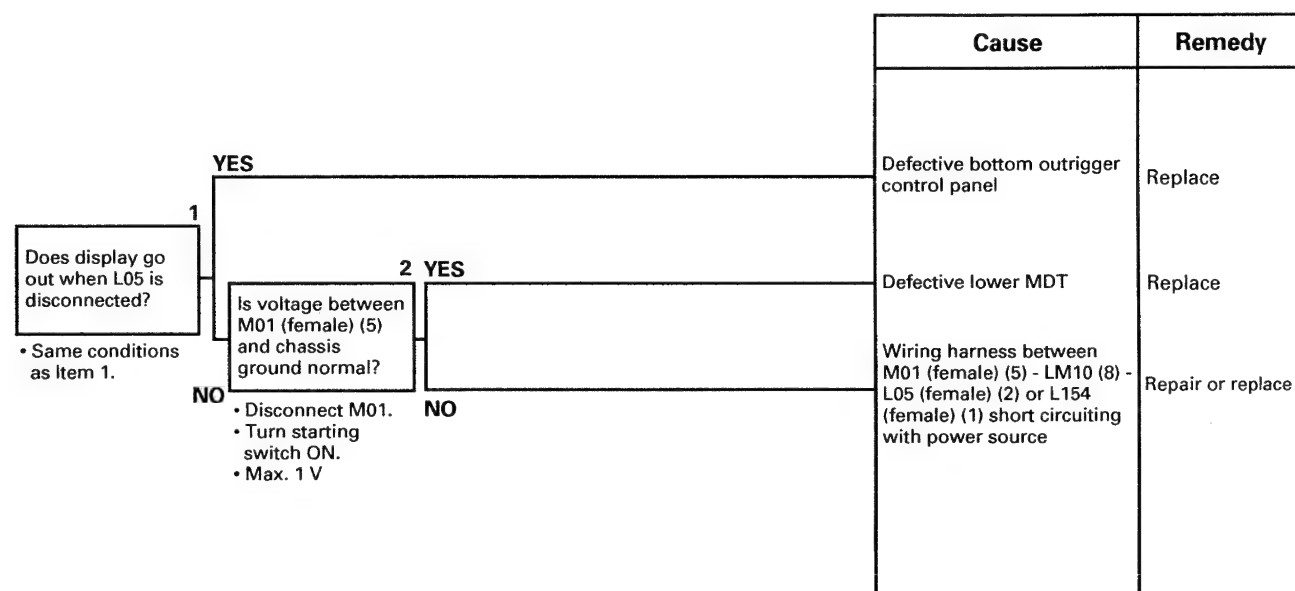
EL-60 Related electric circuit diagram (H-shaped outrigger)



EL-61 MDTL error E84 (Outtrigger slide RL short circuited with power source) is displayed

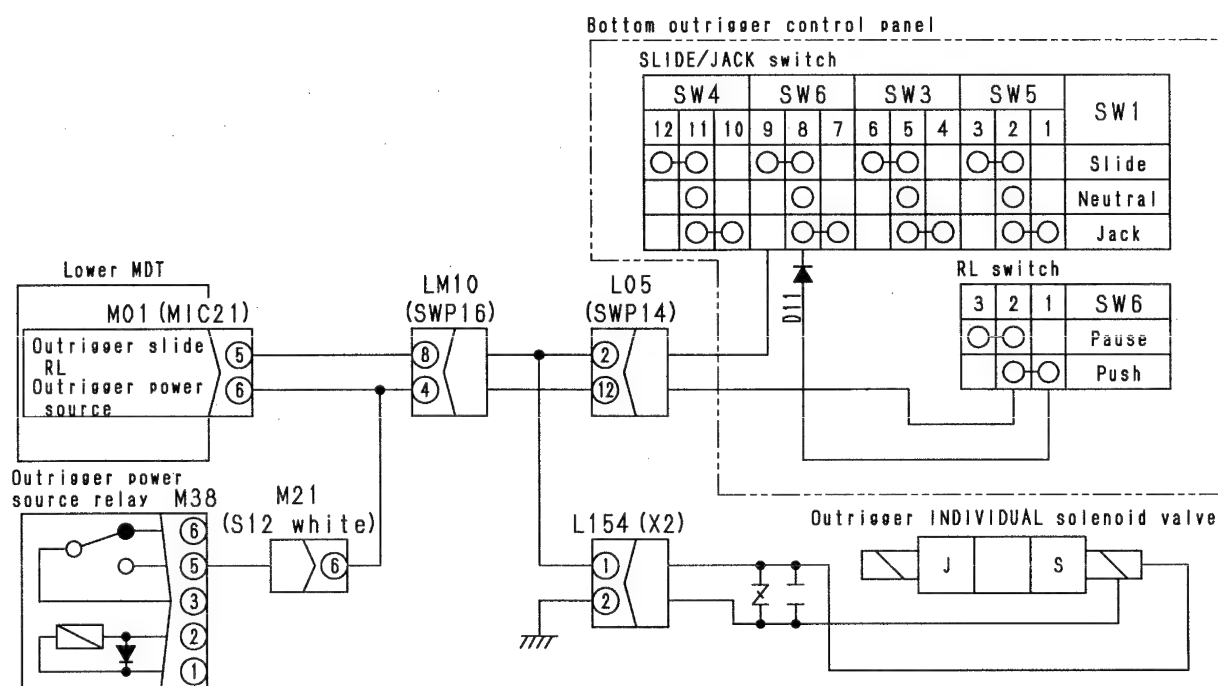
X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

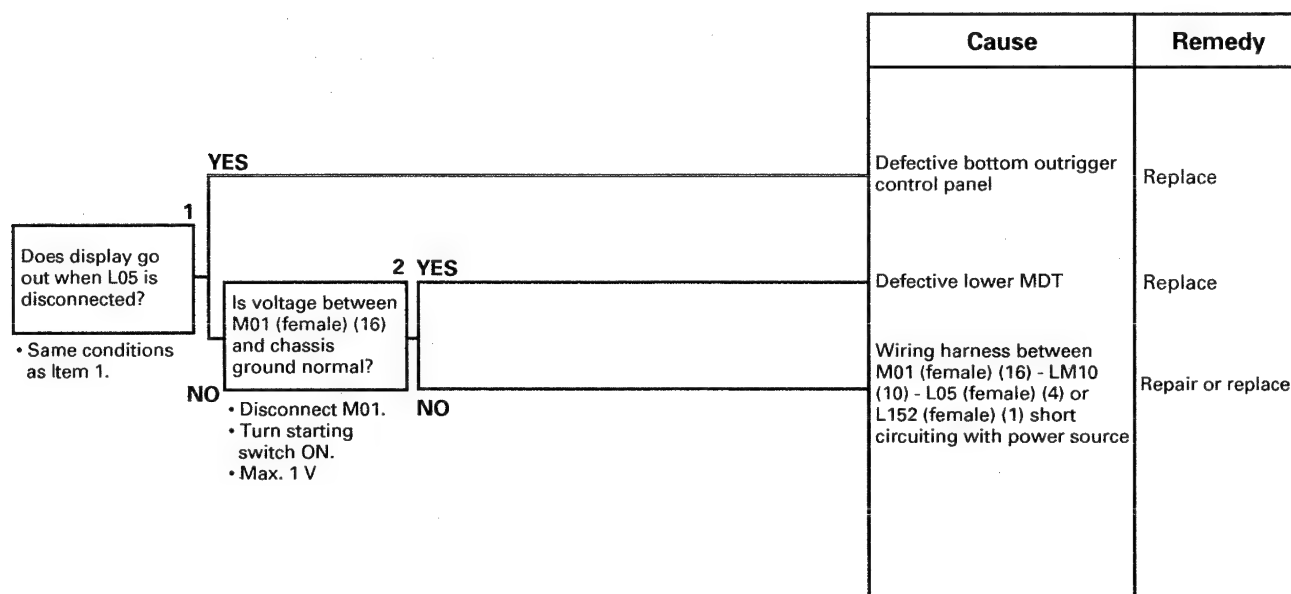
EL-61 Related electric circuit diagram (X-shaped outrigger)



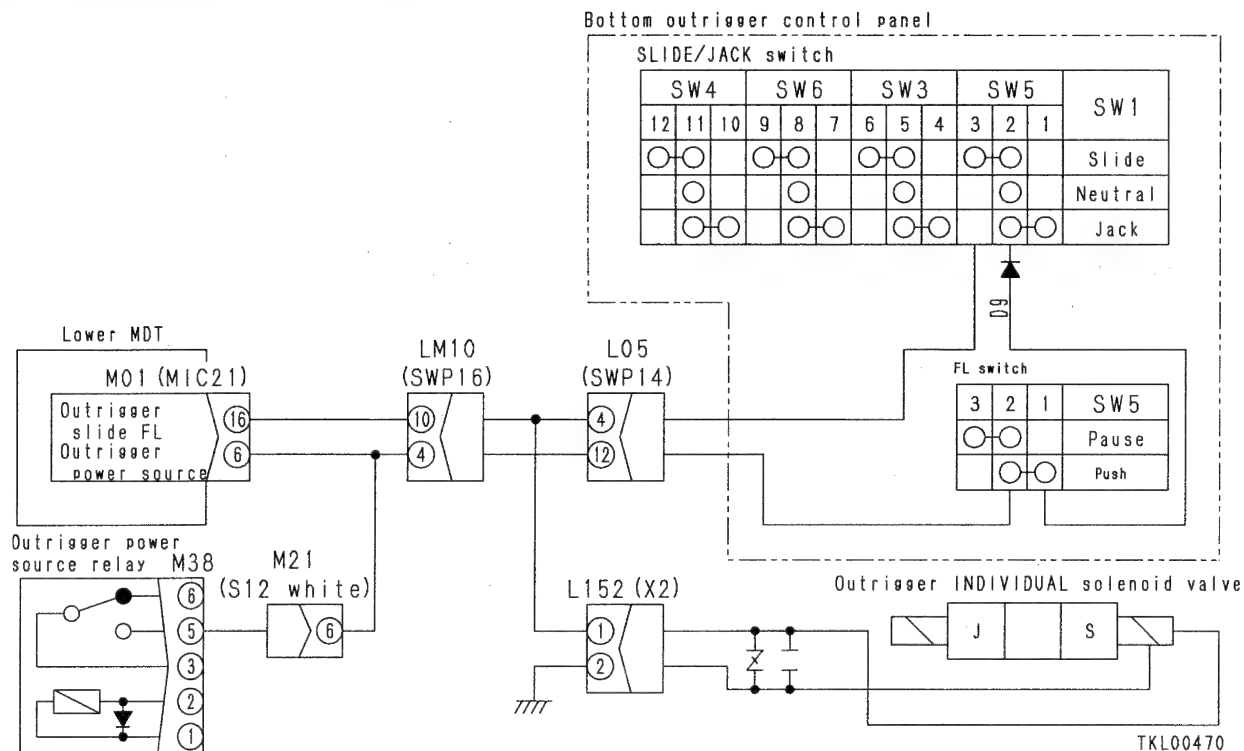
TKL00469

EL-62 MDTL error E85 (Outtrigger slide FL short circuited with power source) is displayed

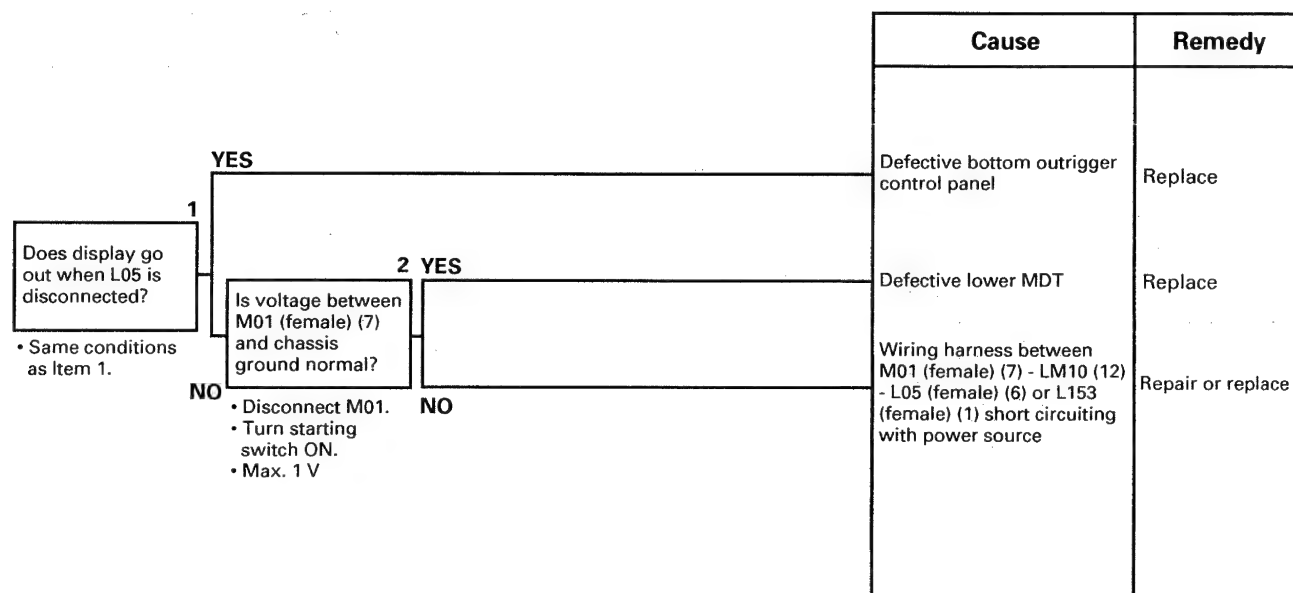
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



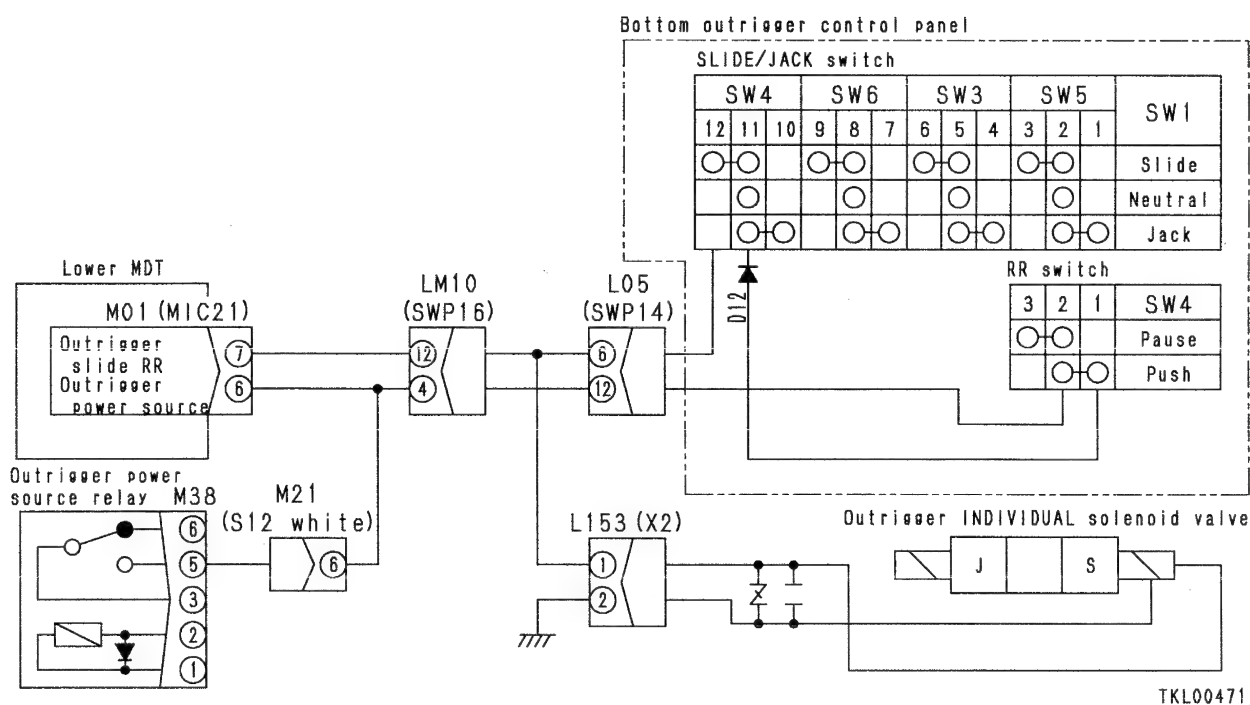
EL-62 Related electric circuit diagram



- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

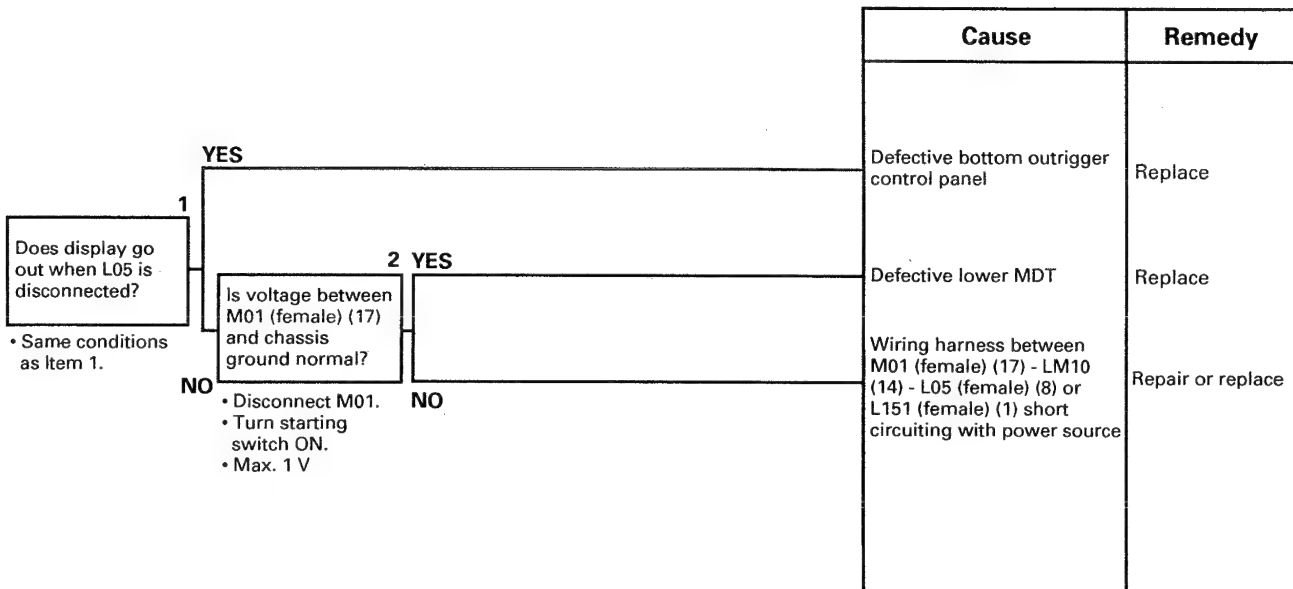


023S02

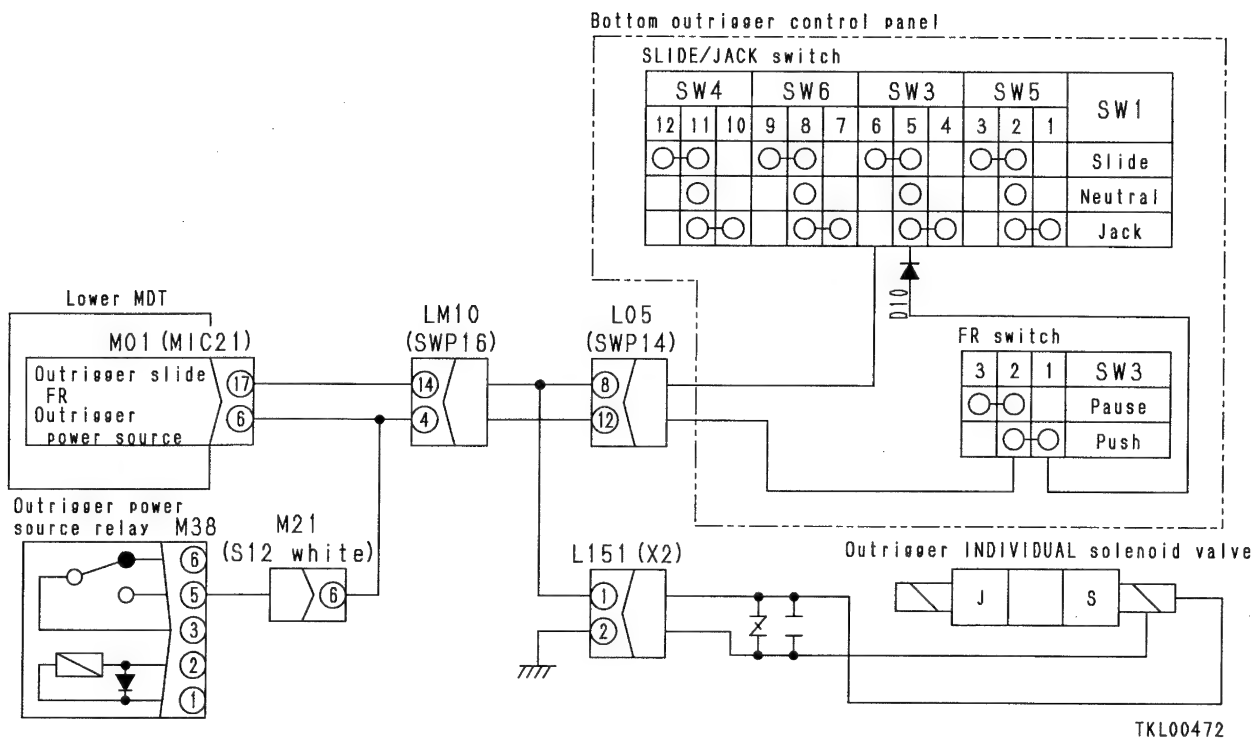


EL-64 MDTL error E87 (Outtrigger slide FR short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-64 Related electric circuit diagram

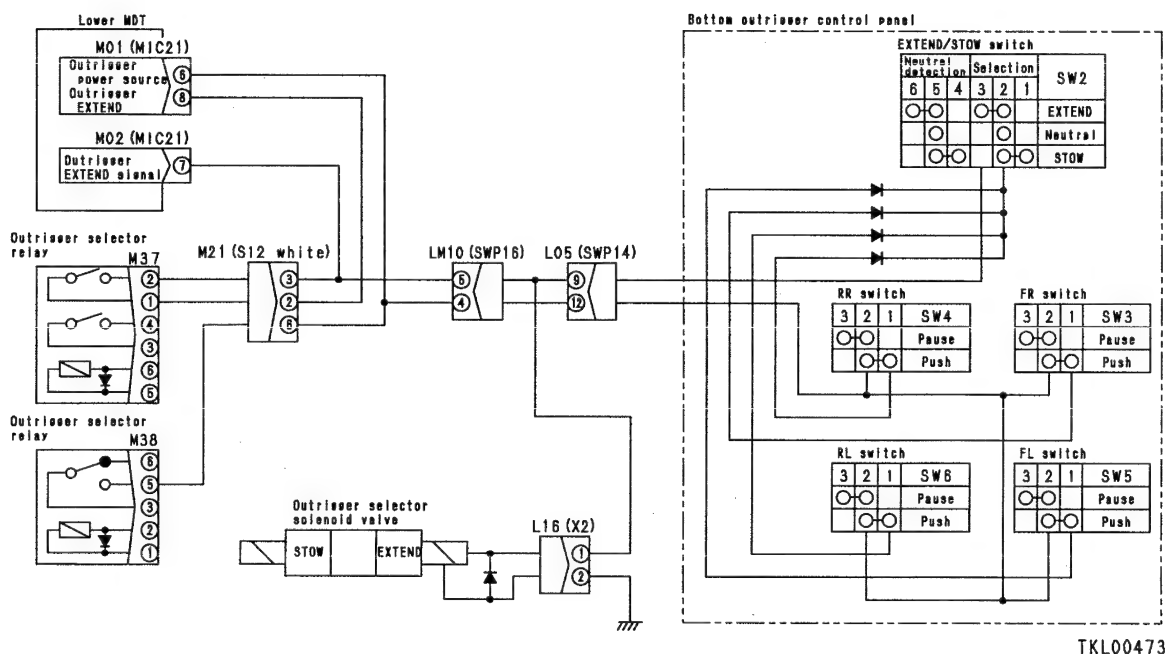


EL-65 MDTL error E88 (Outrigger selector EXTEND short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

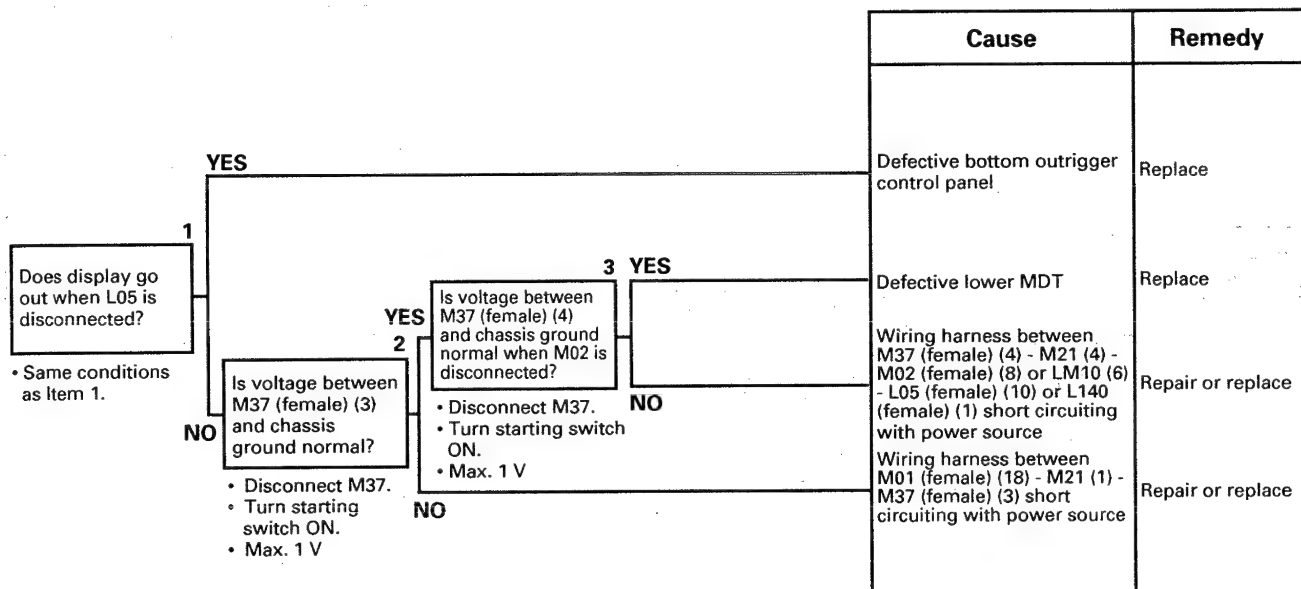
	Cause	Remedy
<p>1</p> <p>Does display go out when L05 is disconnected?</p> <p>• Same conditions as Item 1.</p> <p>YES</p> <p>NO</p>	Defective bottom outrigger control panel	Replace
<p>2</p> <p>Is voltage between M37 (female) (1) and chassis ground normal?</p> <p>• Disconnect M37.</p> <p>• Turn starting switch ON.</p> <p>• Max. 1 V</p> <p>YES</p> <p>NO</p>	Defective lower MDT	Replace
<p>3</p> <p>Is voltage between M37 (female) (2) and chassis ground normal when M02 is disconnected?</p> <p>• Disconnect M37.</p> <p>• Turn starting switch ON.</p> <p>• Max. 1 V</p> <p>YES</p> <p>NO</p>	Wiring harness between M37 (female) (2) - M21 (3) - M02 (female) (7) or LM10 (5) - L05 (female) (9) or L16 (female) (1) short circuiting with power source	Repair or replace
	Wiring harness between M01 (female) (8) - M21 (2) - M37 (female) (1) short circuiting with power source	Repair or replace

EL-65 Related electric circuit diagram



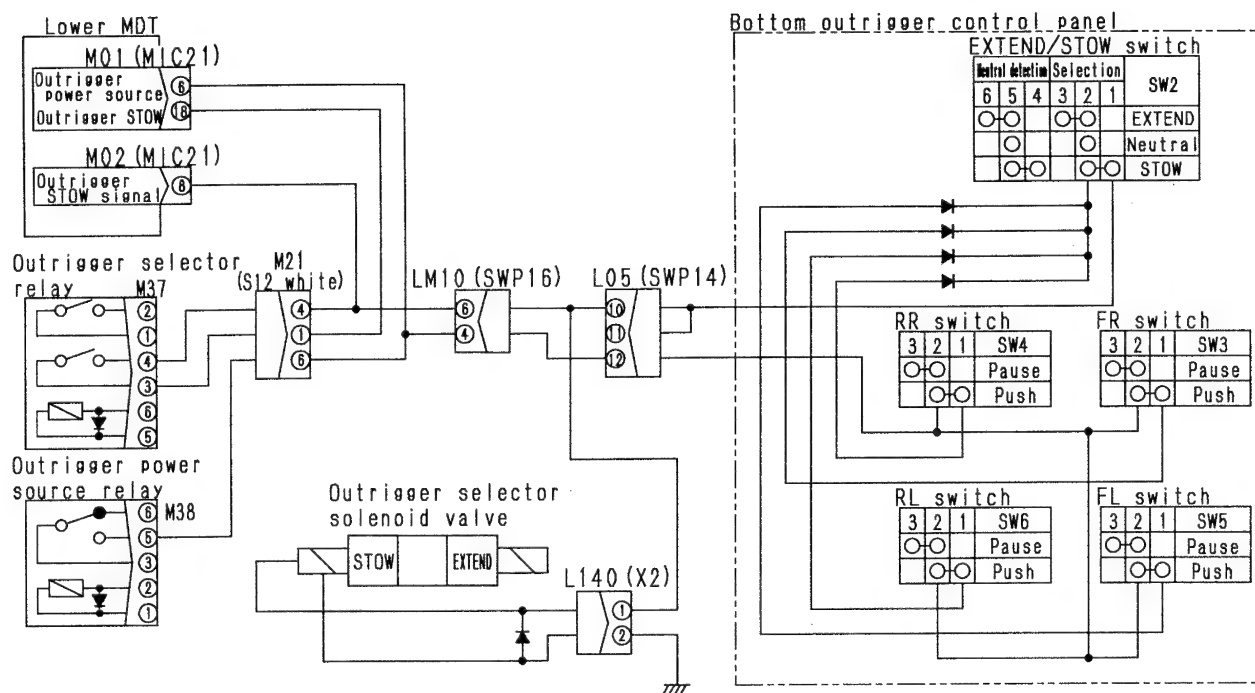
EL-66 MDTL error E89 (Outtrigger selector STOW short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EL-66 Related electric circuit diagram



TKL00691

EL-67 MDTL error E8A (Rear steering LOCK solenoid short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

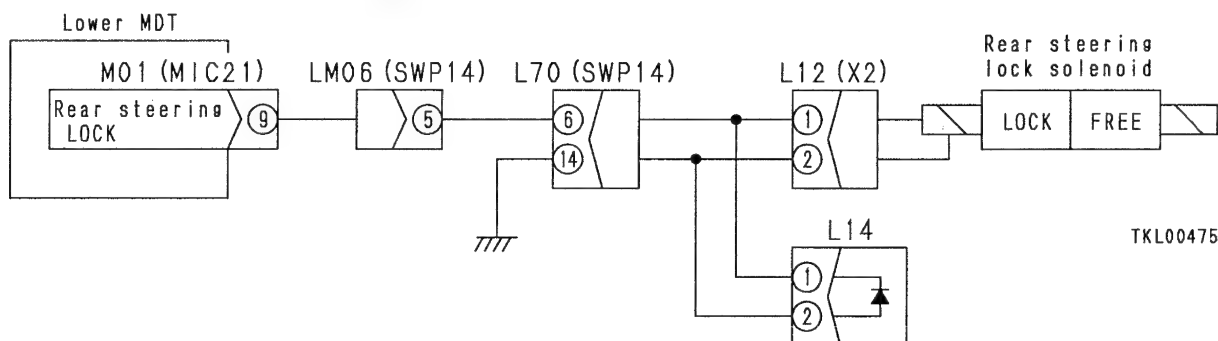
Is voltage between M01 (female) (9), L12 (female) (1) and chassis normal?

- Max. 1 V
- Disconnect M01 and L12.
- Turn starting switch ON.

NO

Cause	Remedy
Defective lower MDT	Repair or replace
Wiring harness between M01 (female) (9) - LM06 (5) - L70 (6) - L12 (female) (1) short circuiting with power source	Repair or replace

EL-67 Related electric circuit diagram



EL-68 MDTL error E8B (Rear steering FREE solenoid short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

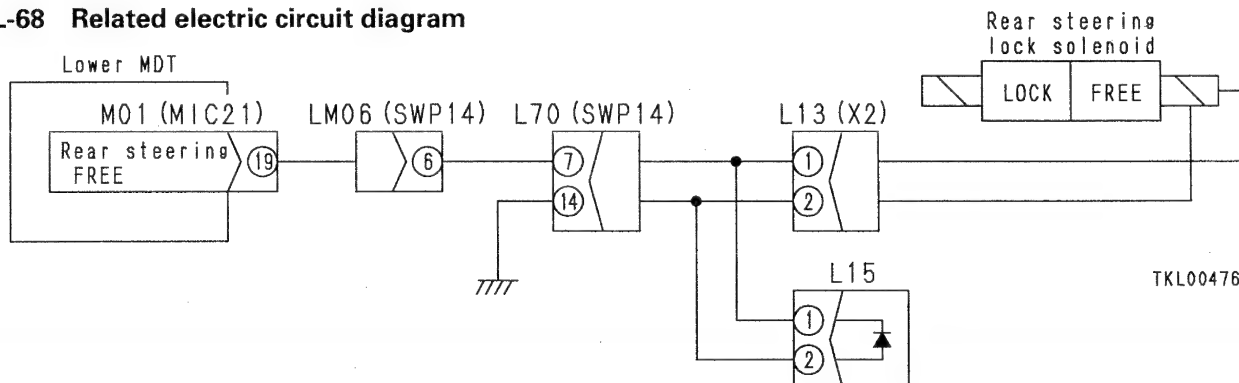
Is voltage between M01 (female) (19), L13 (female) (1) and chassis normal?

- Max. 1 V
- Disconnect M01 and L13.
- Turn starting switch ON.

NO

Cause	Remedy
Defective lower MDT	Repair or replace
Wiring harness between M01 (female) (19) - LM06 (6) - L70 (7) - L13 (female) (1) short circuiting with power source	Repair or replace

EL-68 Related electric circuit diagram



EL-69 MDTL error E8C (Service brake solenoid short circuited with power source) is displayed

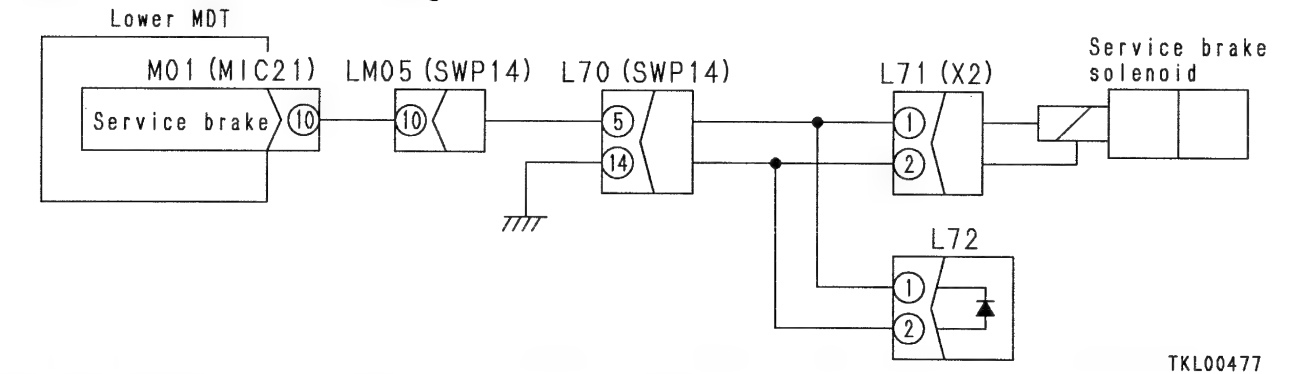
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- 1 YES

Is voltage between M01 (10), L71 (1) and chassis normal?

NO

- Max. 1 V
 - Disconnect M01 and L71.
 - Turn starting switch ON.
- | Cause | Remedy |
|--|-------------------|
| Defective lower MDT | Repair or replace |
| Wiring harness between M01 (female) (10) - LM05 (10) - L70 (5) - L71 (female) (1) short circuiting with power source | Repair or replace |

EL-69 Related electric circuit diagram



EL-70 MDTL error E8D (Exhaust brake solenoid short circuited with power source) is displayed

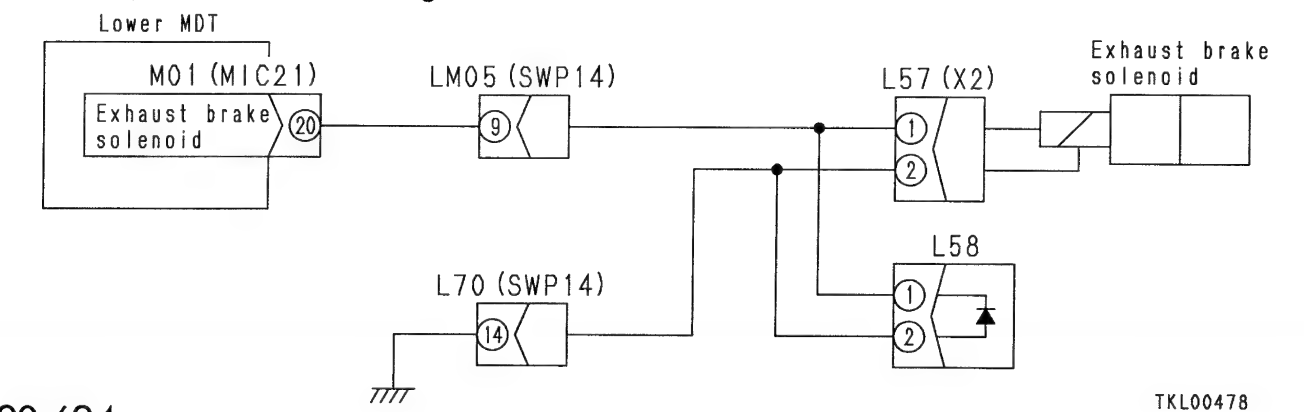
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- 1 YES

Is voltage between M01 (20), L57 (1) and chassis normal?

NO

- Max. 1 V
 - Disconnect M01 and L57.
 - Turn starting switch ON.
- | Cause | Remedy |
|---|-------------------|
| Defective lower MDT | Repair or replace |
| Wiring harness between M01 (female) (20) - LM05 (9) - L57 (female) (1) short circuiting with power source | Repair or replace |

EL-70 Related electric circuit diagram



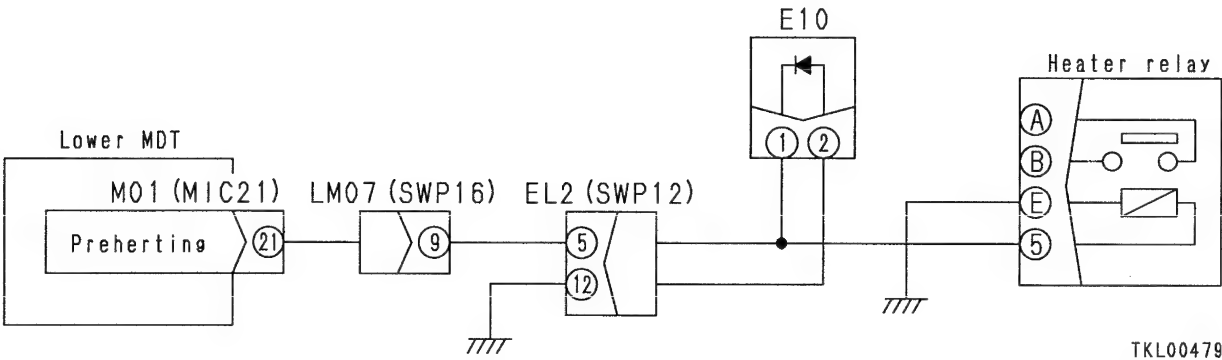
TKL00478

EL-72 MDTL error E8F (Preheating [heater relay circuit] short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div>1 YES</div> <div>Is voltage between M01 (21), heater relay terminal (5) and chassis normal?</div> <div>• Max. 1 V</div> <div>• Disconnect M01 and heater relay terminal.</div> <div>• Turn starting switch ON.</div>	YES	Defective lower MDT	Repair or replace
	NO	Wiring harness between M01 (female) (21) - LM07 (9) - EL2 (5) - heater relay terminal (5) short circuiting with power source	Repair or replace

EL-66 Related electric circuit diagram



EL-73 MDTL error E9A (Head lamp Hi relay short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

Is voltage between M04 (female) (6), M26 (female) (1) and chassis ground normal?

• Max. 1 V

• Turn starting switch OFF.

• Disconnect M04 and M26.

• Turn starting switch ON.

NO

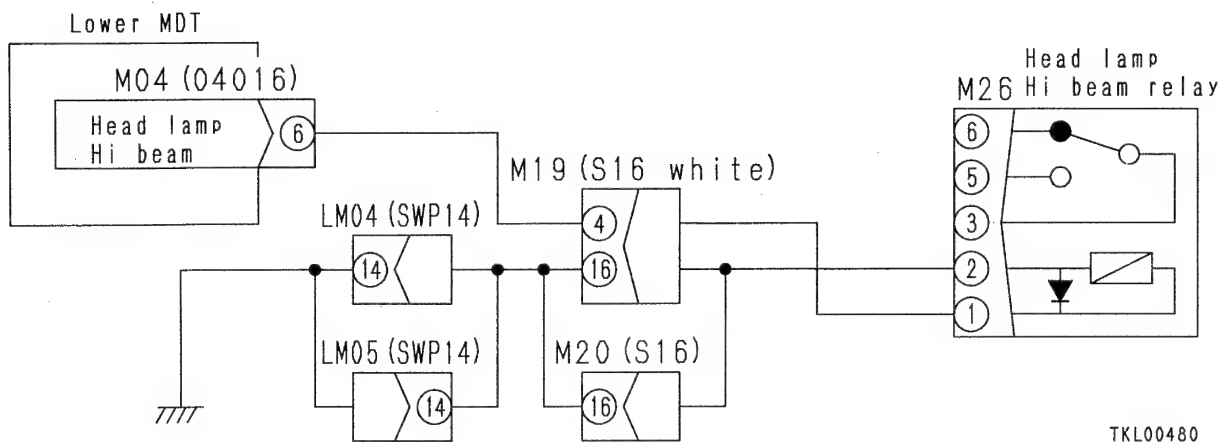
Defective lower MDT

Replace

Wiring harness between M04 (female) (6) - M19 (4) - M26 (female) (1) short circuiting with power source

Repair or replace

EL-73 Related electric circuit diagram

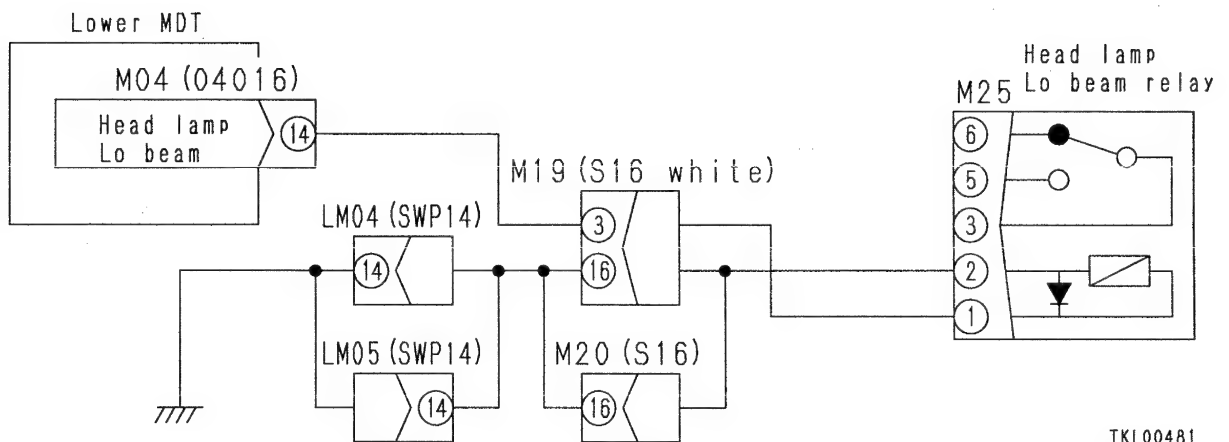


EL-74 MDTL error E9B (Head lamp Lo relay short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Is voltage between M04 (female) (14), M25 (female) (1) and chassis ground normal?</p> <p>• Max. 1 V</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M04 and M25.</p> <p>• Turn starting switch ON.</p>	YES	Defective lower MDT	Replace
	NO	Wiring harness between M04 (female) (14) - M19 (3) - M25 (female) (1) short circuiting with power source	Repair or replace

EL-74 Related electric circuit diagram



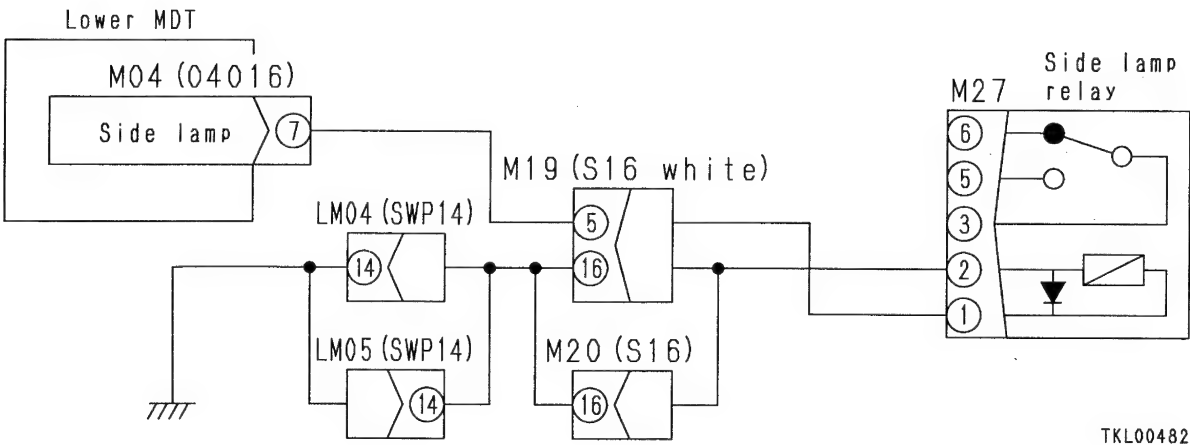
TKL00481

EL-75 MDTL error E9C (Side lamp relay short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div> <div>1 YES</div> <div>Is voltage between M04 (female) (7), M27 (female) (1) and chassis ground normal?</div> </div> <div> <div>NO</div> <div> <ul style="list-style-type: none"> • Max. 1 V • Turn starting switch OFF. • Disconnect M04 and M27. • Turn starting switch ON. </div> </div> </div>		Defective lower MDT	Replace
		Wiring harness between M04 (female) (7) - M19 (5) - M27 (female) (1) short circuiting with power source	Repair or replace

EL-75 Related electric circuit diagram



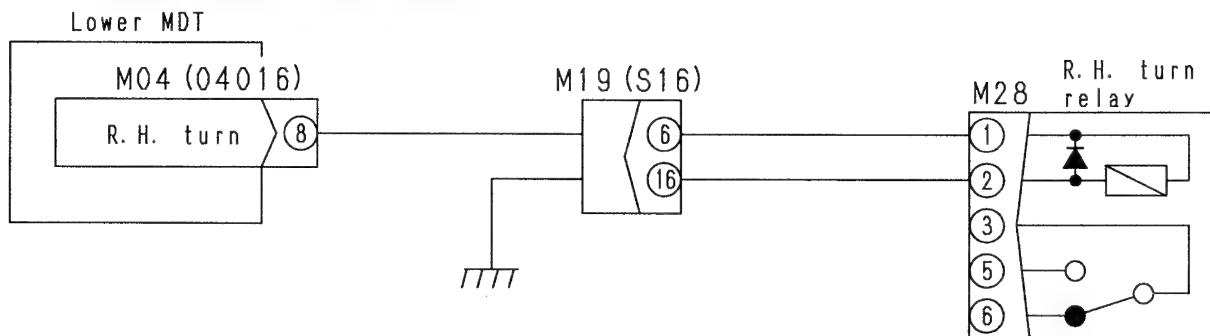
EL-76 MDTL error E9E (Right turn relay short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES		Cause	Remedy
Is voltage between M04 (female) (8), M28 (female) (1) and chassis normal?	YES	Defective lower MDT	Repair or replace
	NO	Wiring harness between M04 (female) (8) - M19 (6) - M28 (female) (1) short circuiting with power source	Repair or replace

- Max. 1 V
- Turn starting switch OFF.
- Disconnect M04 and M28.
- Turn starting switch ON.

EL-76 Related electric circuit diagram



TKL00483

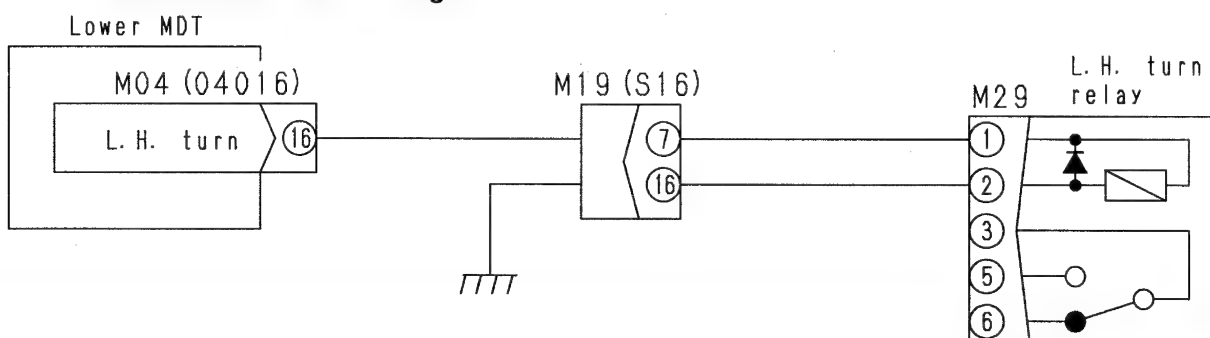
EL-77 MDTL error E9F (Left turn relay short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES		Cause	Remedy
Is voltage between M04 (female) (16), M29 (female) (1) and chassis normal?	YES	Defective lower MDT	Repair or replace
	NO	Wiring harness between M04 (female) (16) - M19 (12) - M29 (female) (1) short circuiting with power source	Repair or replace

- Max. 1 V
- Turn starting switch OFF.
- Disconnect M04 and M29.
- Turn starting switch ON.

EL-77 Related electric circuit diagram



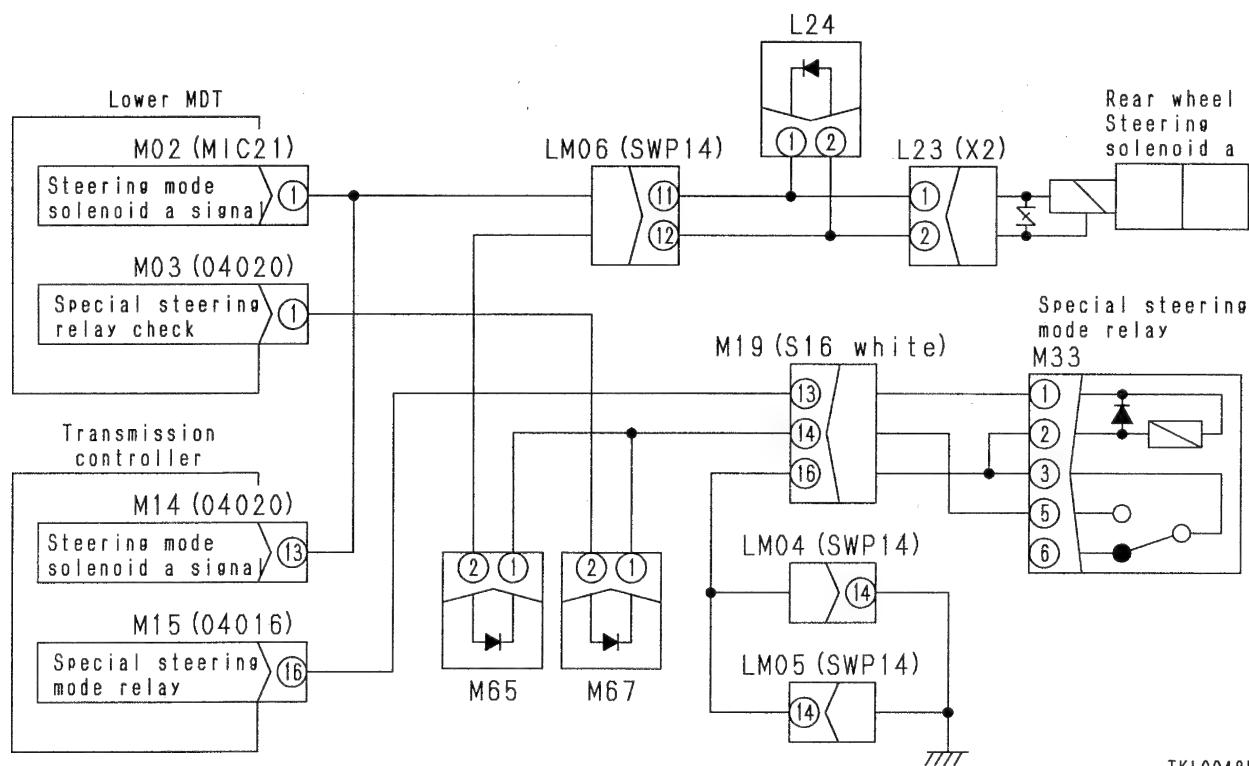
TKL00484

EL-78 MDTL error EA0 (Steering mode solenoid a short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Is voltage between M02 (female) (1), L23 (female) (1) and chassis normal?</p> <p>• Max. 1 V</p> <p>• Disconnect M02, L23, and M14.</p> <p>• Turn starting switch ON.</p>	YES	Defective lower MDT	Repair or replace
	NO	Wiring harness between M02 (female) (1) - M14 (female) (13) - LM06 (11) - L23 (female) (1) short circuiting with power source	Repair or replace

EL-78 Related electric circuit diagram



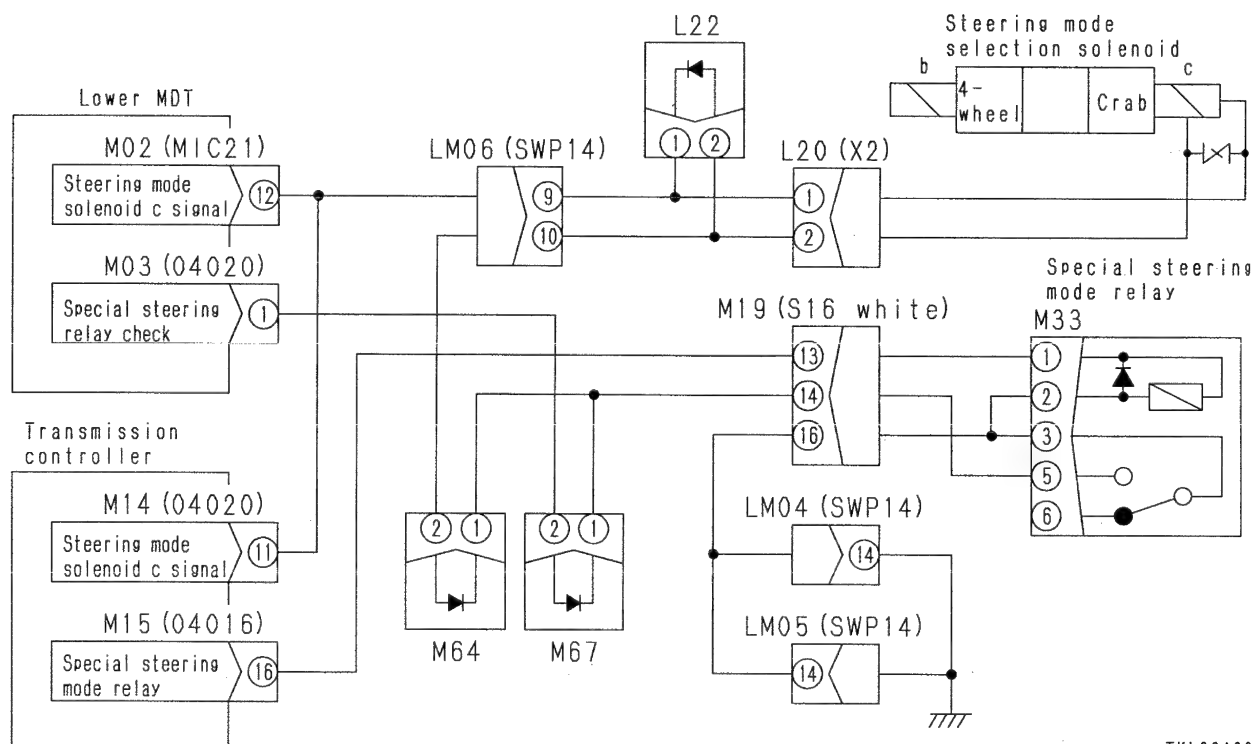
TKL00485

EL-79 MDTL error EA1 (Steering mode solenoid c short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<p>1 YES</p> <p>Is voltage between M02 (female) (12), L20 (female) (1) and chassis normal?</p>	Defective lower MDT	Repair or replace
<p>NO</p> <ul style="list-style-type: none"> • Max. 1 V • Disconnect M02, L20, and M14. • Turn starting switch ON. 	Wiring harness between M02 (female) (12) - M14 (female) (11) - LM06 (9) - L20 (female) (1) short circuiting with power source	Repair or replace

EL-79 Related electric circuit diagram



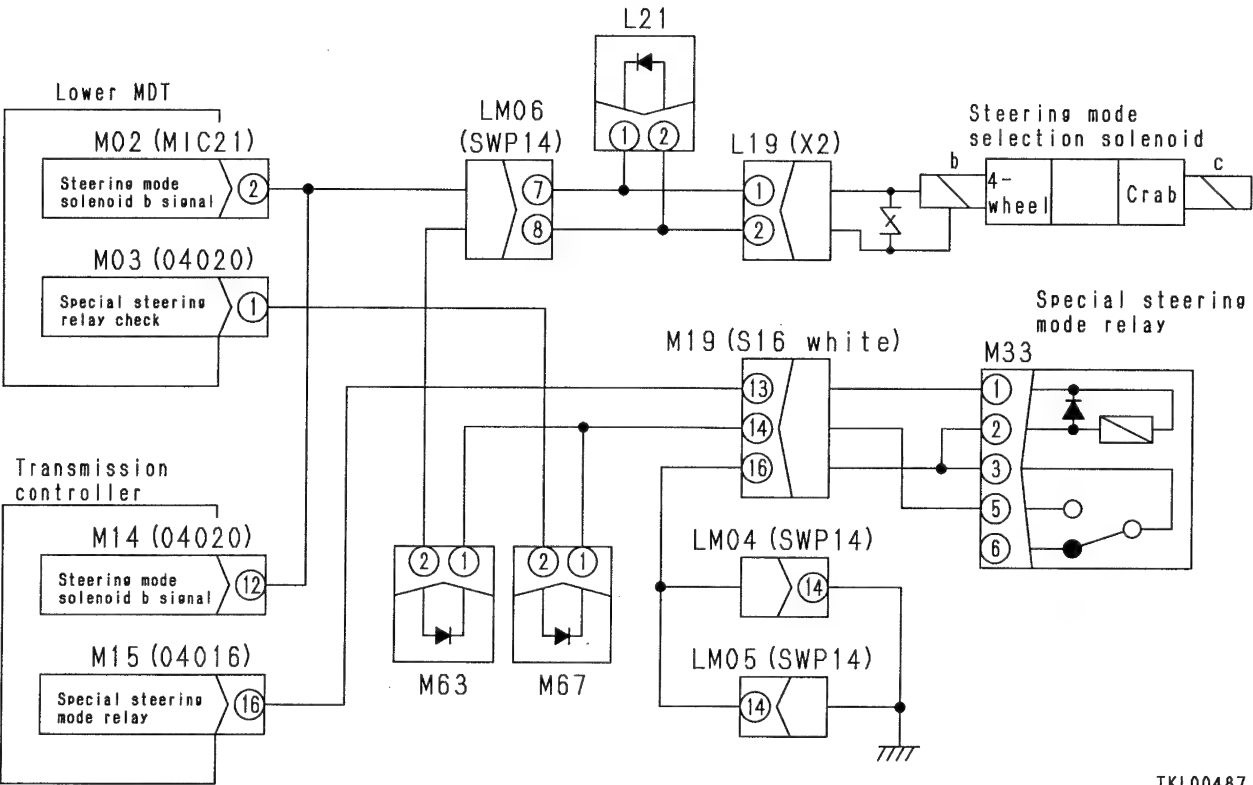
TKL00486

EL-80 MDTL error EA2 (Steering mode solenoid b short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<div> <div> 1 YES </div> <div> Is voltage between M02 (female) (2), L19 (female) (1) and chassis normal? </div> </div>	Defective lower MDT	Repair or replace
<div> <div>NO</div> <div> <div> • Max. 1 V</div> <div> • Disconnect M02, L19, and M14.</div> <div> • Turn starting switch ON.</div> </div> </div>	Wiring harness between M02 (female) (2) - M14 (female) (12) - LM06 (7) - L19 (female) (1) short circuiting with power source	Repair or replace

EL-80 Related electric circuit diagram



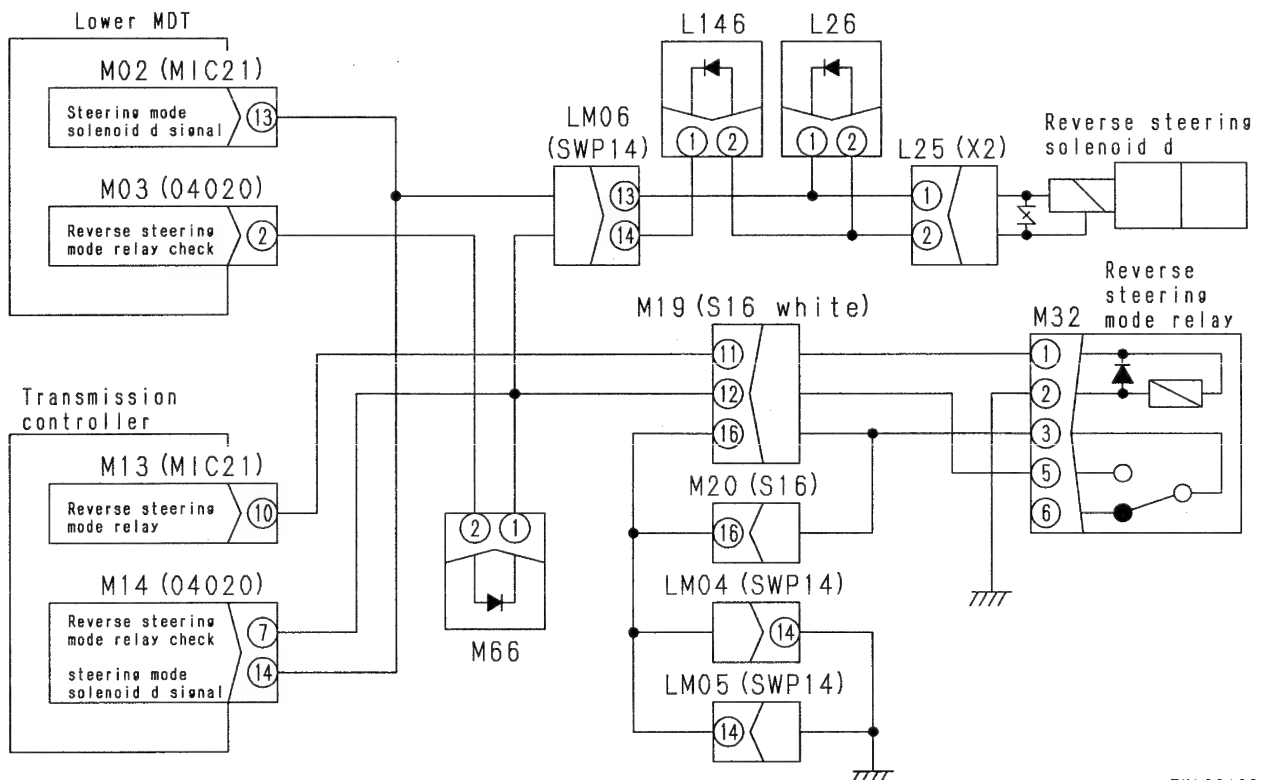
TKL00487

EL-81 MDTL error EA3 (Steering mode solenoid d short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Is voltage between M02 (female) (13), L25 (female) (1) and chassis normal?		Cause	Remedy
1 YES • Max. 1 V • Disconnect M02, L25, and M14. • Turn starting switch ON.	NO	Defective lower MDT Wiring harness between M02 (female) (13) - M14 (female) (14) - LM06 (13) - L25 (female) (1) short circuiting with power source	Repair or replace Repair or replace

EL-81 Related electric circuit diagram



TKL00488

EL-82 MDTL error EA4 (Swing pump merge solenoid short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Does display go out when M 31 is interchanged with other relay?

• Turn starting switch ON.

YES

2

Is voltage between M02 (female) (3) and chassis ground normal?

• Disconnect M02.

• Turn starting switch ON.

• Max. 1 V

NO

NO

Defective swing pump merge solenoid relay

Replace

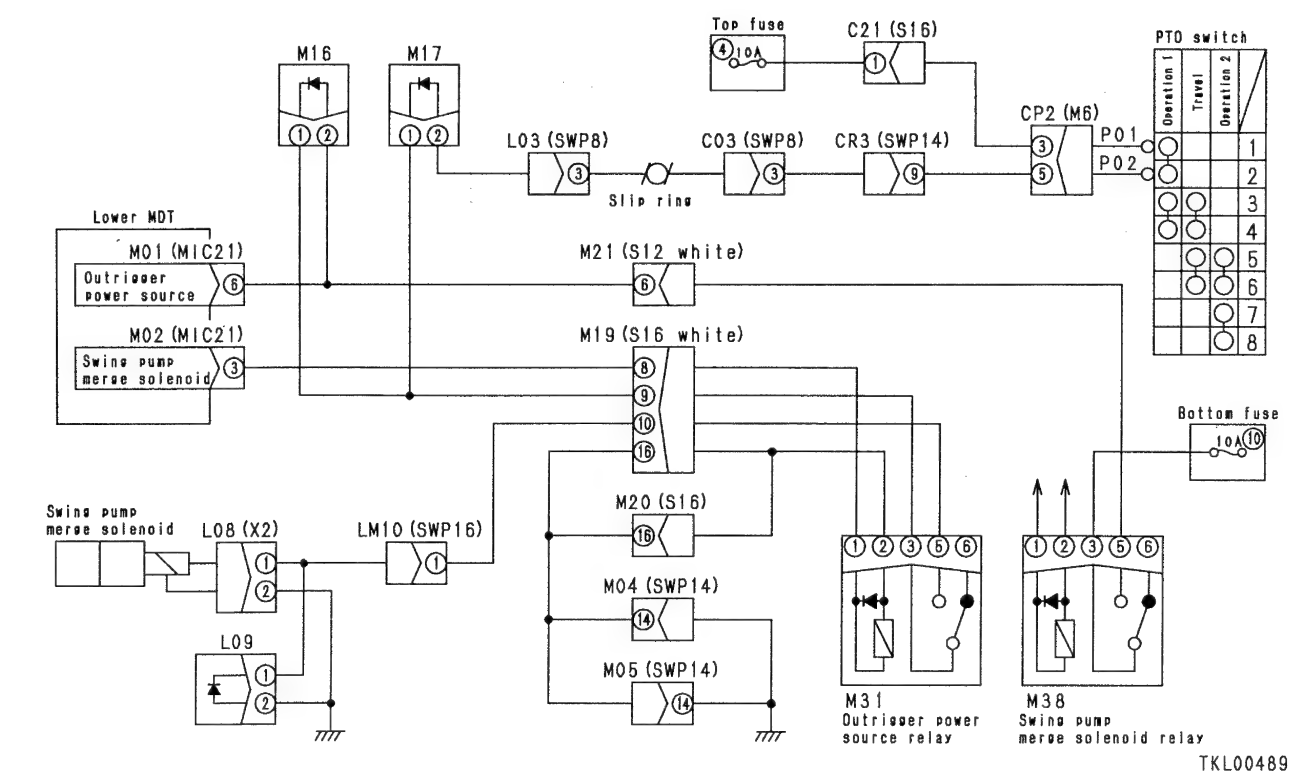
Defective lower MDT

Replace

Wiring harness between M02 (female) (3) - M19 (8) - M31 (female) (1) short circuiting with power source

Repair or replace

EL-82 Related electric circuit diagram



023S02

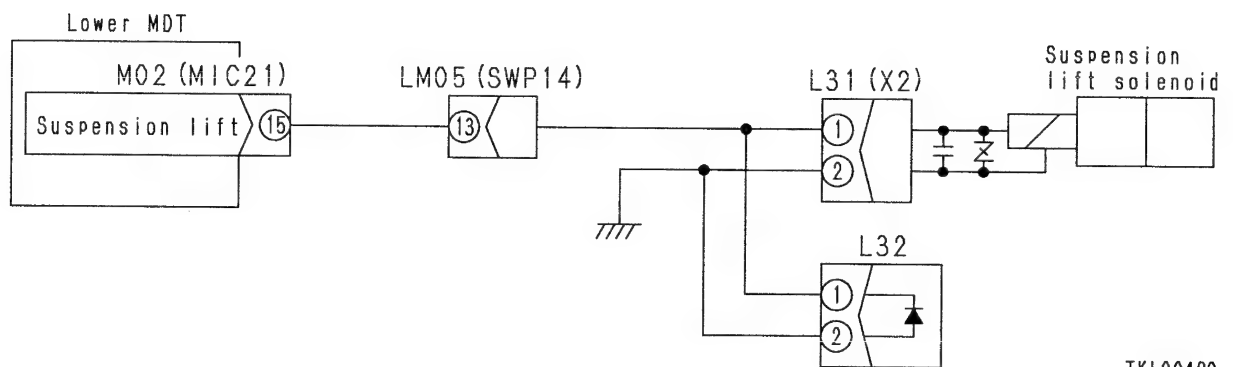
EL-83 MDTL error EA7 (Suspension lift solenoid short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Is voltage between M02 (female) (15), L31 (female) (1) and chassis normal?</p> <p>• Max. 1 V</p> <p>• Disconnect M02 and L31.</p> <p>• Turn starting switch ON.</p>	YES	Defective lower MDT	Repair or replace
	NO	Wiring harness between M02 (female) (15) - LM05 (13) - L31 (female) (1) short circuiting with power source	Repair or replace

023S02

EL-83 Related electric circuit diagram

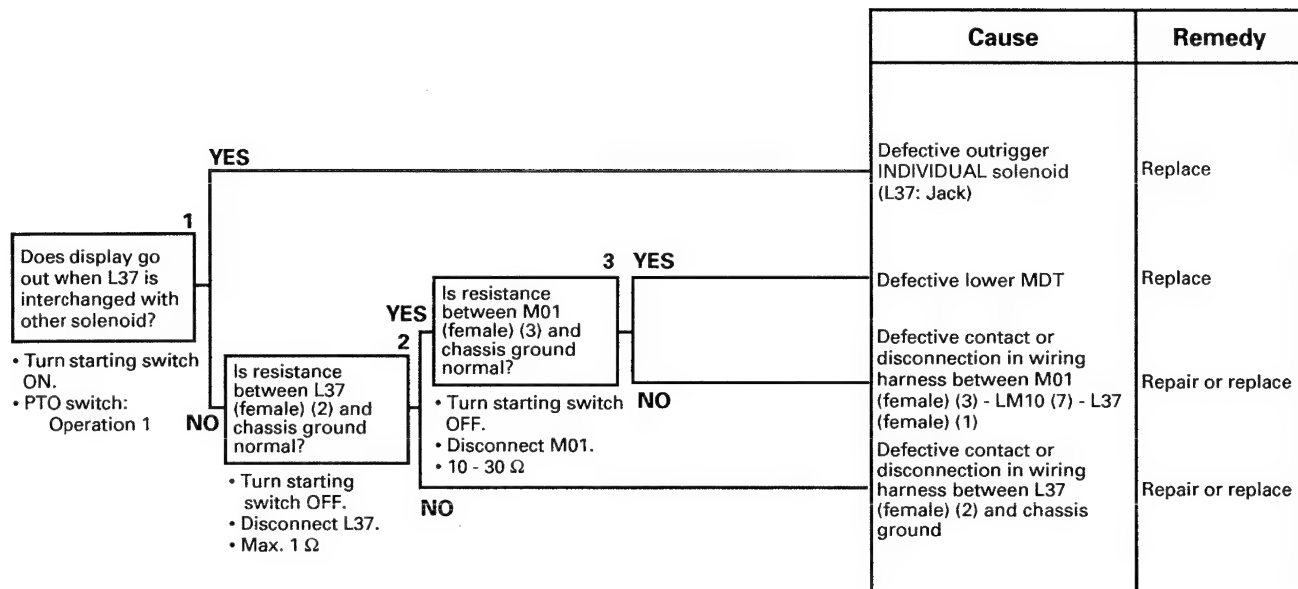


TKL00490

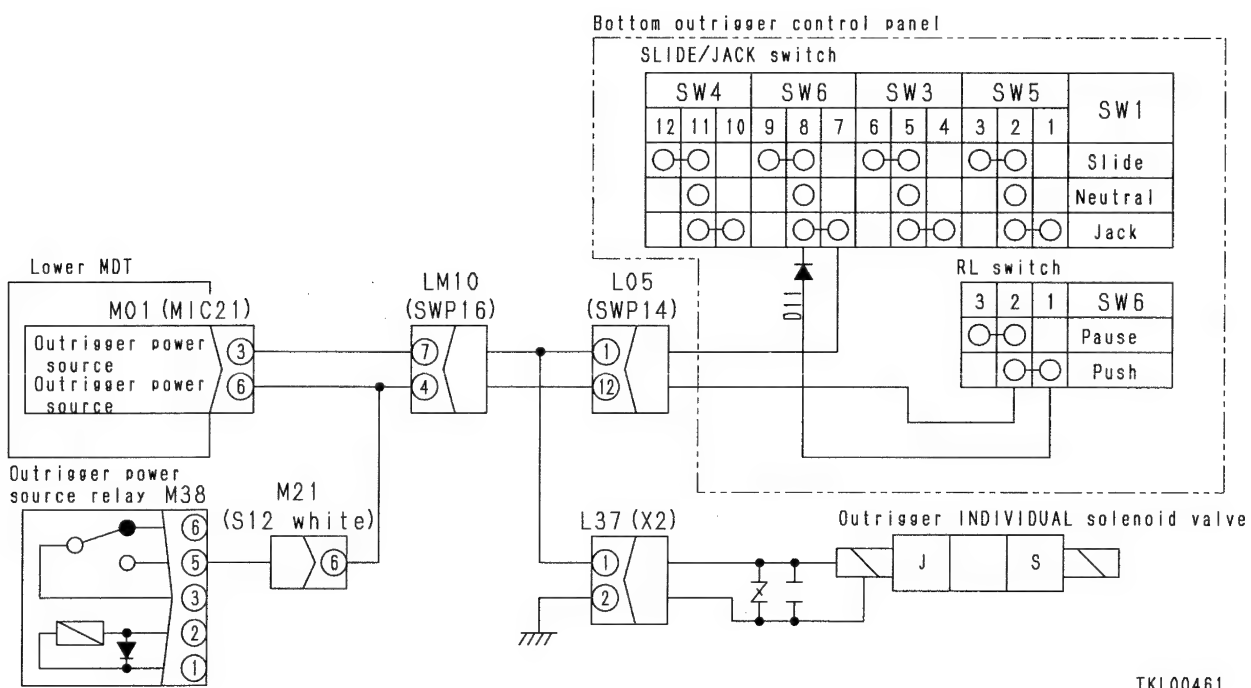
EL-84 MDTL error EB0 (Disconnection in outrigger jack RL) is displayed

X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

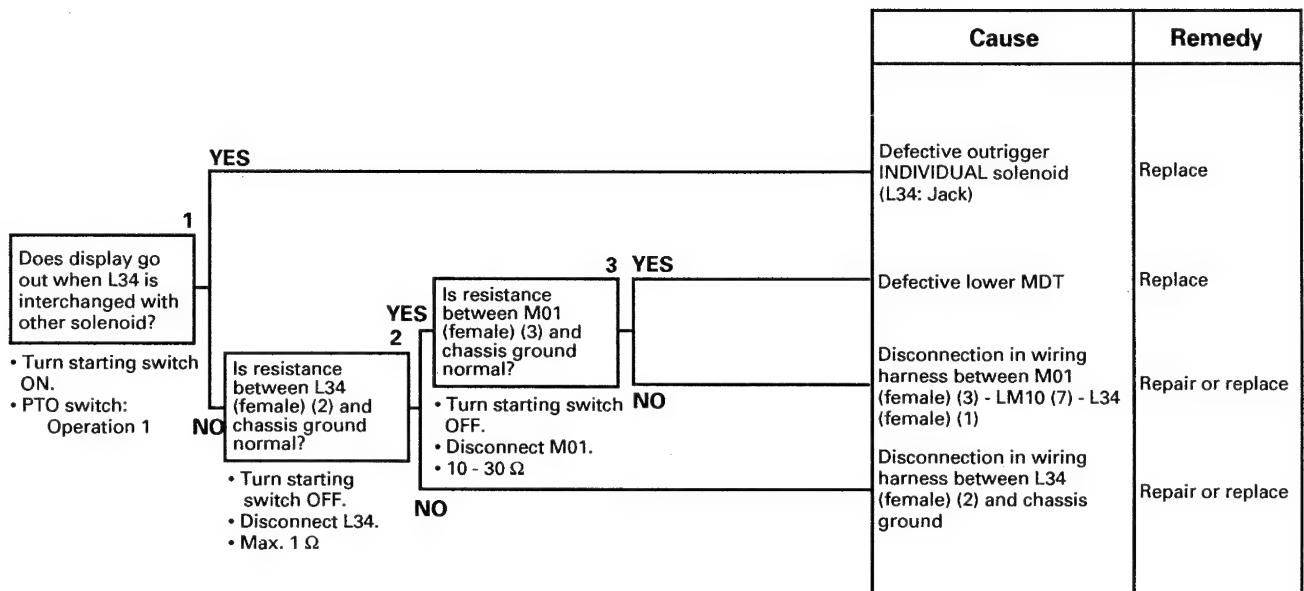


EL-84 Related electric circuit diagram (X-shaped outrigger)



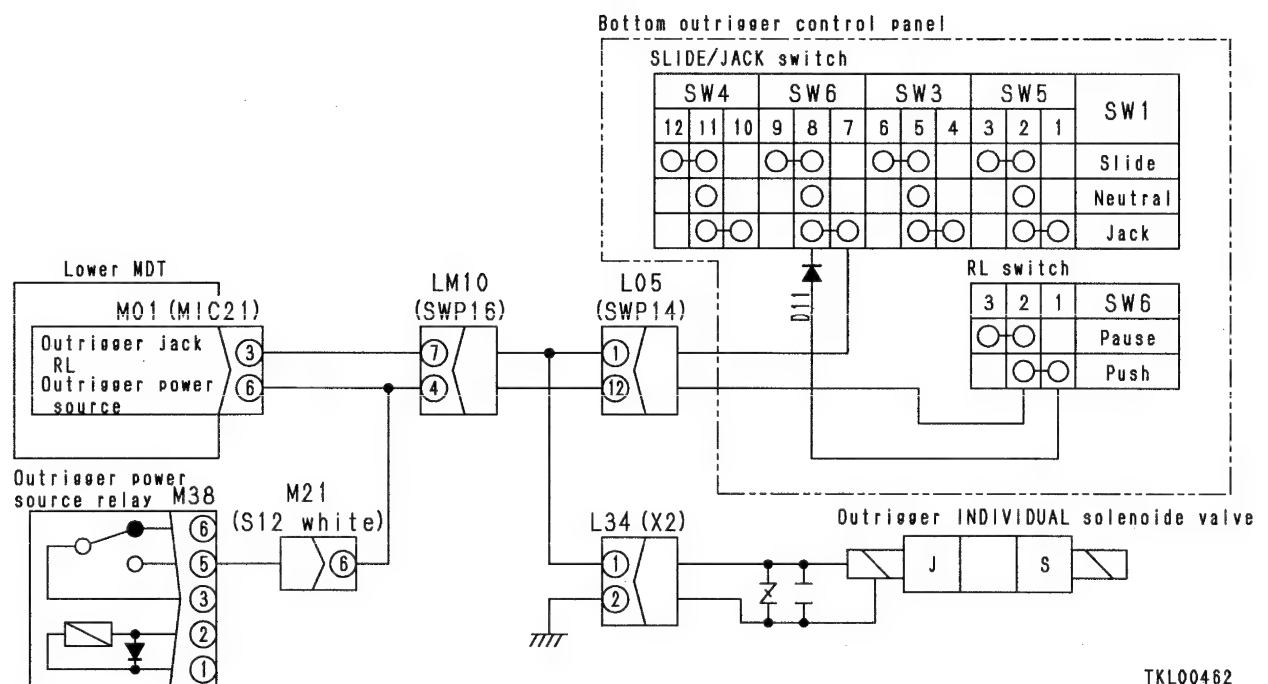
H-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EL-84 Related electric circuit diagram (H-shaped outrigger)

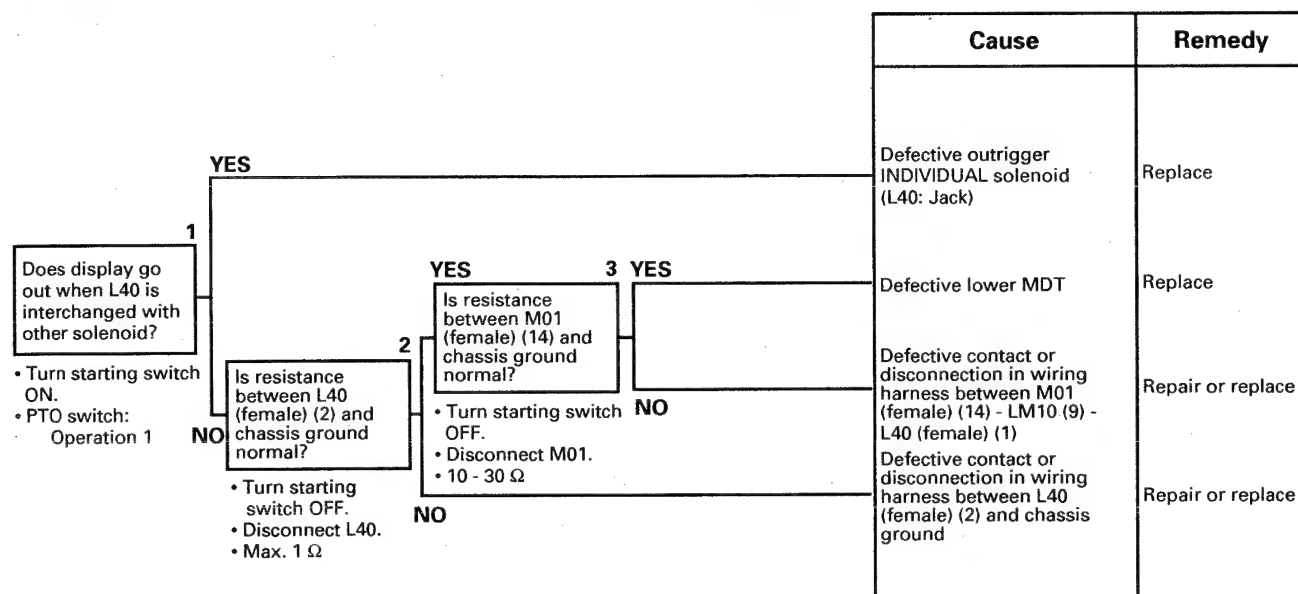


TKL00462

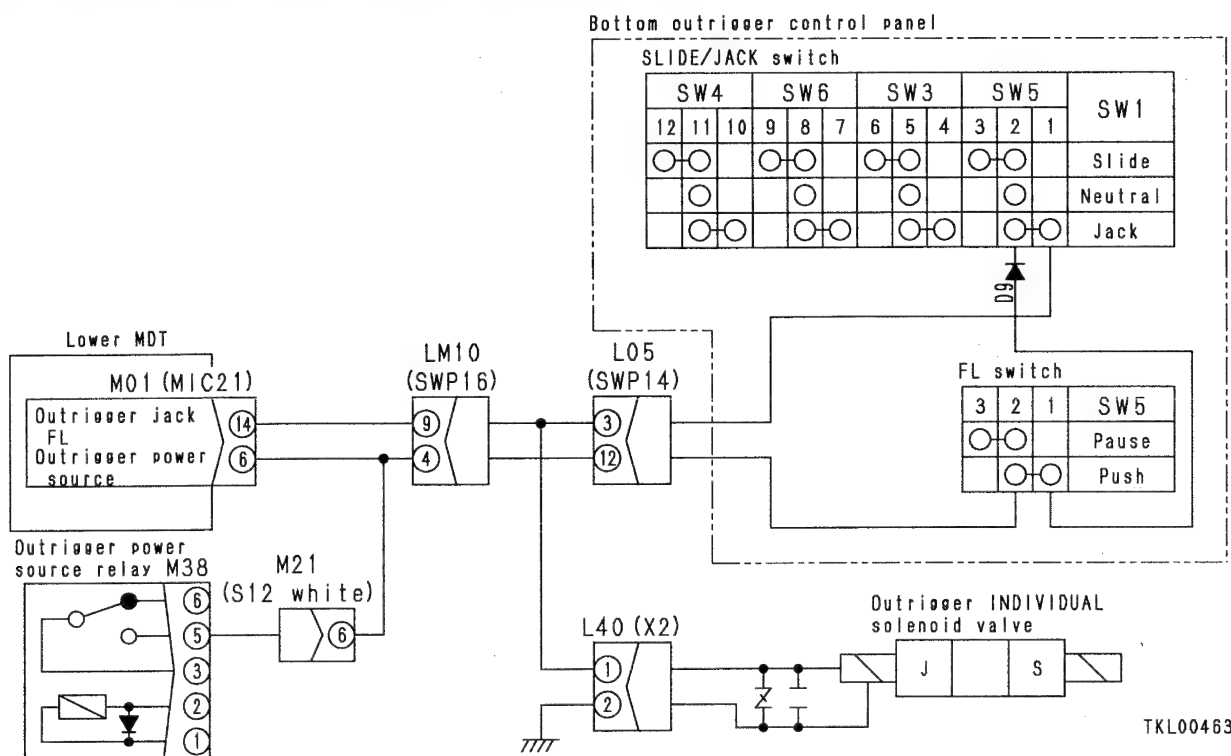
EL-85 MDTL error EB1 (Disconnection in outrigger jack FL) is displayed

X-shaped outrigger specification

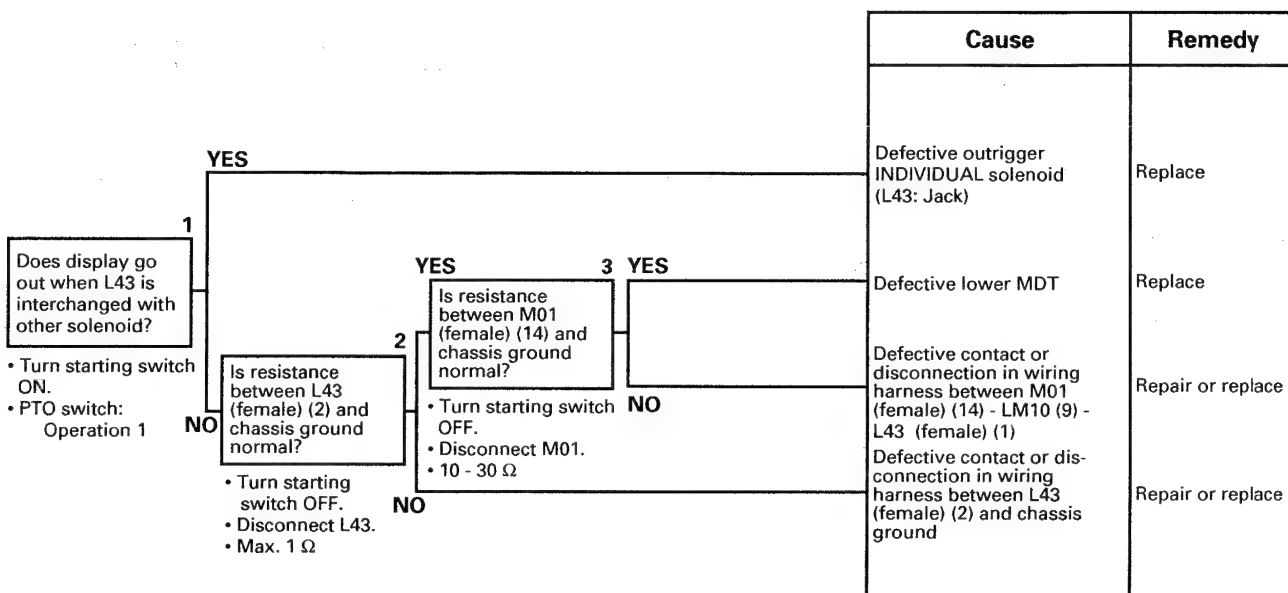
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



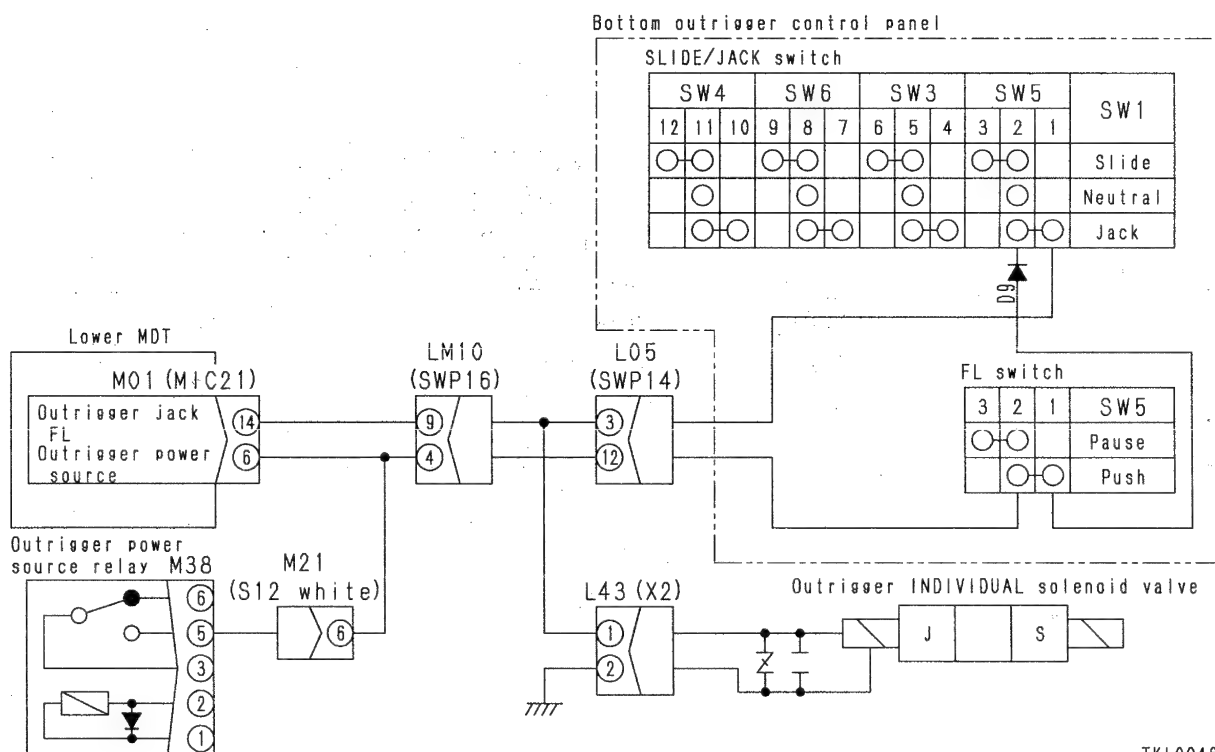
EL-85 Related electric circuit diagram (X-shaped outrigger)



- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-85 Related electric circuit diagram (H-shaped outrigger)

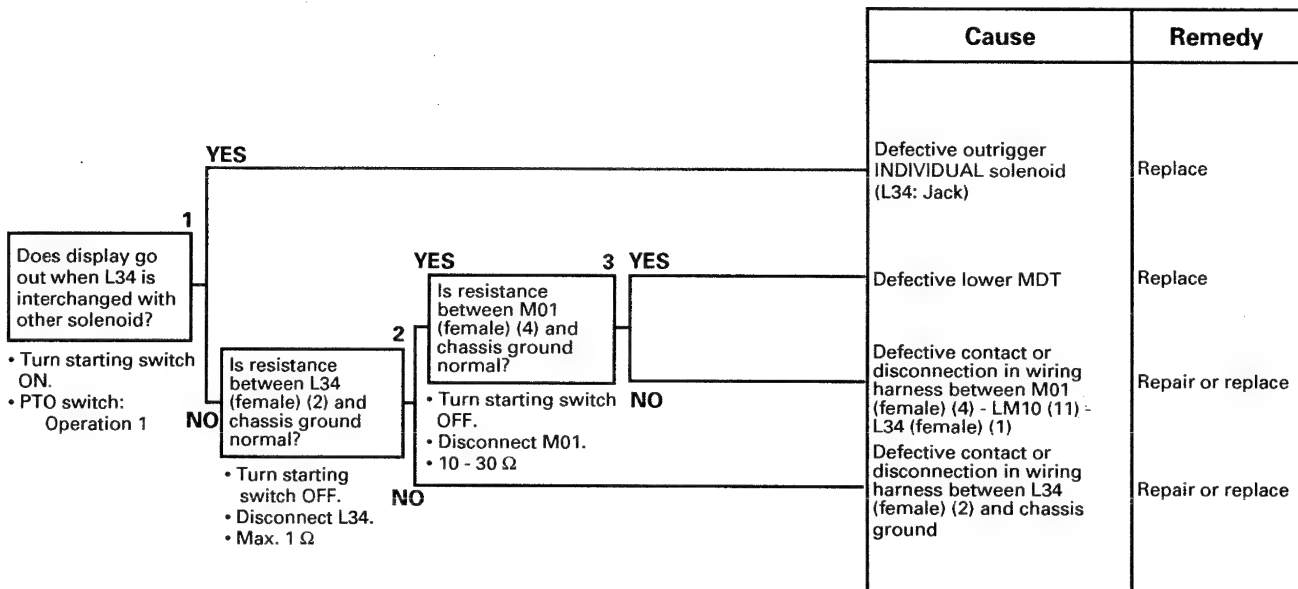


TKL00464

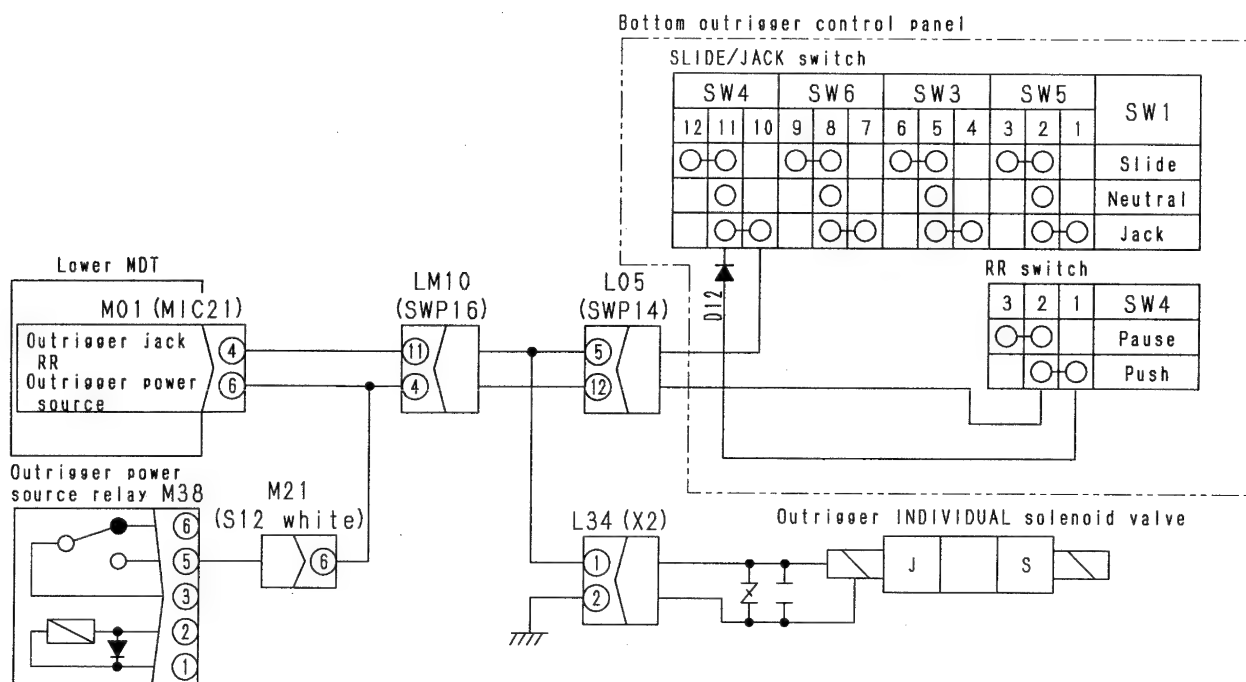
EL-86 MDTL error EB2 (Disconnection in outrigger jack RR) is displayed

X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



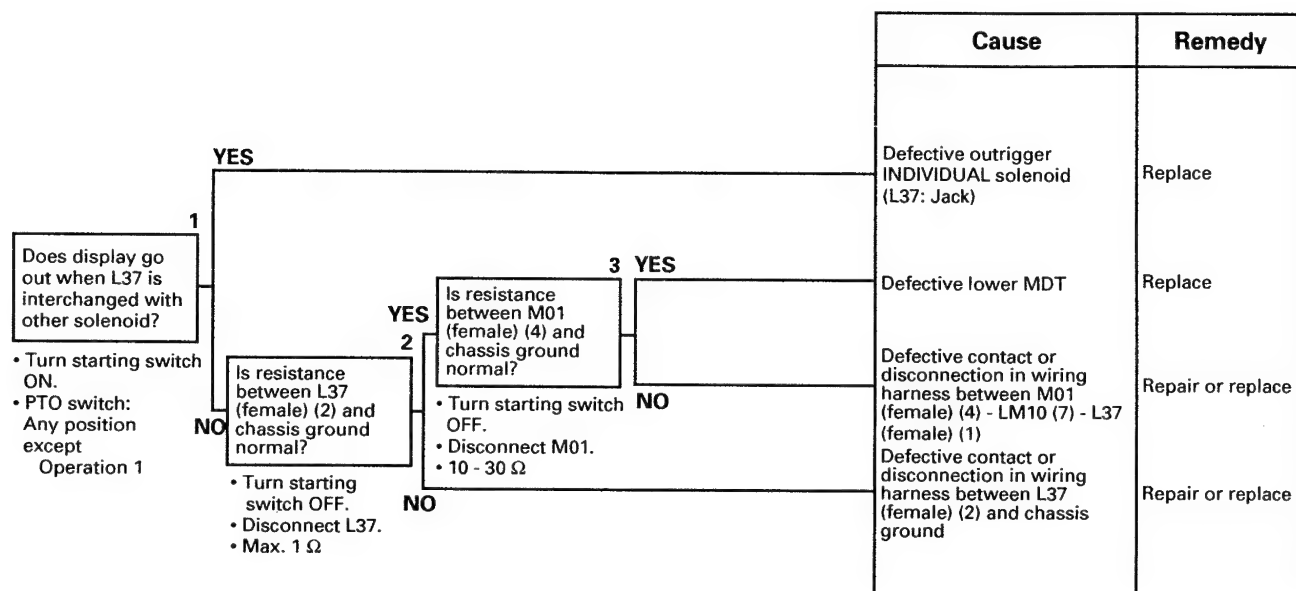
EL-86 Related electric circuit diagram (X-shaped outrigger)



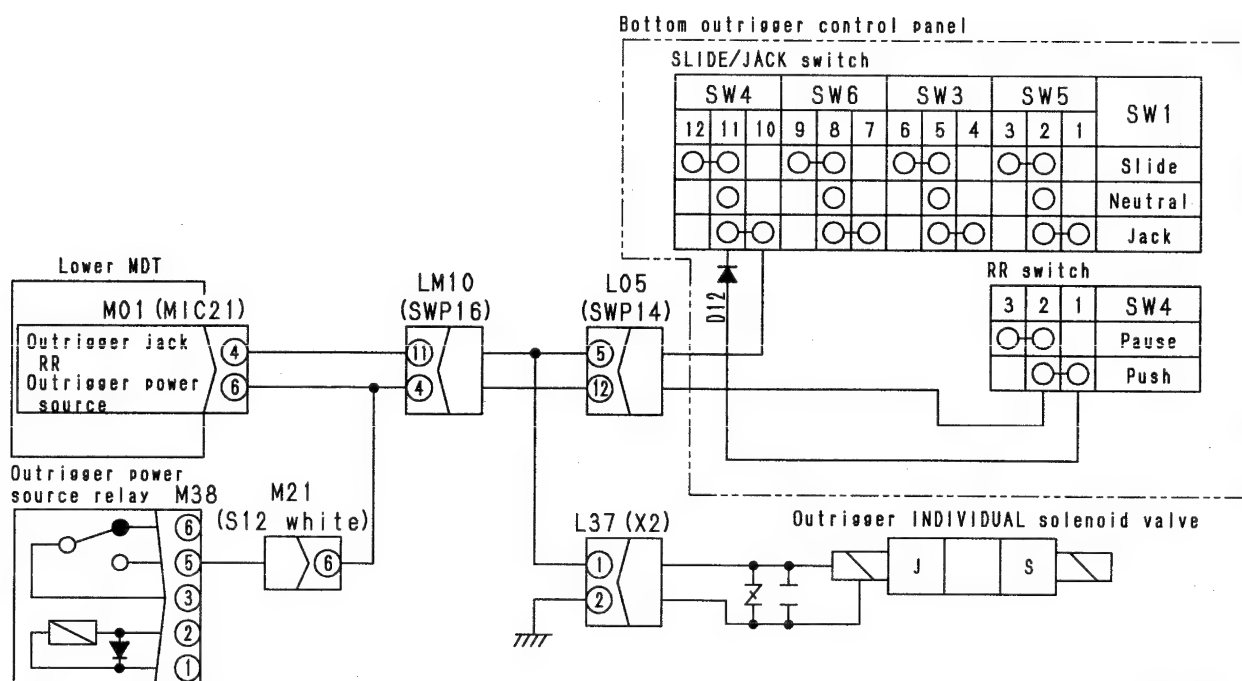
TKL00465

H-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-86 Related electric circuit diagram (H-shaped outrigger)

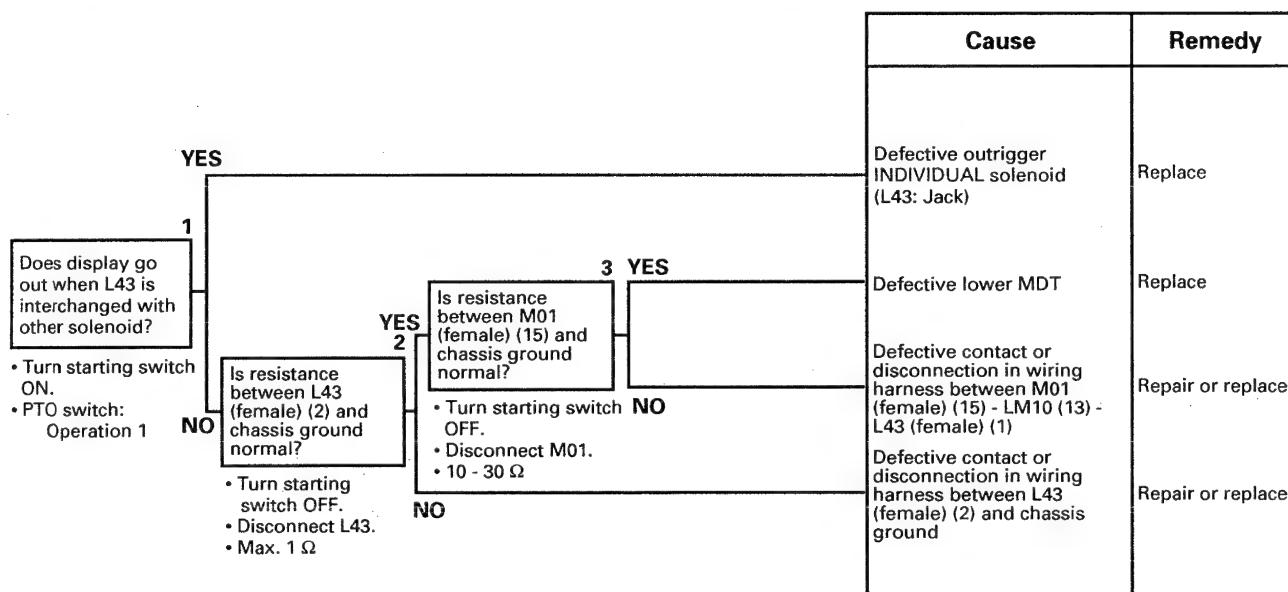


TKL00466

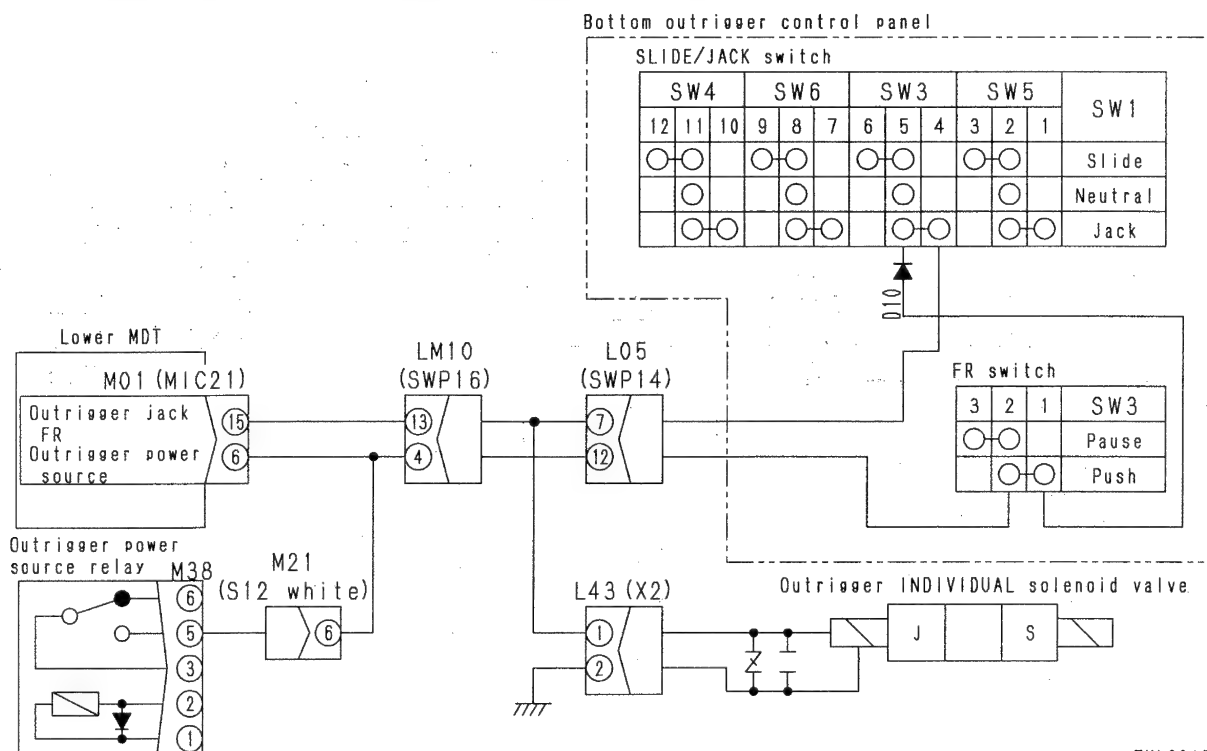
EL-87 MDTL error EB3 (Disconnection in outrigger jack FR) is displayed

X-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



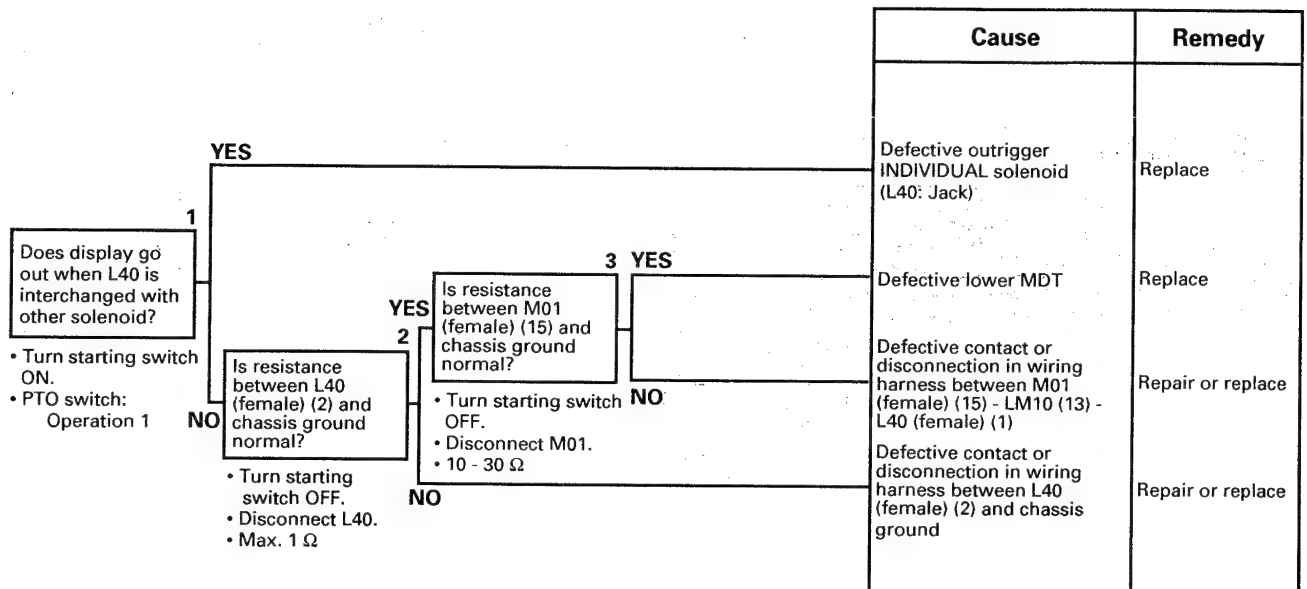
EL-87 Related electric circuit diagram (X-shaped outrigger)



TKL00467

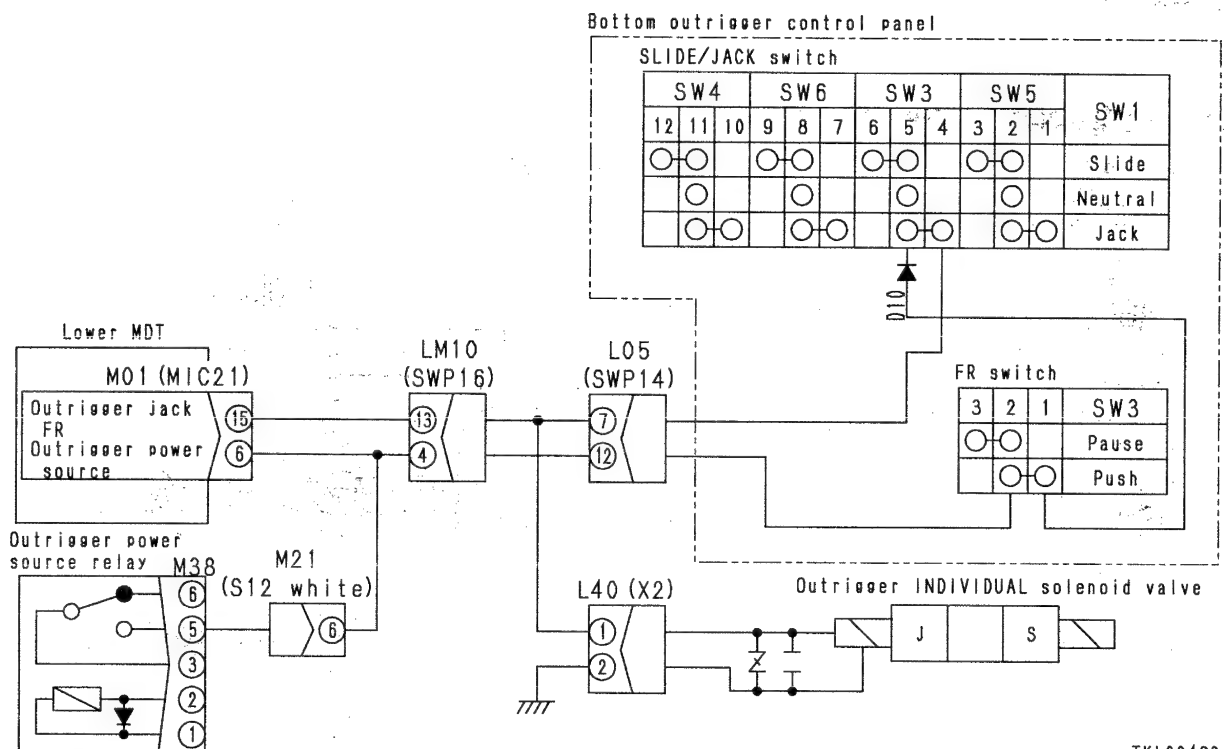
H-shaped outrigger specification

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



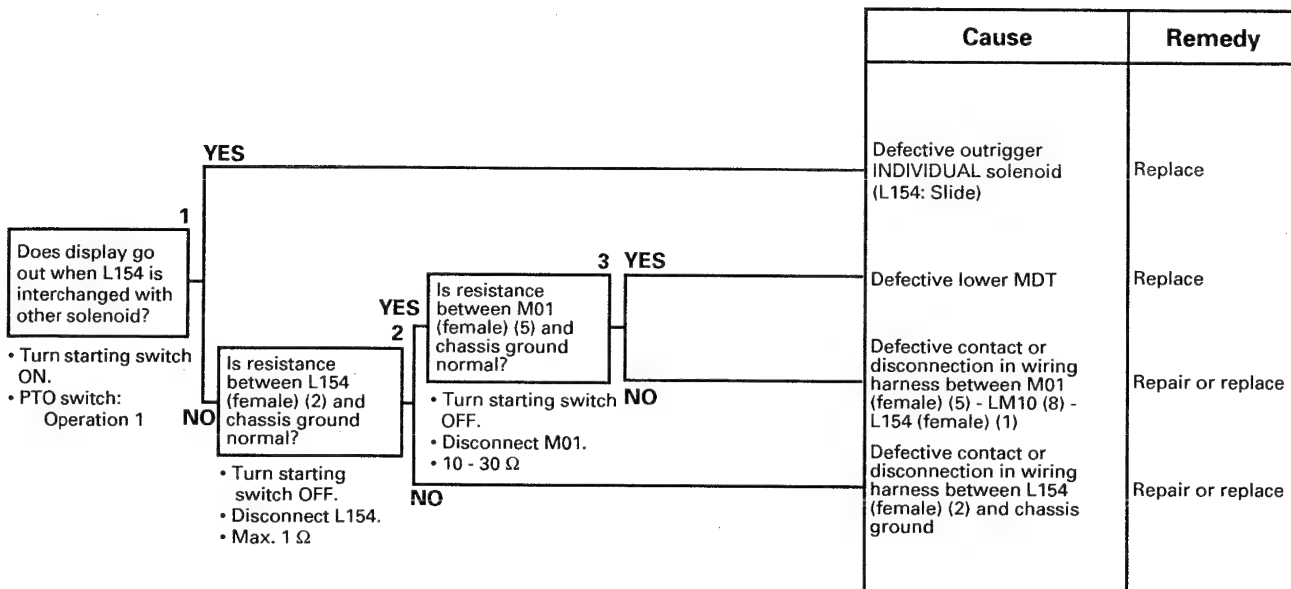
023S02

EL-87 Related electric circuit diagram (H-shaped outrigger)



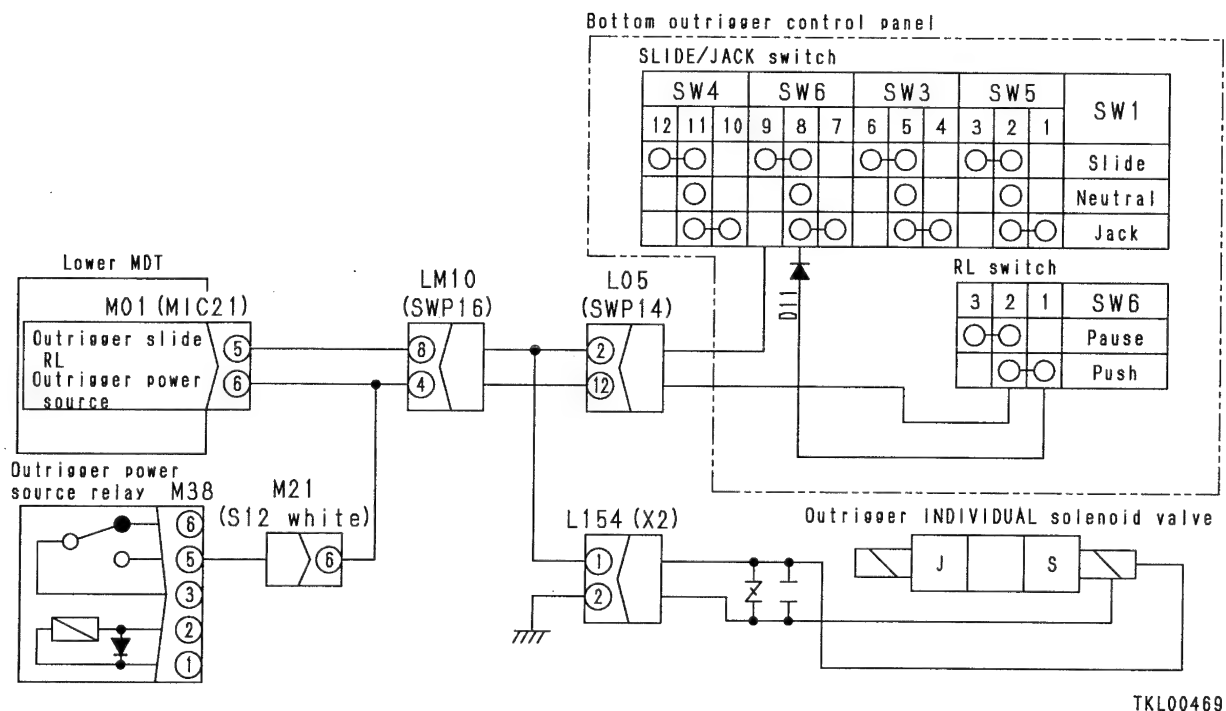
EL-88 MDTL error EB4 (Disconnection in outrigger slide RL) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

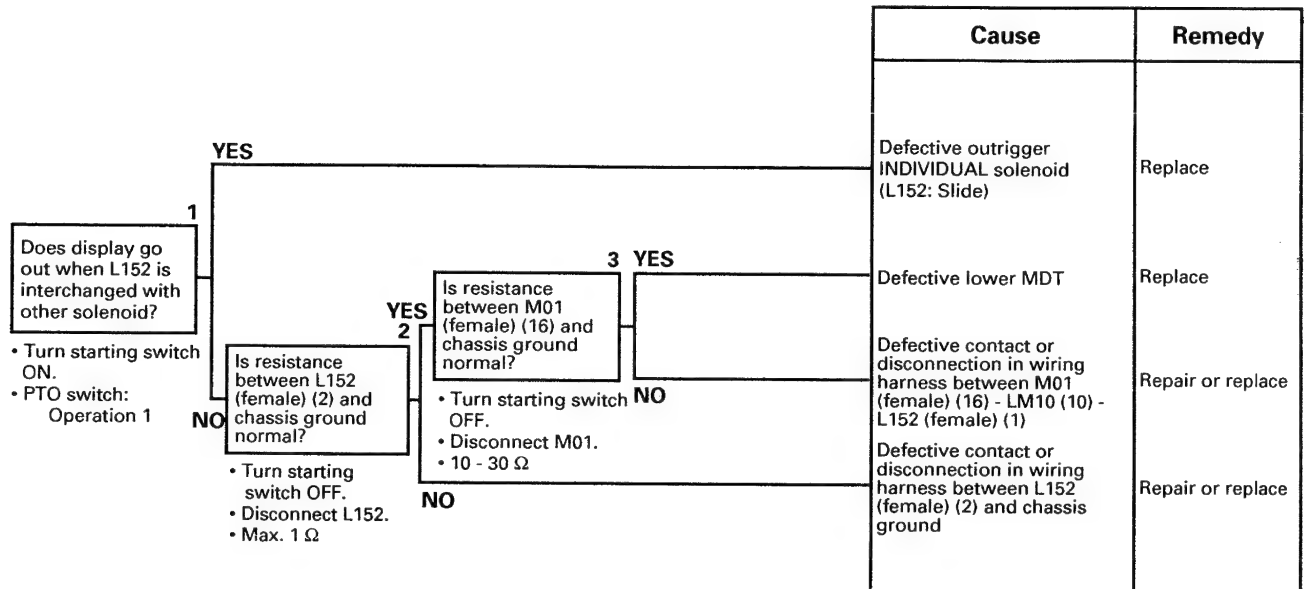
EL-87 Related electric circuit diagram



TKL00469

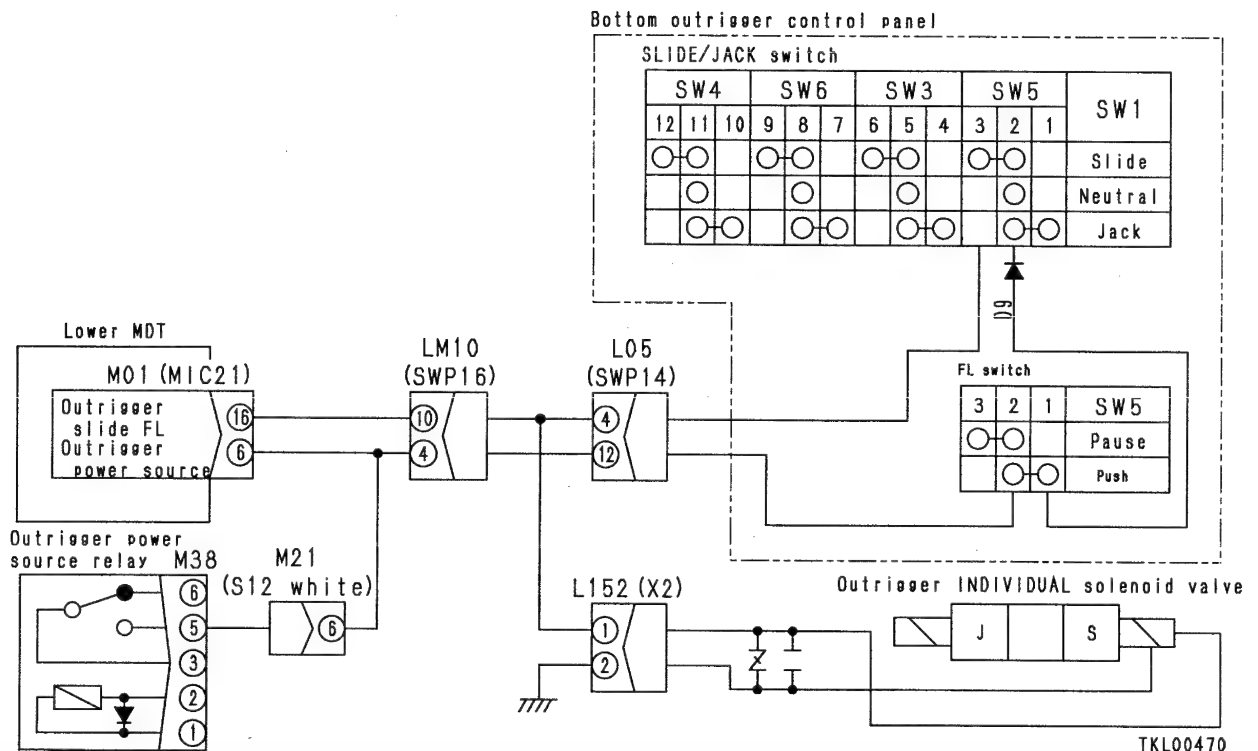
EL-89 MDTL error EB5 (Disconnection in outrigger slide FL) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



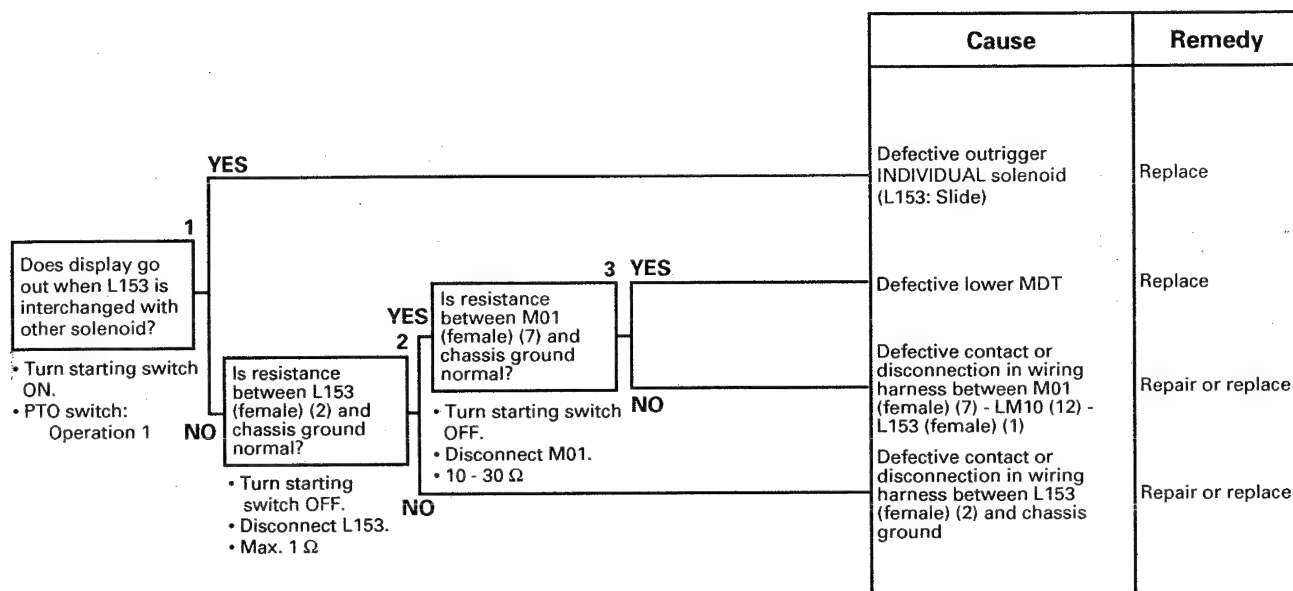
023S02

EL-89 Related electric circuit diagram



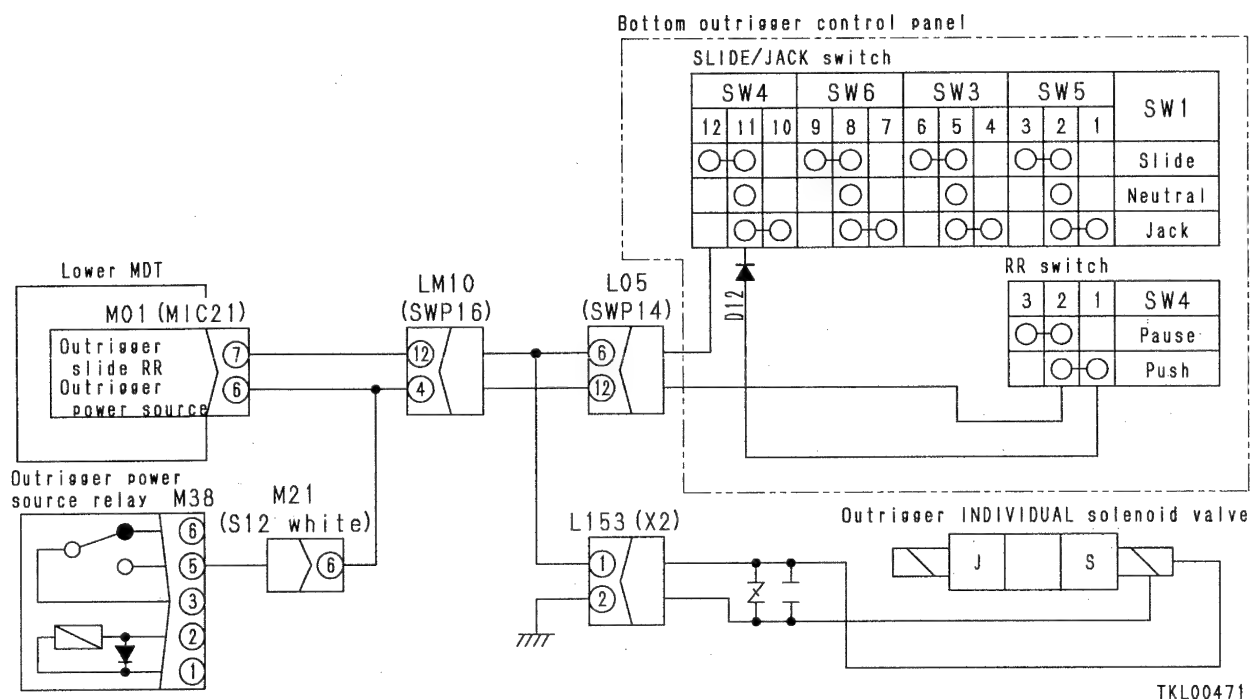
EL-90 MDTL error EB6 (Disconnection in outrigger slide RR) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



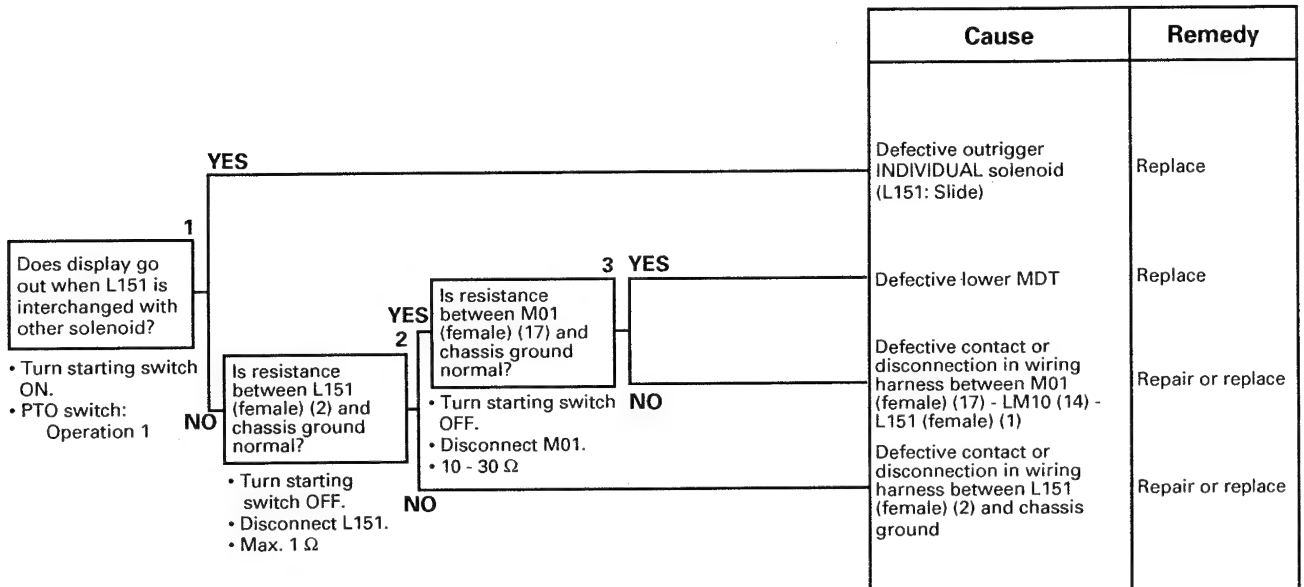
023S02

EL-90 Related electric circuit diagram



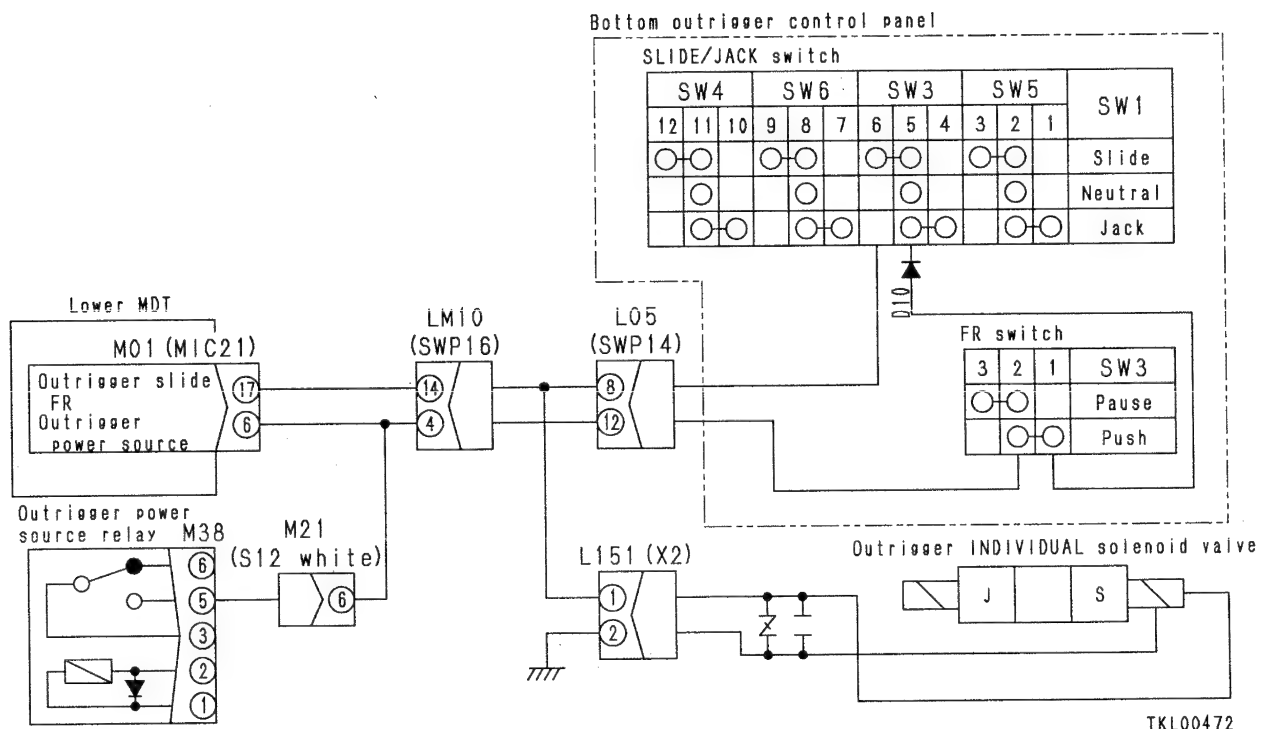
EL-89 MDTL error EB5 (Disconnection in outrigger slide FL) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

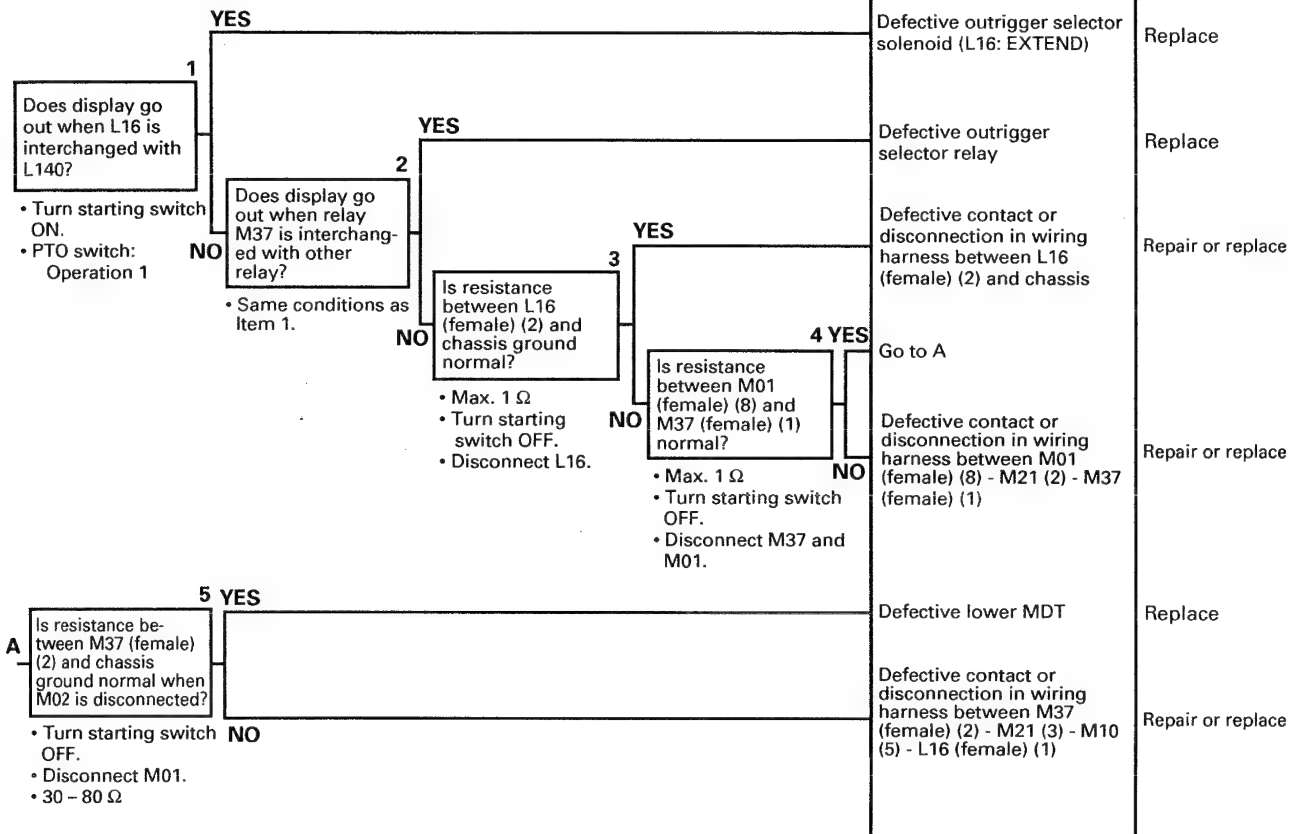


023S02

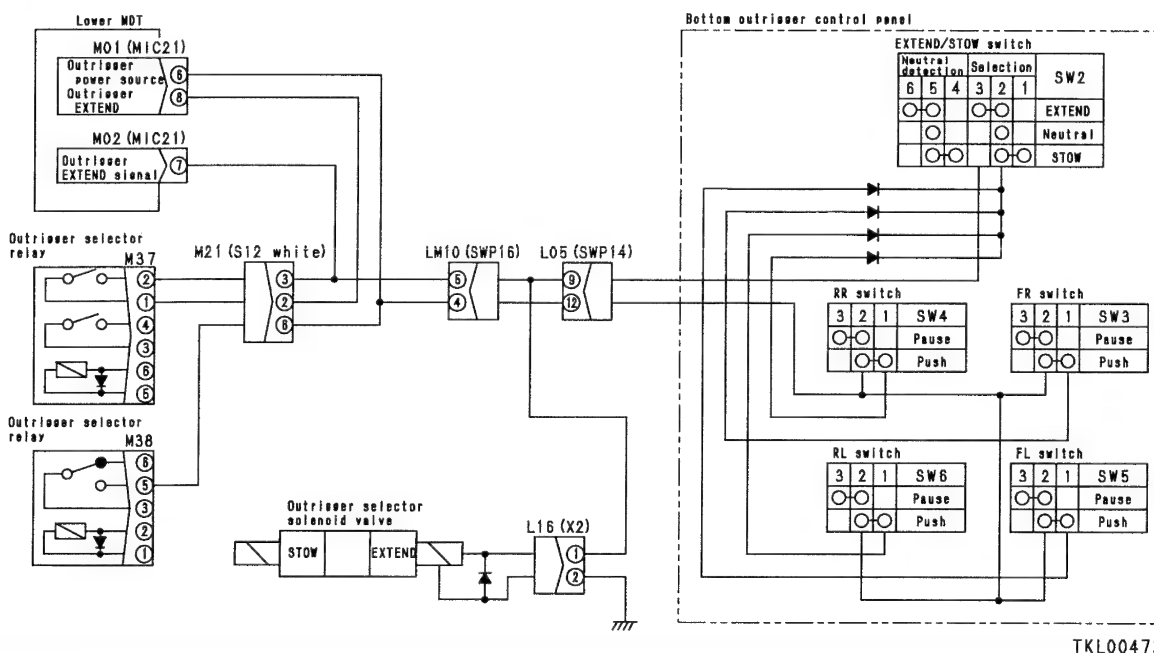
EL-91 Related electric circuit diagram



- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

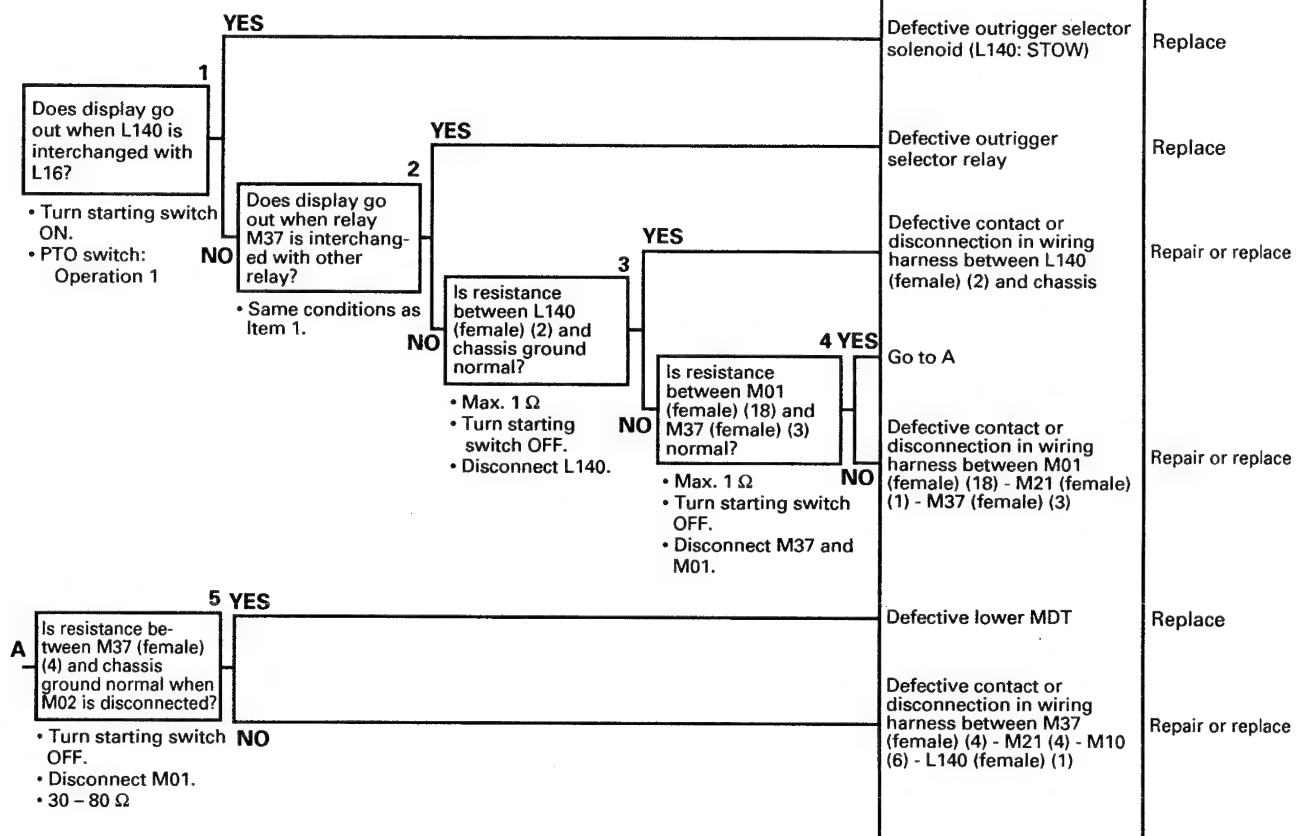


023S02

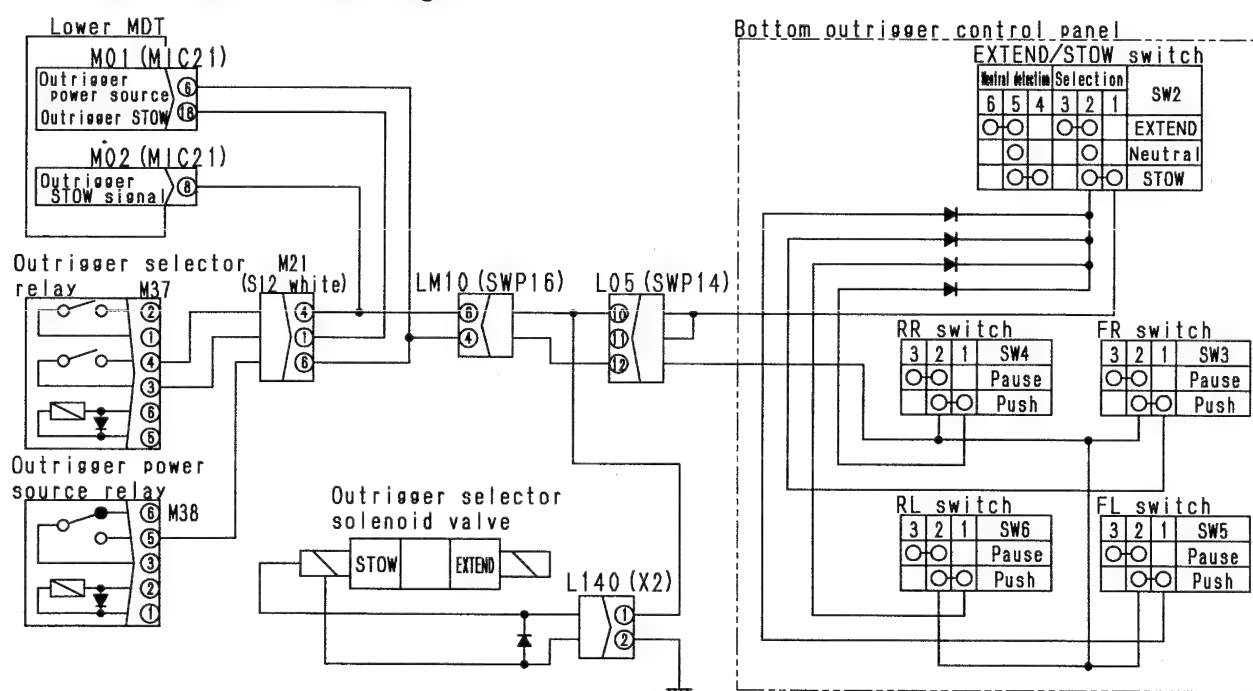


EL-93 MDTL error EB9 (Disconnection in outrigger selector STOW) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-93 Related electric circuit diagram

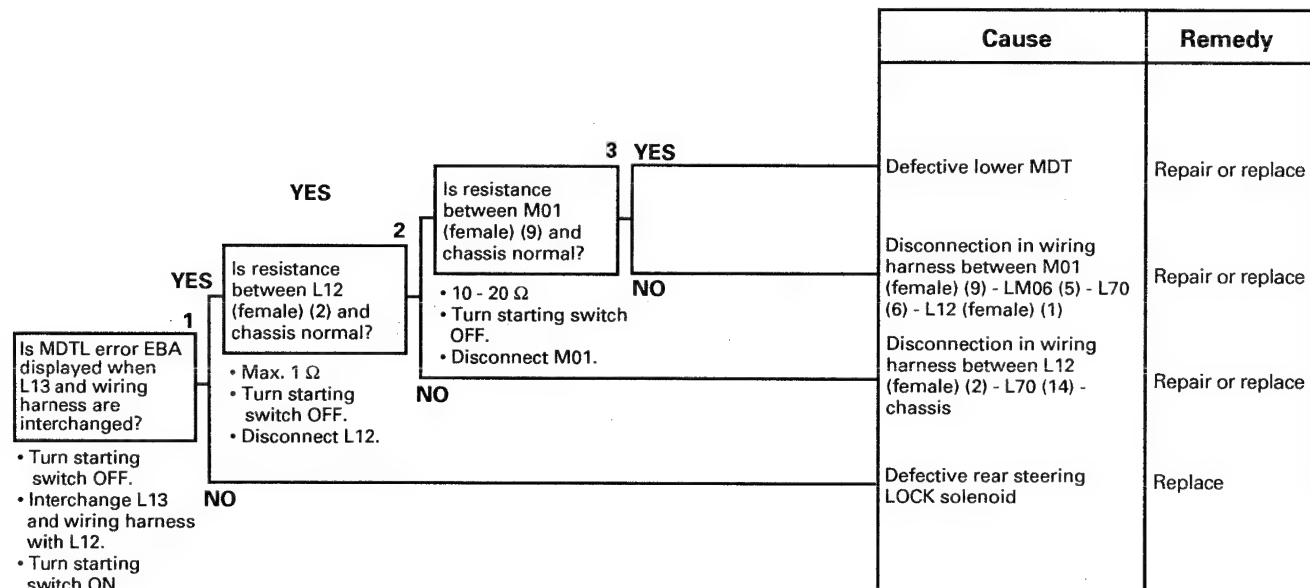


TKL00691

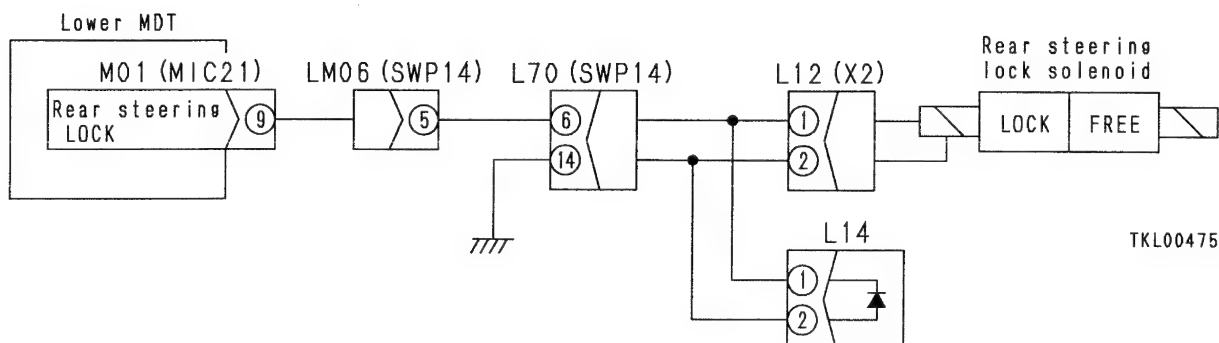
023S02

EL-94 MDTL error EBA (Disconnection in rear steering LOCK solenoid) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-94 Related electric circuit diagram

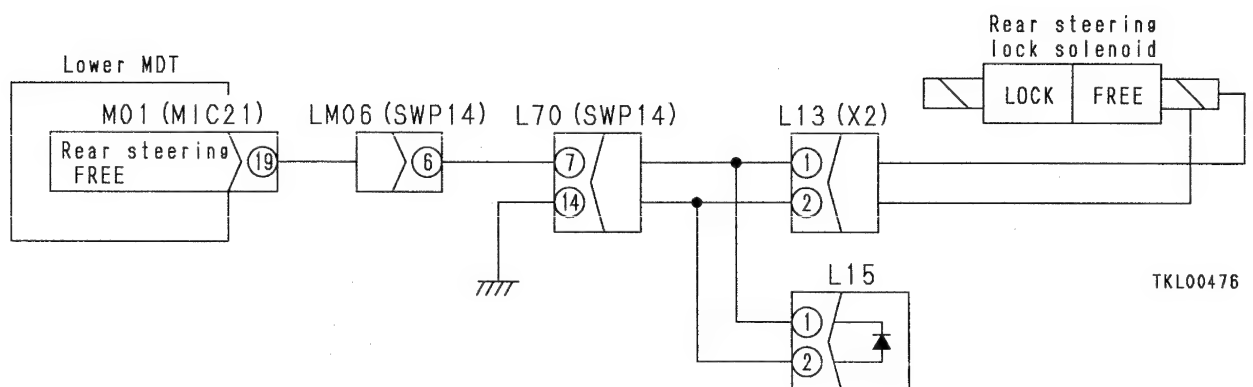


EL-95 MDTL error EBB (Disconnection in rear steering FREE solenoid) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

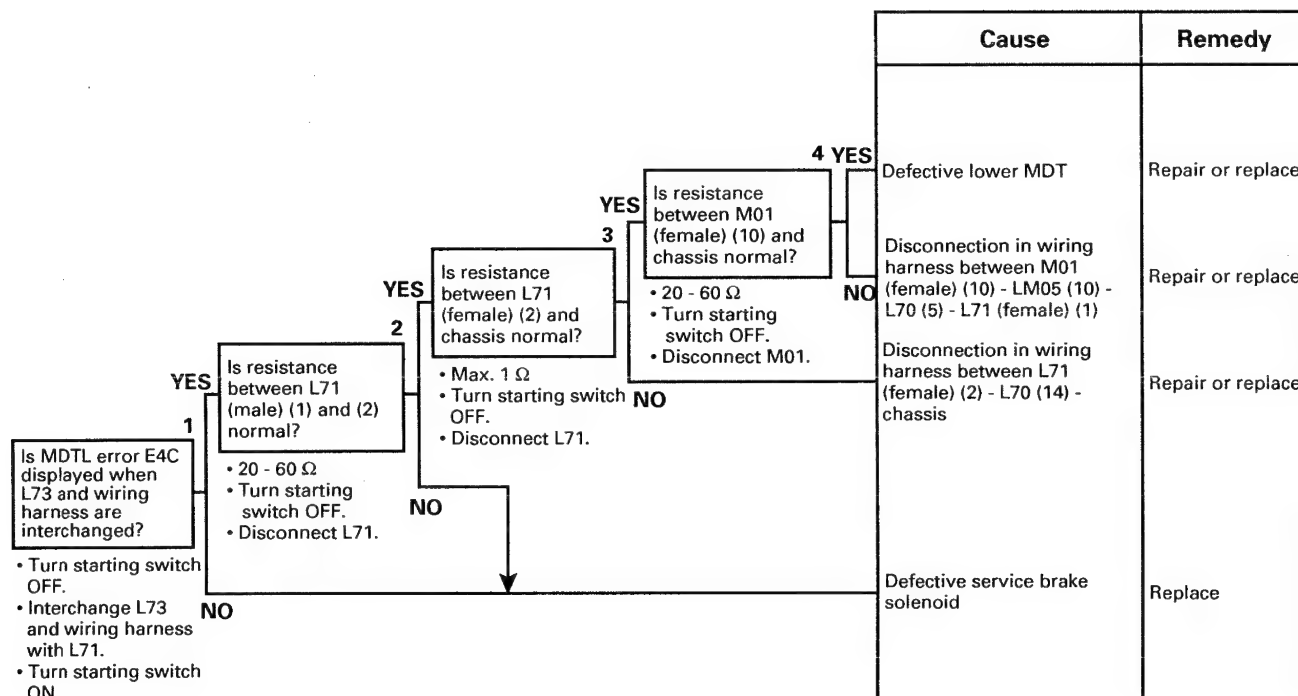
		Cause	Remedy
<p>023S02</p> <p>1</p> <p>Is MDTL error EBB displayed when L12 and wiring harness are interchanged?</p> <p>• Turn starting switch OFF.</p> <p>• Interchange L12 and wiring harness with L13.</p> <p>• Turn starting switch ON.</p>	YES		
	2	Is resistance between L13 (female) (2) and chassis normal?	
	YES	<p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect L13.</p>	
	NO		
	3	Is resistance between M01 (female) (19) and chassis normal?	
	YES	<p>• 10 - 20 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M01.</p>	
	NO		
		Defective lower MDT	Repair or replace
		Disconnection in wiring harness between M01 (female) (19) - LM06 (6) - L70 (7) - L13 (female) (1)	Repair or replace
		Disconnection in wiring harness between L13 (female) (2) - L70 (14) - chassis	Repair or replace
		Defective rear steering FREE solenoid	Replace

EL-95 Related electric circuit diagram

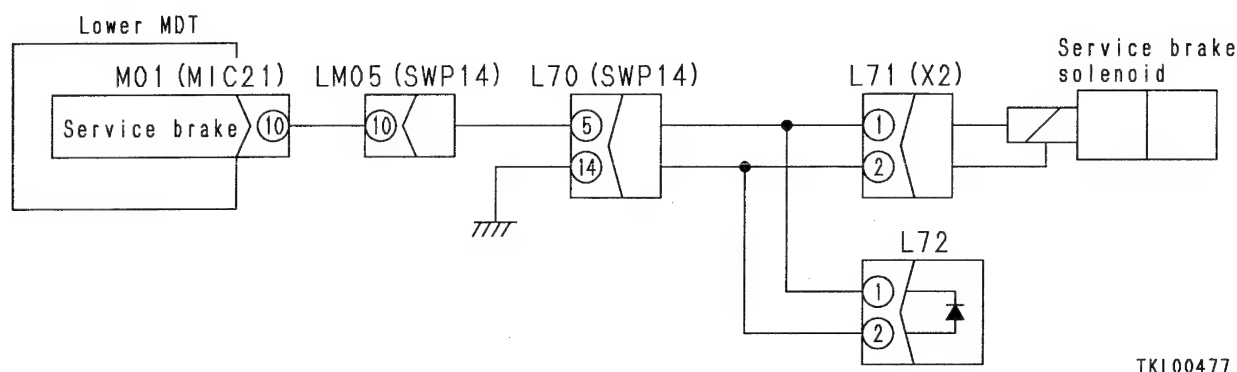


EL-96 MDTL error EBC (Disconnection in service brake solenoid) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-96 Related electric circuit diagram

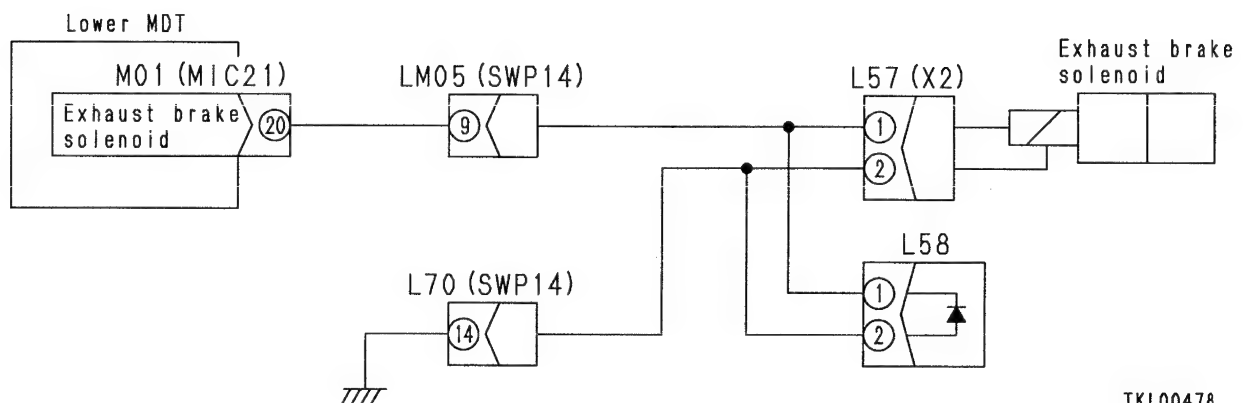


EL-97 MDTL error EBD (Disconnection in exhaust brake solenoid) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>023S02</p> <p>1</p> <p>Is resistance between L57 (male) (1) and (2) normal?</p> <ul style="list-style-type: none"> • 20 - 60 Ω • Turn starting switch OFF. • Disconnect L57. <p>YES</p> <p>2</p> <p>Is resistance between L57 (female) (2) and chassis normal?</p> <ul style="list-style-type: none"> • Max. 1 Ω • Turn starting switch OFF. • Disconnect L57. <p>YES</p> <p>3</p> <p>Is resistance between M01 (female) (20) and chassis normal?</p> <ul style="list-style-type: none"> • 20 - 60 Ω • Turn starting switch OFF. • Disconnect M01. <p>YES</p> <p>NO</p>		Defective lower MDT	Repair or replace
		Disconnection in wiring harness between M01 (female) (20) - LM05 (9) - L57 (female) (1)	Repair or replace
		Disconnection in wiring harness between L57 (female) (2) - L70 (14) - chassis	Repair or replace
		Defective exhaust brake solenoid	Replace

EL-97 Related electric circuit diagram



TKL00478

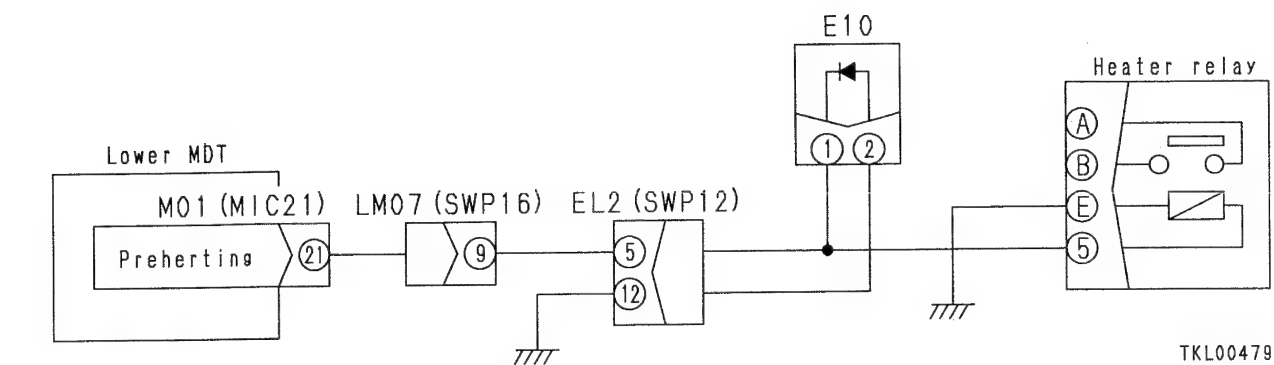
EL-98 MDTL error EBF (Disconnection in preheating [heater relay circuit]) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

			Cause	Remedy
<div><div>1</div><div>Is resistance between heater relay terminals (5) - E normal?</div><div><ul style="list-style-type: none">• 20 - 24 Ω• Turn starting switch OFF.• Disconnect heater relay terminal.</div></div> <div><div>2</div><div>Is resistance between heater relay terminal E and chassis normal?</div><div><ul style="list-style-type: none">• Max. 1 Ω• Turn starting switch OFF.• Disconnect M01 and heater relay terminal.</div></div> <div><div>3</div><div>Is resistance between M01 (female) (21) and chassis normal?</div><div><ul style="list-style-type: none">• 10 - 20 Ω• Turn starting switch OFF.• Disconnect M01.</div></div>			Defective lower MDT	Repair or replace
YES			Disconnection in wiring harness between M01 (female) (21) - LM07 (9) - EL2 (5) - heater relay terminal (5)	Repair or replace
NO			Disconnection in wiring harness between heater relay terminal E and chassis	Repair or replace
NO			Defective heater relay	Replace

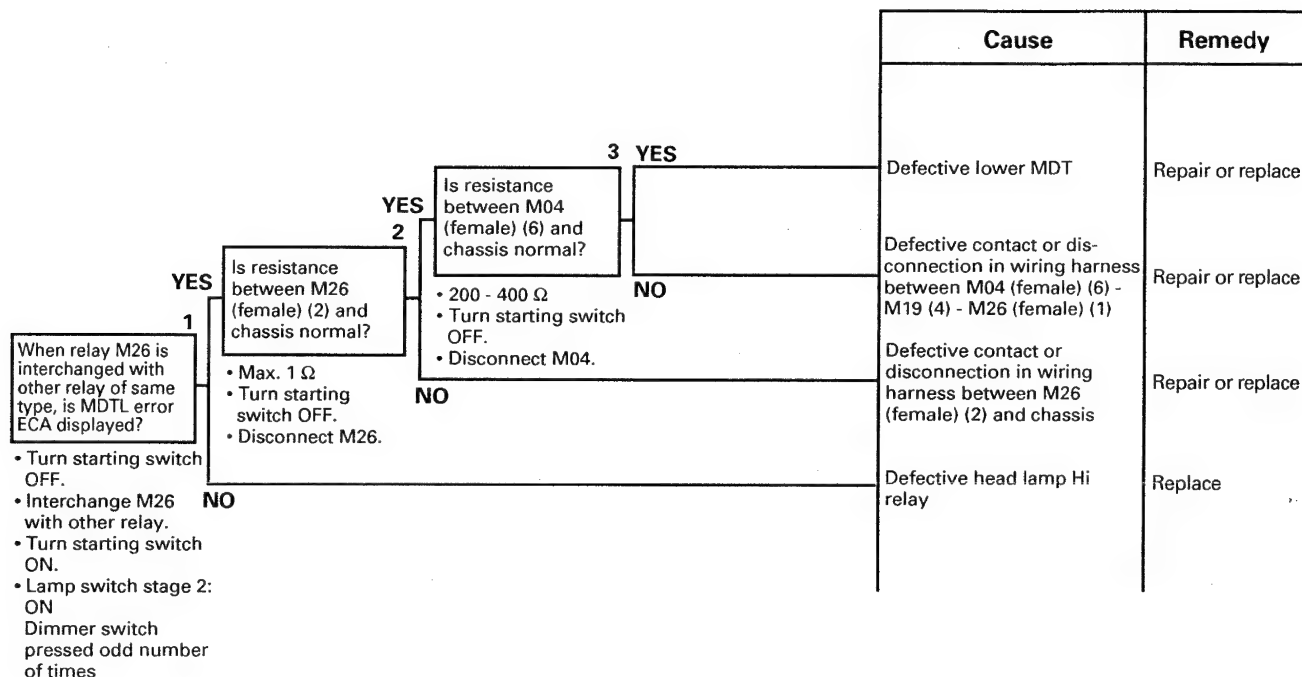
023S02

EL-98 Related electric circuit diagram

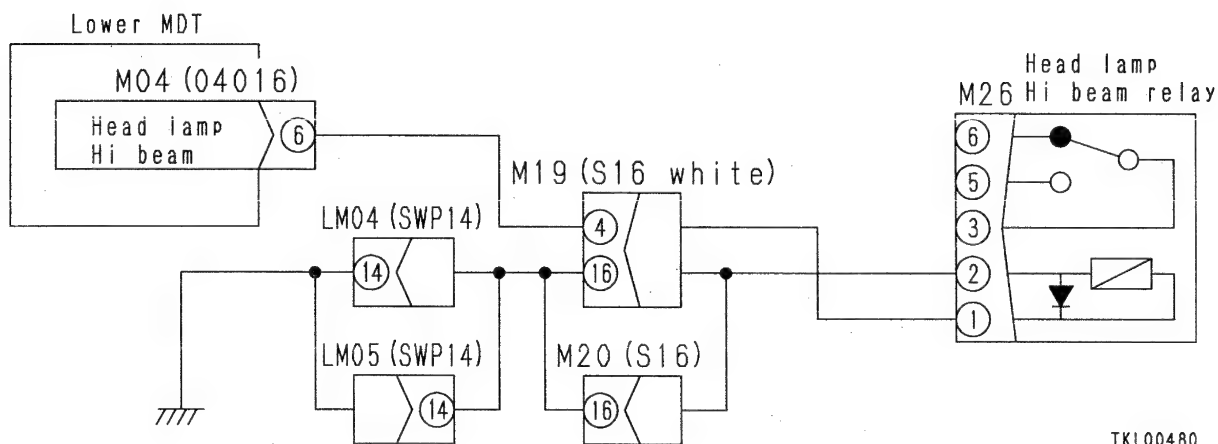


EL-99 MDTL error ECA (Disconnection in head lamp Hi relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

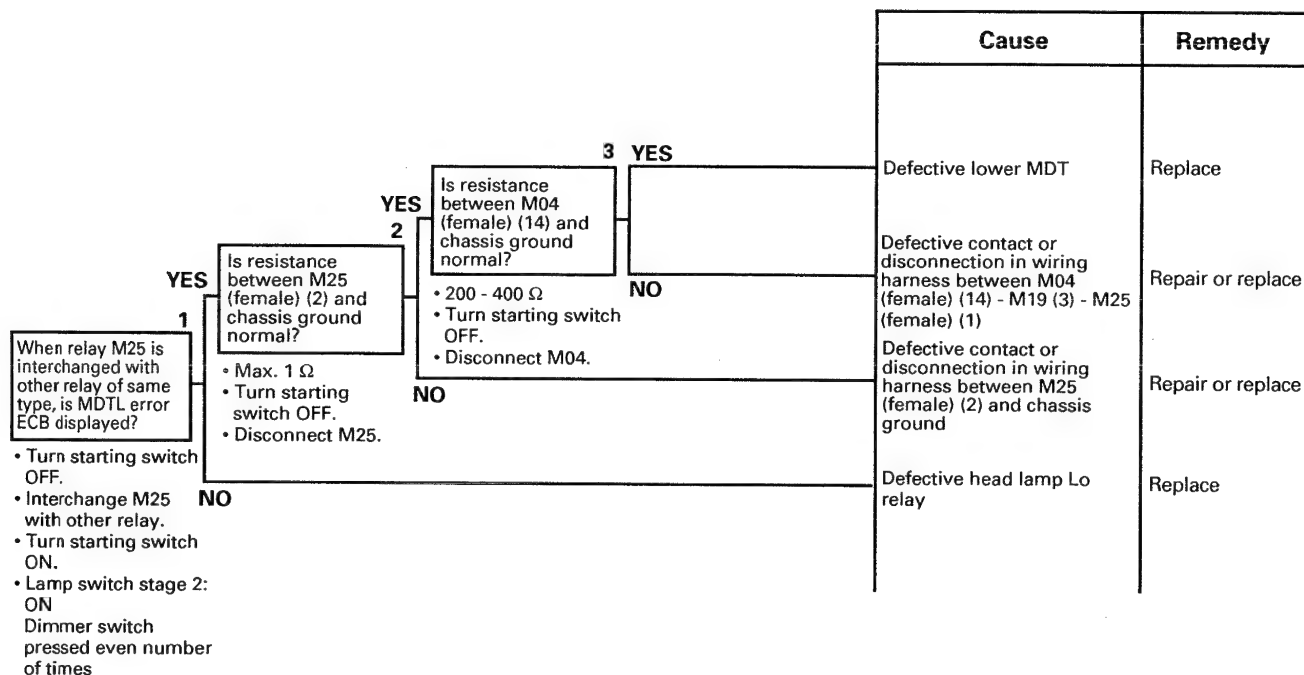


EL-99 Related electric circuit diagram

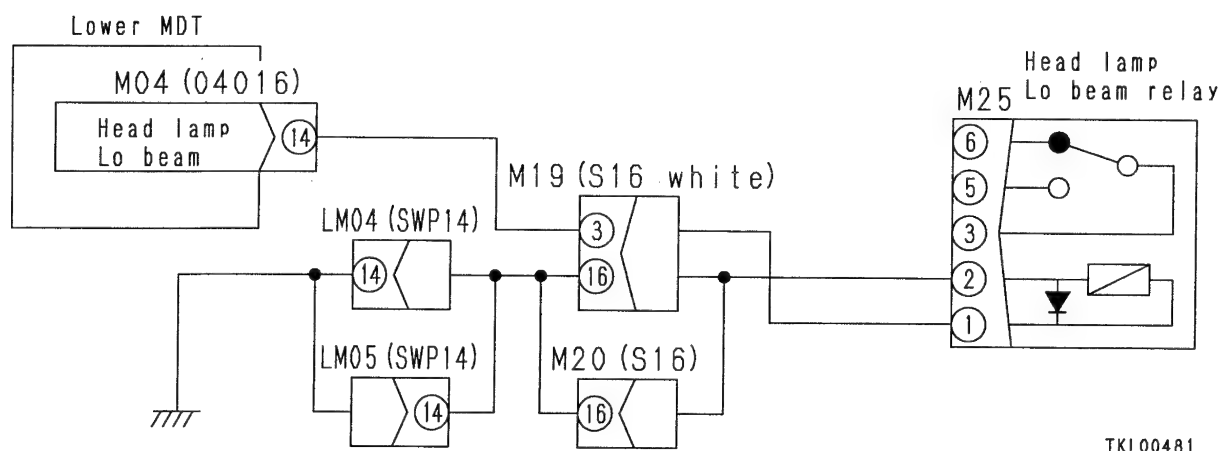


EL-100 MDTL error ECB (Disconnection in head lamp Lo relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-100 Related electric circuit diagram

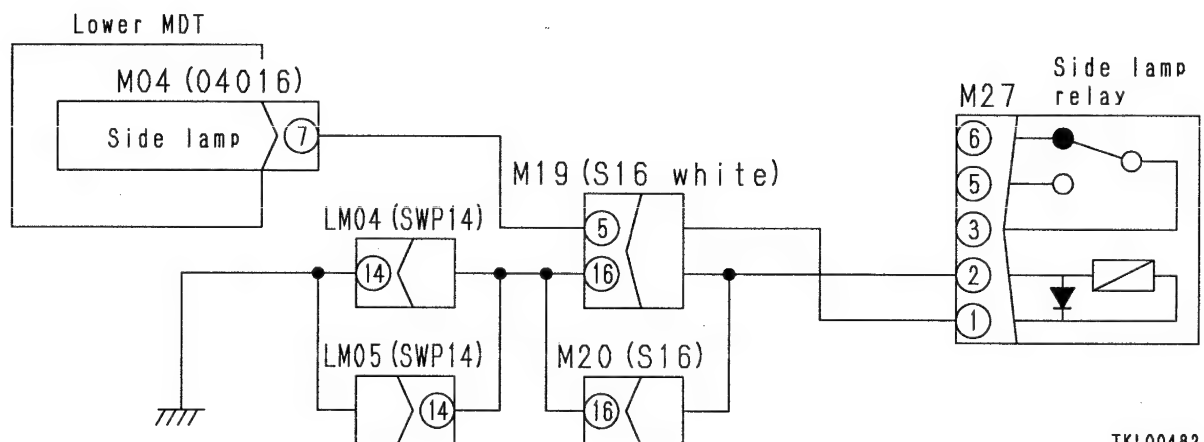


EL-101 MDTL error ECC (Disconnection in side lamp relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

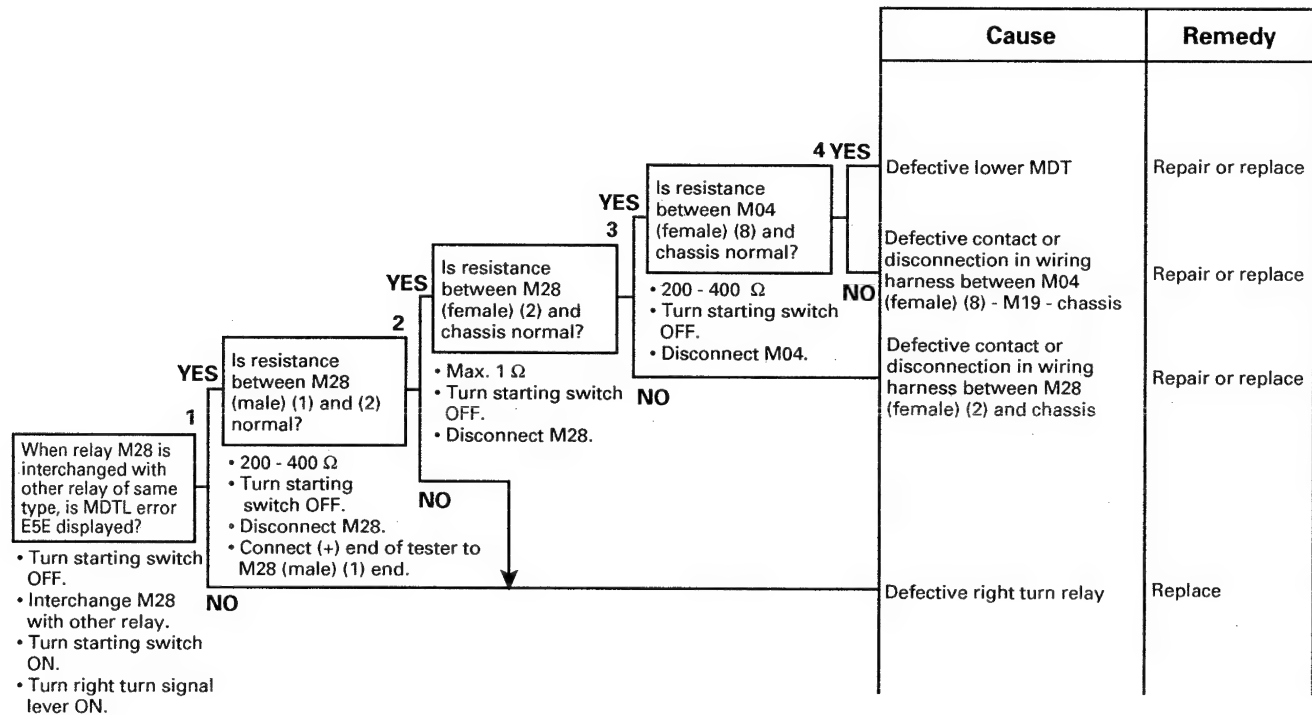
	Cause	Remedy
<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> 1 YES When relay M27 is interchanged with other relay of same type, is MDTL error ECC displayed? • Turn starting switch OFF. • Interchange M27 with other relay. • Turn starting switch ON. • Lamp switch stage 1: ON </div> <div style="margin-bottom: 10px;"> 2 YES Is resistance between M27 (female) (2) and chassis ground normal? • Max. 1 Ω • Turn starting switch OFF. • Disconnect M27. </div> <div style="margin-bottom: 10px;"> 3 YES Is resistance between M04 (female) (7) and chassis ground normal? • 200 - 400 Ω • Turn starting switch OFF. • Disconnect M04. </div> <div> NO </div> </div>	Defective lower MDT	Replace
	Defective contact or disconnection in wiring harness between M04 (female) (7) - M19 (5) - M27 (female) (1)	Repair or replace
	Defective contact or disconnection in wiring harness between M27 (female) (2) and chassis ground	Repair or replace
	Defective side lamp relay	Replace

EL-101 Related electric circuit diagram

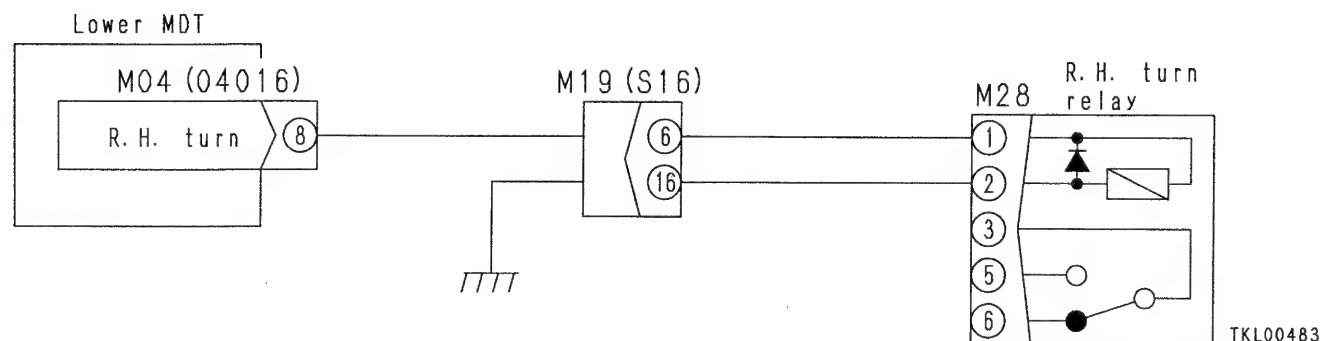


EL-102 MDTL error ECE (Disconnection in right turn relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

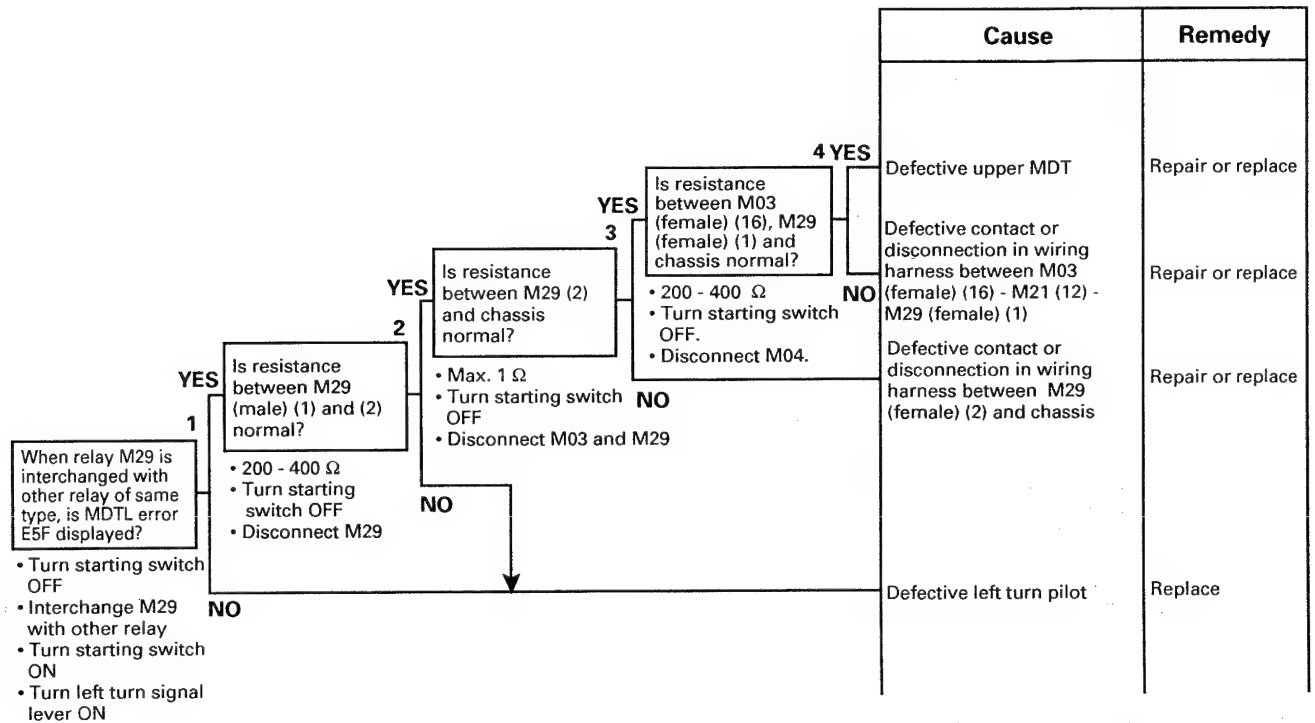


EL-102 Related electric circuit diagram

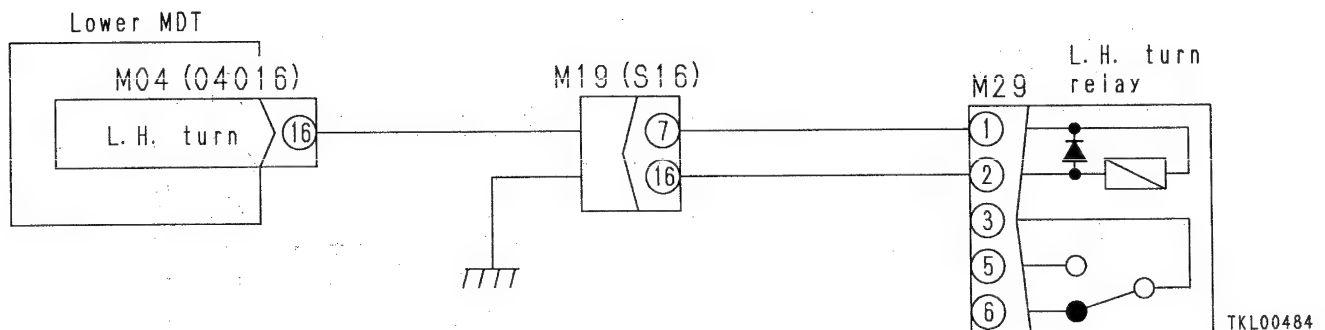


EL-103 MDTL error ECF (Disconnection in left turn relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

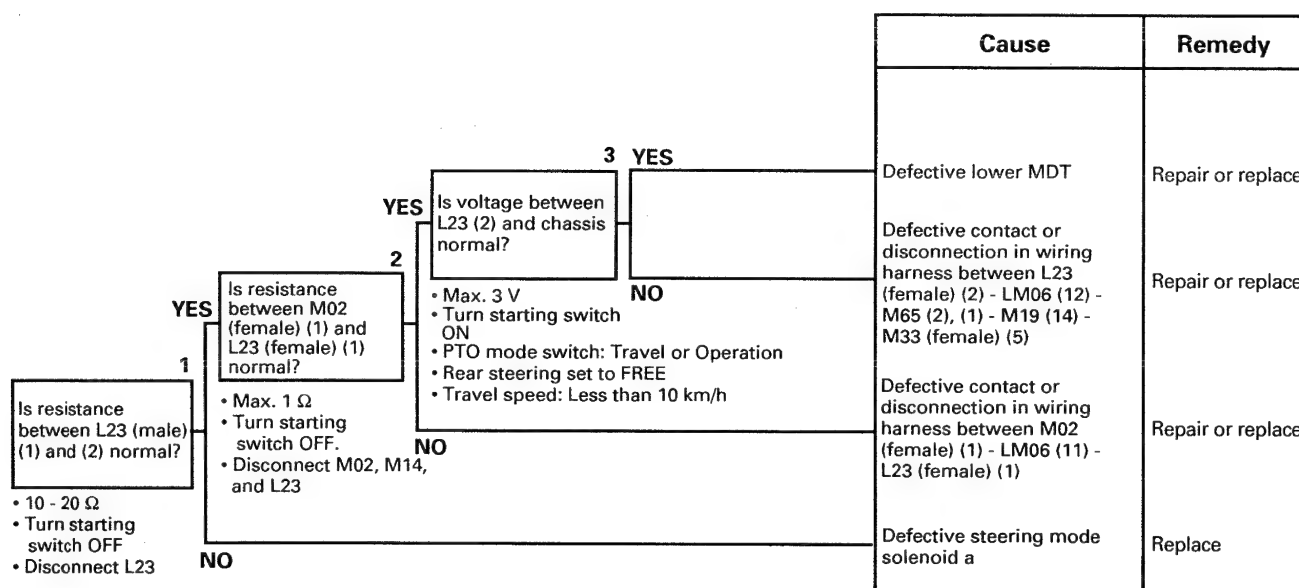


EL-103 Related electric circuit diagram

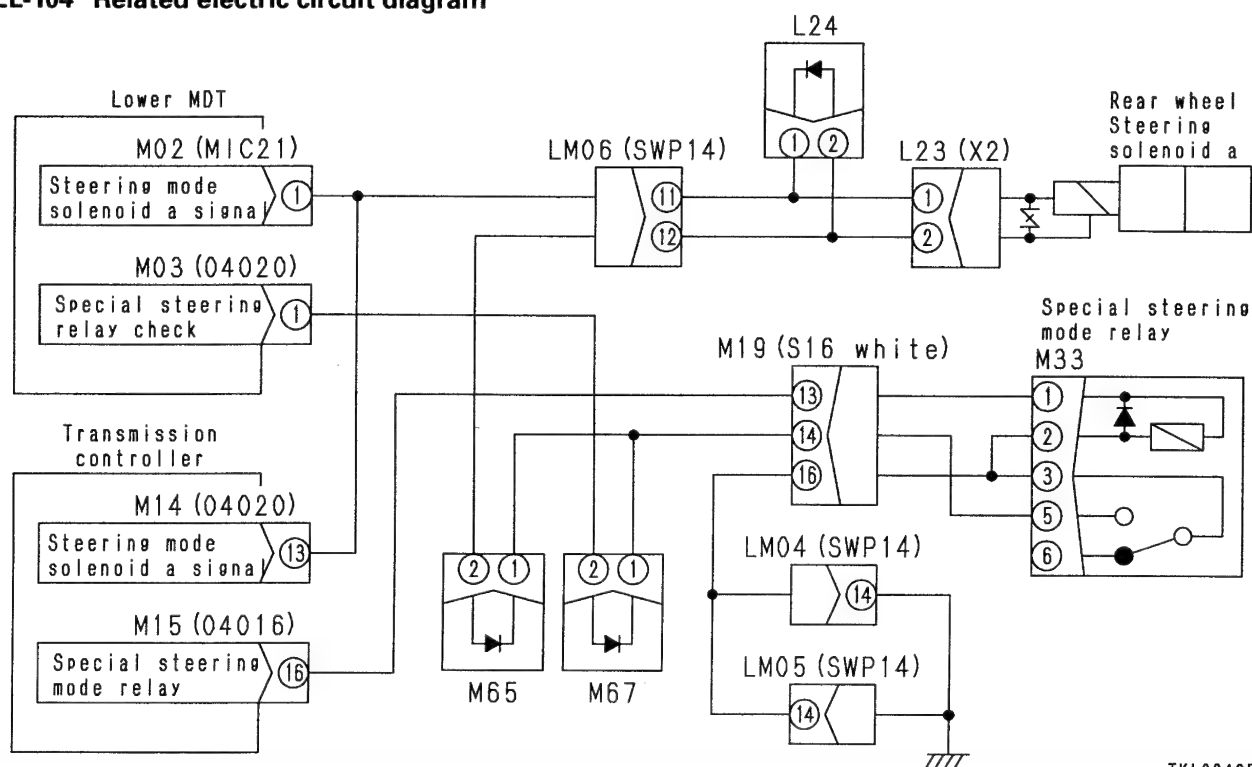


EL-104 MDTL error ED0 (Disconnection in steering mode solenoid a) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ When transmission error codes (ATM error E5A, E5B, E7F, E8F) are not occurring.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-104 Related electric circuit diagram



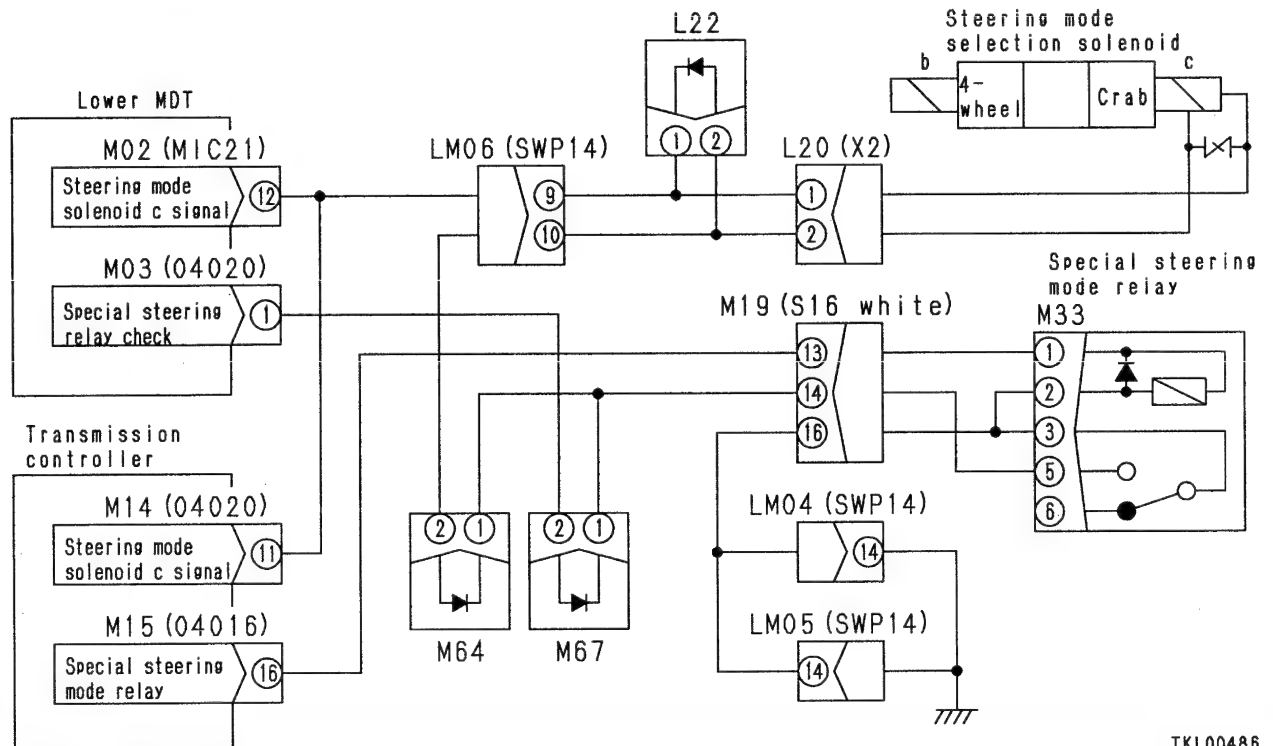
TKL00485

EL-105 MDTL error ED1 (Disconnection in steering mode solenoid c) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ When transmission error codes (ATM error E5A, E5B, E7F, E8F) are not occurring.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

			Cause	Remedy
<p>023S02</p> <p>1</p> <p>Is resistance between L20 (male) (1) and (2) normal?</p> <ul style="list-style-type: none"> • 10 - 20 Ω • Turn starting switch OFF • Disconnect L20 	YES	2	Is resistance between M02 (female) (12) and L20 (female) (1) normal?	
	YES	3	Is voltage between L20 (2) and chassis normal?	
	NO	NO	Defective lower MDT	Repair or replace
	NO	NO	Defective contact or disconnection in wiring harness between L20 (female) (2) - LM06 (10) - M64 (2), (1) - M19 (14) - M33 (female) (5)	Repair or replace
	NO	NO	Defective contact or disconnection in wiring harness between M02 (female) (12) - LM06 (9) - L20 (female) (1)	Repair or replace
	NO	NO	Defective steering mode solenoid c	Replace

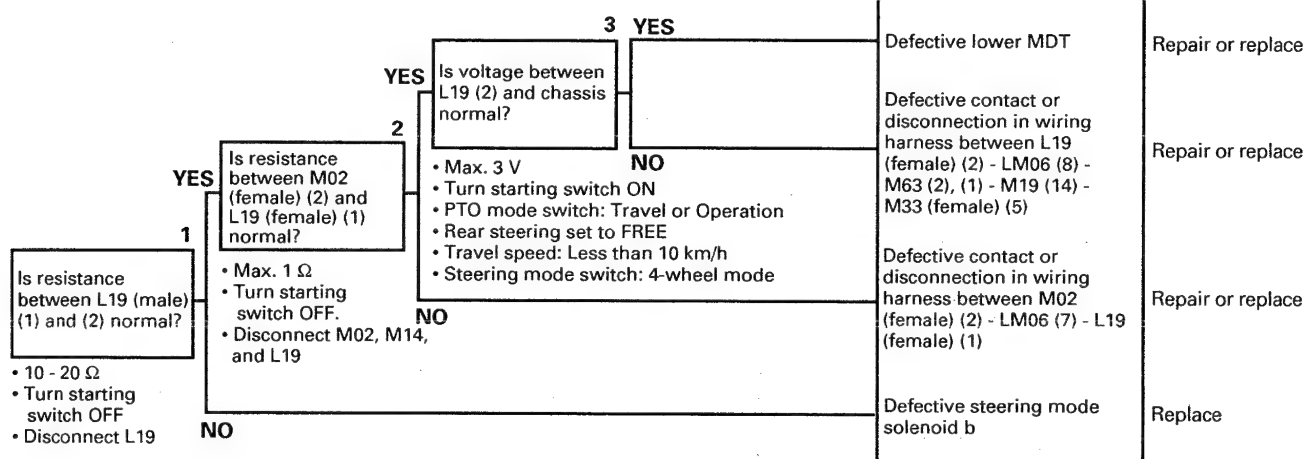
EL-105 Related electric circuit diagram



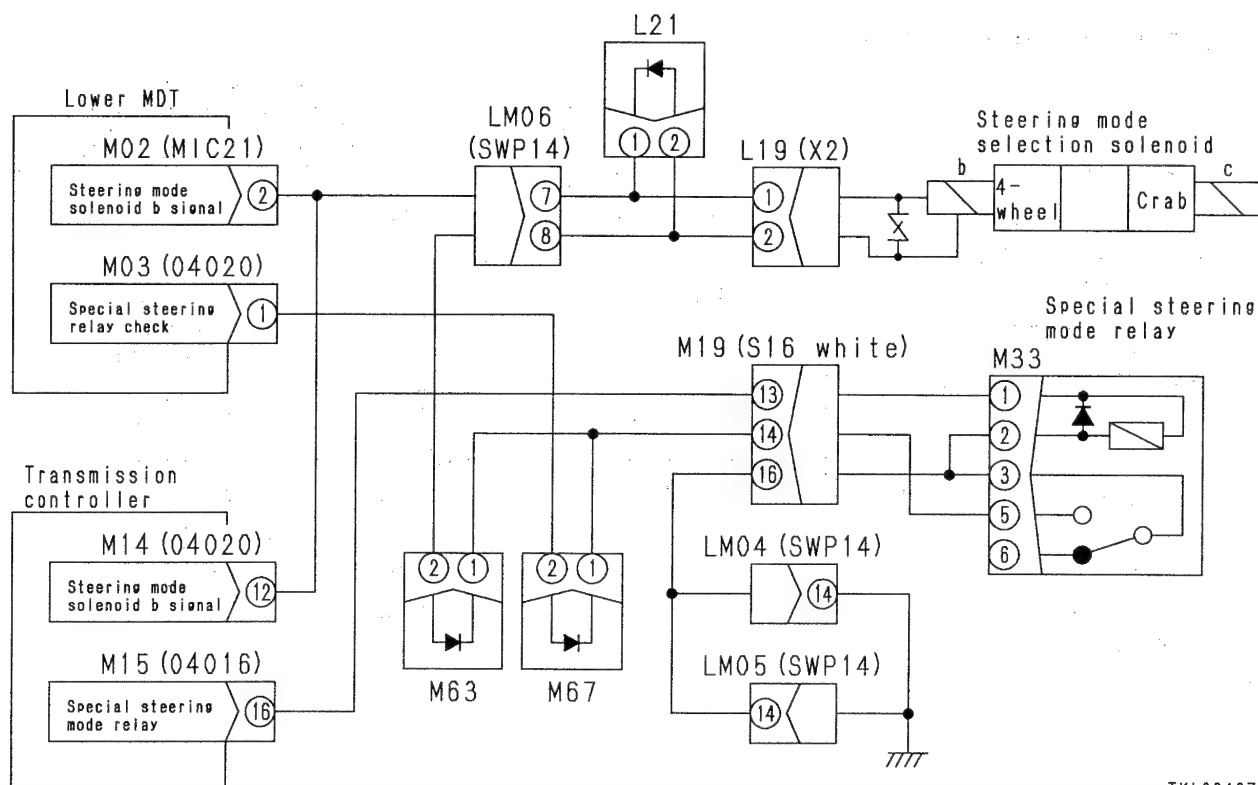
TKL00486

EL-106 MDTL error ED2 (Disconnection in steering mode solenoid b) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
 - ★ When transmission error codes (ATM error E5A, E5B, E7F, E8F) are not occurring.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
| | |



EL-106 Related electric circuit diagram



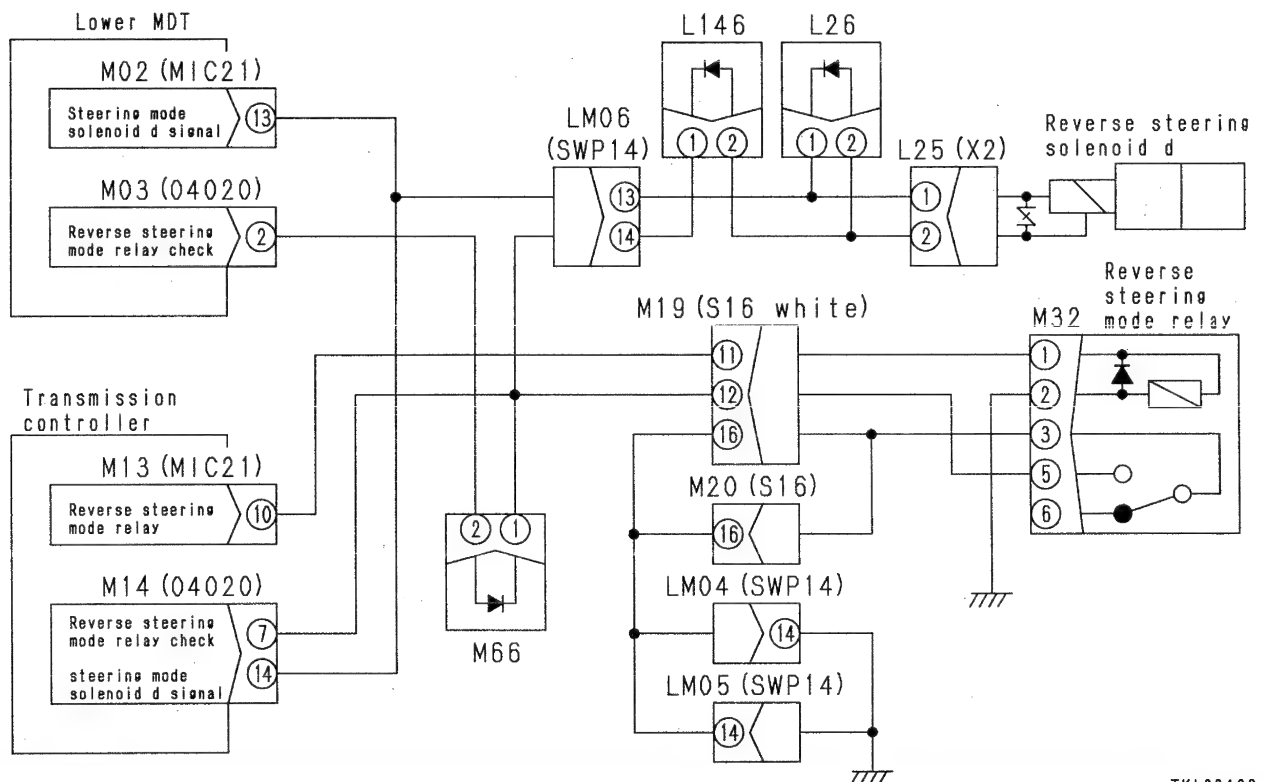
TKL00487

EL-107 MDTL error ED3 (Disconnection in steering mode solenoid d) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ When transmission error codes (ATM error E5C, E5D, E7F, E8F) are not occurring.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 Is resistance between L25 (male) (1) and (2) normal?</p> <p>• 10 - 20 Ω</p> <p>• Turn starting switch OFF</p> <p>• Disconnect L25</p> <p>YES</p> <p>2 Is resistance between M02 (female) (13) and L25 (female) (1) normal?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF</p> <p>• Disconnect M02, M14, and L25</p> <p>YES</p> <p>3 Is voltage between L25 (2) and chassis normal?</p> <p>• Max. 1 V</p> <p>• Turn starting switch ON</p> <p>• Swing angle 180° (boom facing rear)</p> <p>• Reverse steering compensation switch: ON</p> <p>NO</p>	YES	Defective lower MDT	Repair or replace
	NO	Defective contact or disconnection in wiring harness between L25 (female) (2) - L146 (2), (1) - LM06 (14) - M19 (12) - M32 (female) (5)	Repair or replace
	NO	Defective contact or disconnection in wiring harness between M02 (female) (13) - LM06 (13) - LM25 (1)	Repair or replace
	NO	Defective steering mode solenoid d	Replace

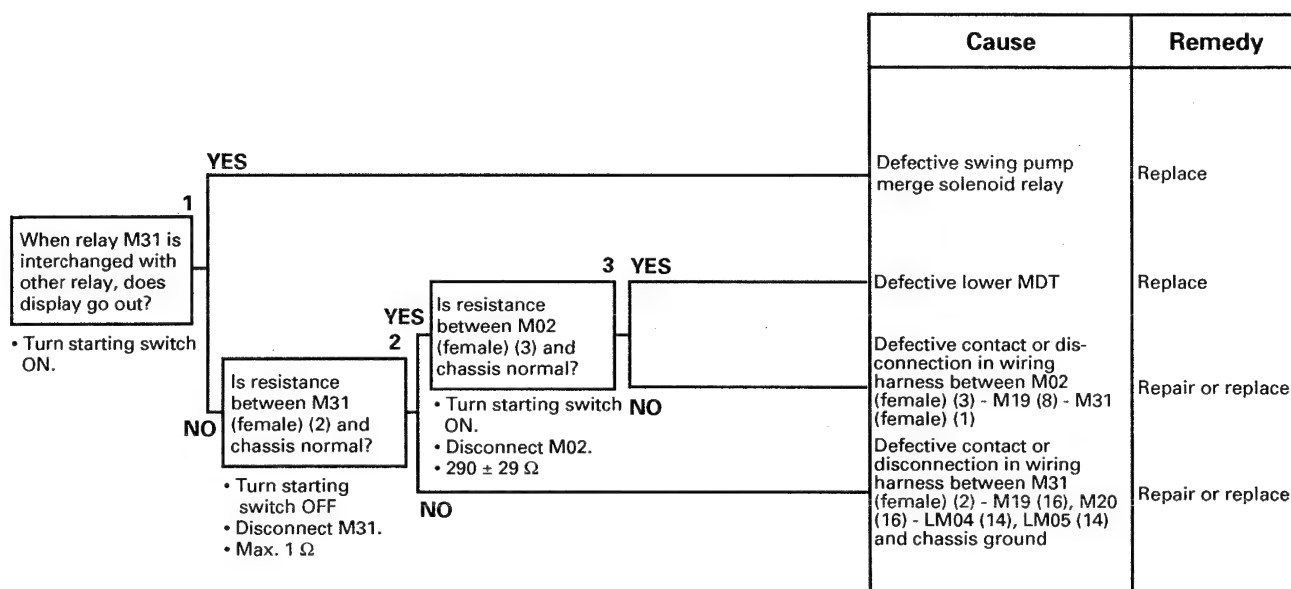
EL-107 Related electric circuit diagram



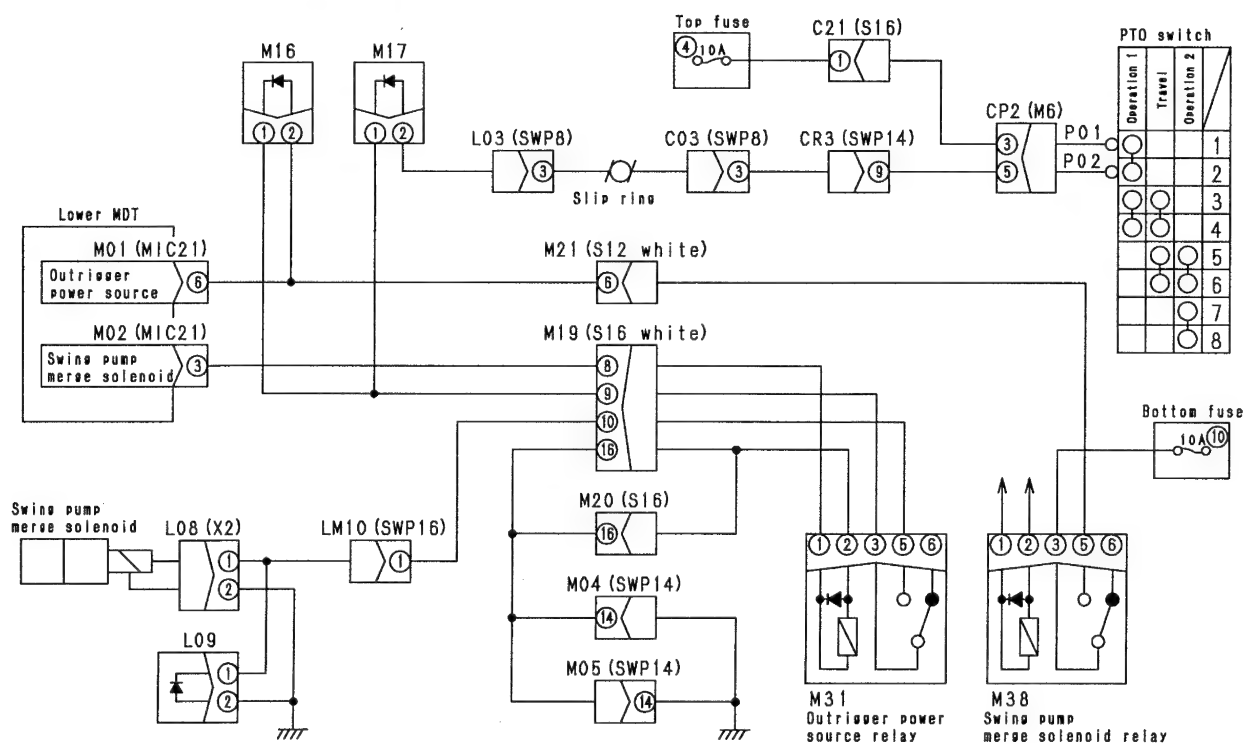
TKL00488

EL-108 MDTL error ED4 (Disconnection in swing pump merge solenoid) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-108 Related electric circuit diagram



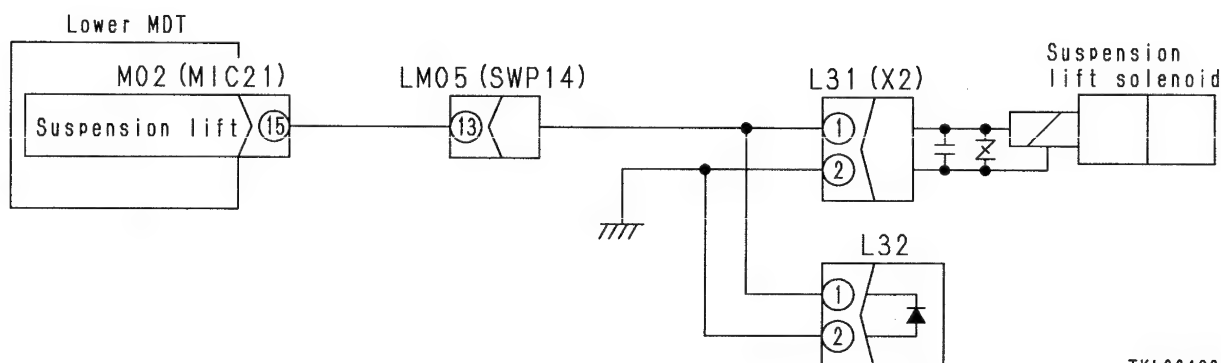
TKL00489

EL-109 MDTL error ED7 (Disconnection in suspension lift solenoid) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
023S02	1	Is resistance between L31 (male) (1) and (2) normal?	
	YES	• 10 - 20 Ω • Turn starting switch OFF. • Disconnect L31	
	2	Is resistance between L31 (female) (2) and chassis normal?	
	YES	• Max. 1 Ω • Turn starting switch OFF. • Disconnect M02 and L31.	
	3	Is resistance between M02 (female) (15) and chassis normal?	
	YES	• 10 - 20 Ω • Turn starting switch OFF. • Disconnect M02.	Defective lower MDT Repair or replace
	NO		Disconnection in wiring harness between M02 (female) (15) - LM05 (13) - L31 (female) (1) Repair or replace
	NO		Disconnection in wiring harness between L31 (female) (2) and chassis Repair or replace
	NO		Defective suspension lift solenoid Replace

EL-109 Related electric circuit diagram



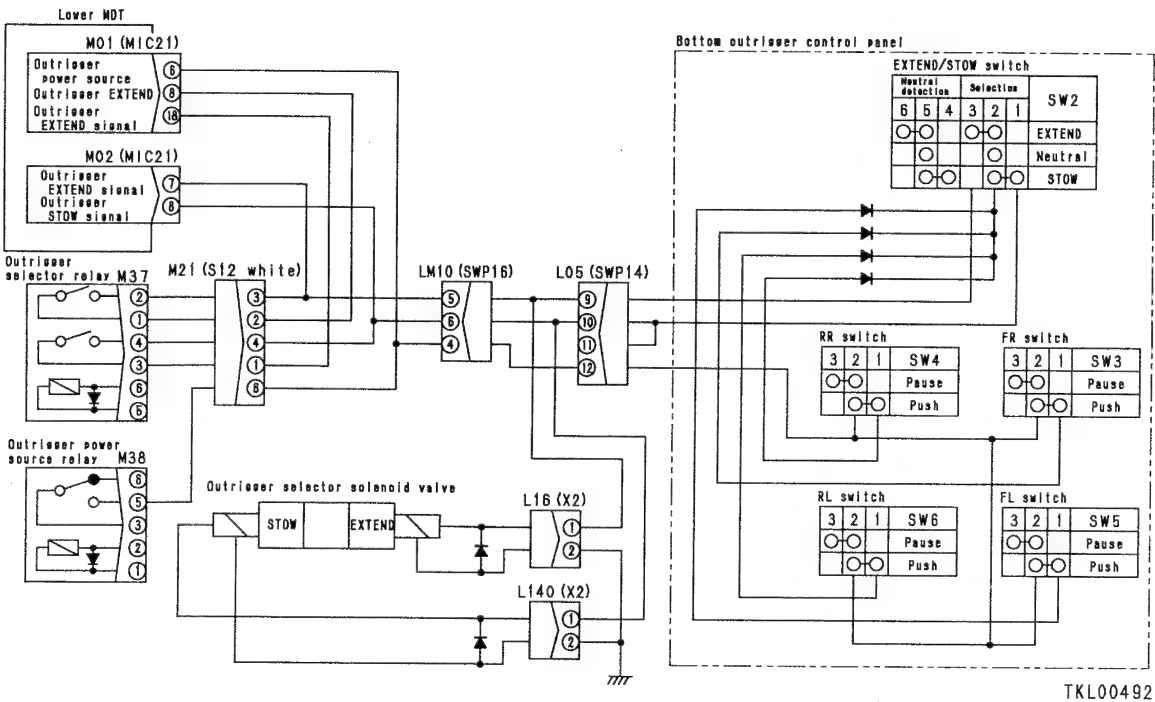
TKL00490

EL-110 MDTL error EE7 (Outrigger control signal short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

			Cause	Remedy
<div> <div>1</div> <div>Is voltage between M02 (7) and chassis ground normal?</div> <div> <div>• Max. 1 V</div> <div>• Turn starting switch ON.</div> <div>• PTO switch: Any position except Operation 1</div> </div> </div>	YES	<div> <div>2 YES</div> <div>Is voltage between M02 (8) and chassis ground normal?</div> <div> <div>• Turn starting switch ON</div> <div>• Max. 1 V</div> </div> </div>	Defective lower MDT	Replace
	NO		Wiring harness between M02 (female) (8) and M21 (female) (4) short circuiting with power source	Repair or replace
	NO		Wiring harness between M02 (female) (7) and M21 (female) (3) short circuiting with power source	Repair or replace

EL-110 Related electric circuit diagram



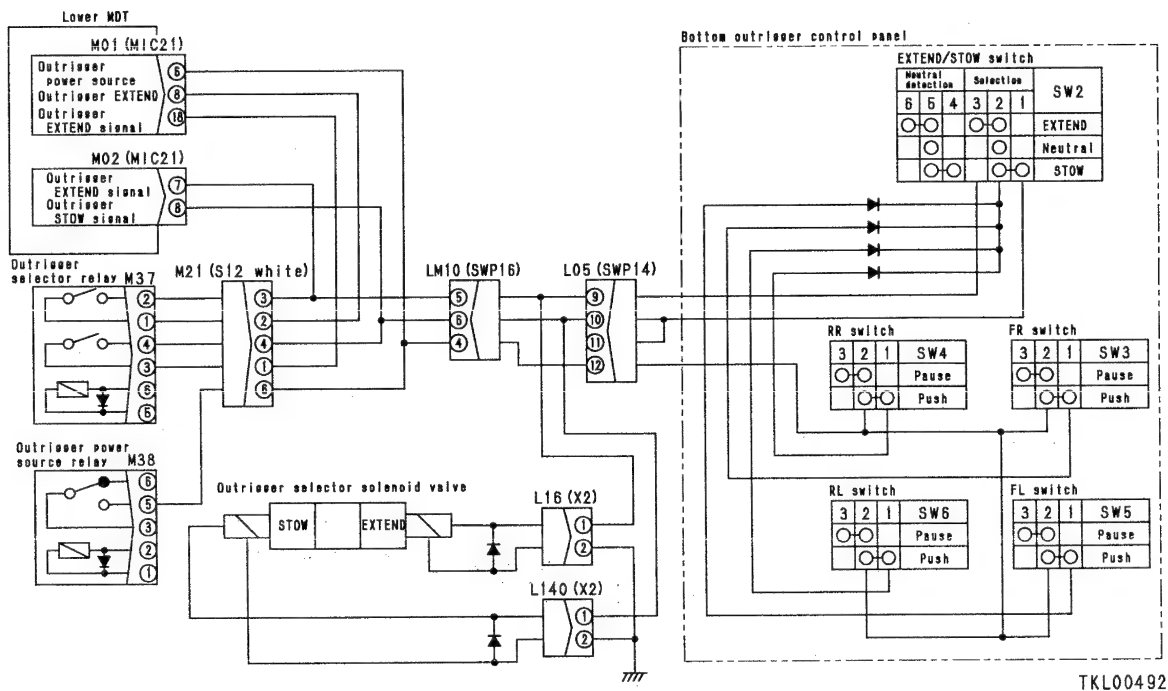
TKL00492

EL-111 MDTL error EE8 (Outrigger control signal short circuited with ground, disconnection) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div> <div>1</div> <div>Is resistance between M02 (female) (7),(8) and chassis ground normal?</div> <div> <ul style="list-style-type: none"> • Min. 1 MΩ • Turn starting switch OFF. • Disconnect M02 </div> </div> <div> <div>YES</div> <div>Is resistance between M02 (female) (7) - M37 (female) (2) and M02 (female) (8) - M37 (female) (4) normal?</div> <div> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect M02. </div> </div> <div> <div>2 YES</div> <div></div> </div> <div> <div>NO</div> <div></div> </div> <div> <div>NO</div> <div></div> </div> </div>		Defective lower MDT	Replace
		Defective contact or disconnection in wiring harness between M02 (female) (7) - M21 (3) - M37 (female) (2) or M02 (female) (8) - M21 (4) - M37 (female) (4)	Repair or replace
		Wiring harness between M02 (female) (7) - M21 (female) (3) short circuiting with chassis ground or wiring harness between M02 (female) (8) - M21 (female) (4) short circuiting with chassis ground	Repair or replace

EL-111 Related electric circuit diagram



TKL00492

EL-112 MDTL error EE9 (Disconnection in fuel sensor) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Is resistance between fuel sensor terminal L85 (female) and L86 (female) as shown in Table 1?

• Turn starting switch OFF.
• Disconnect fuel sensor terminals L85 and L86.

2

Is resistance between fuel sensor terminal L86 (male) and chassis normal?

• Max. 1 Ω
• Turn starting switch OFF.
• Disconnect fuel sensor terminal L86.

3

Is resistance between fuel sensor terminal L85 and M05 (8) normal?

• Max. 1 Ω
• Turn starting switch OFF
• Disconnect fuel sensor terminals L85 and M05.

YES

YES

YES

NO

NO

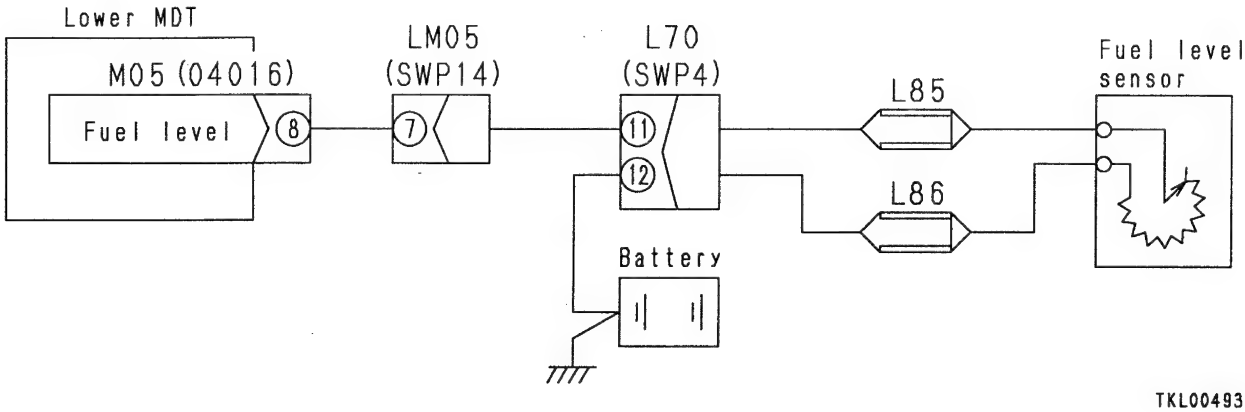
NO

Cause	Remedy
Defective lower MDT	Repair or replace
Disconnection in wiring harness between M05 (female) (8) - LM05 (7) - L70 (11) - fuel sensor terminal L85	Repair or replace
Disconnection in wiring harness between fuel sensor terminal L86 (male) - L70 (12) - chassis	Repair or replace
Defective fuel sensor	Replace

Table 1

Terminal	Resistance value	
	FULL	Fuel tank
Between L85 (female) - L86 (female)	Approx. 12 Ω	Approx. 82 Ω

EL-112 Related electric circuit diagram



EL-113 MDTL error EEB (Abnormality in rear steering LOCK limit switch/FREE limit switch) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

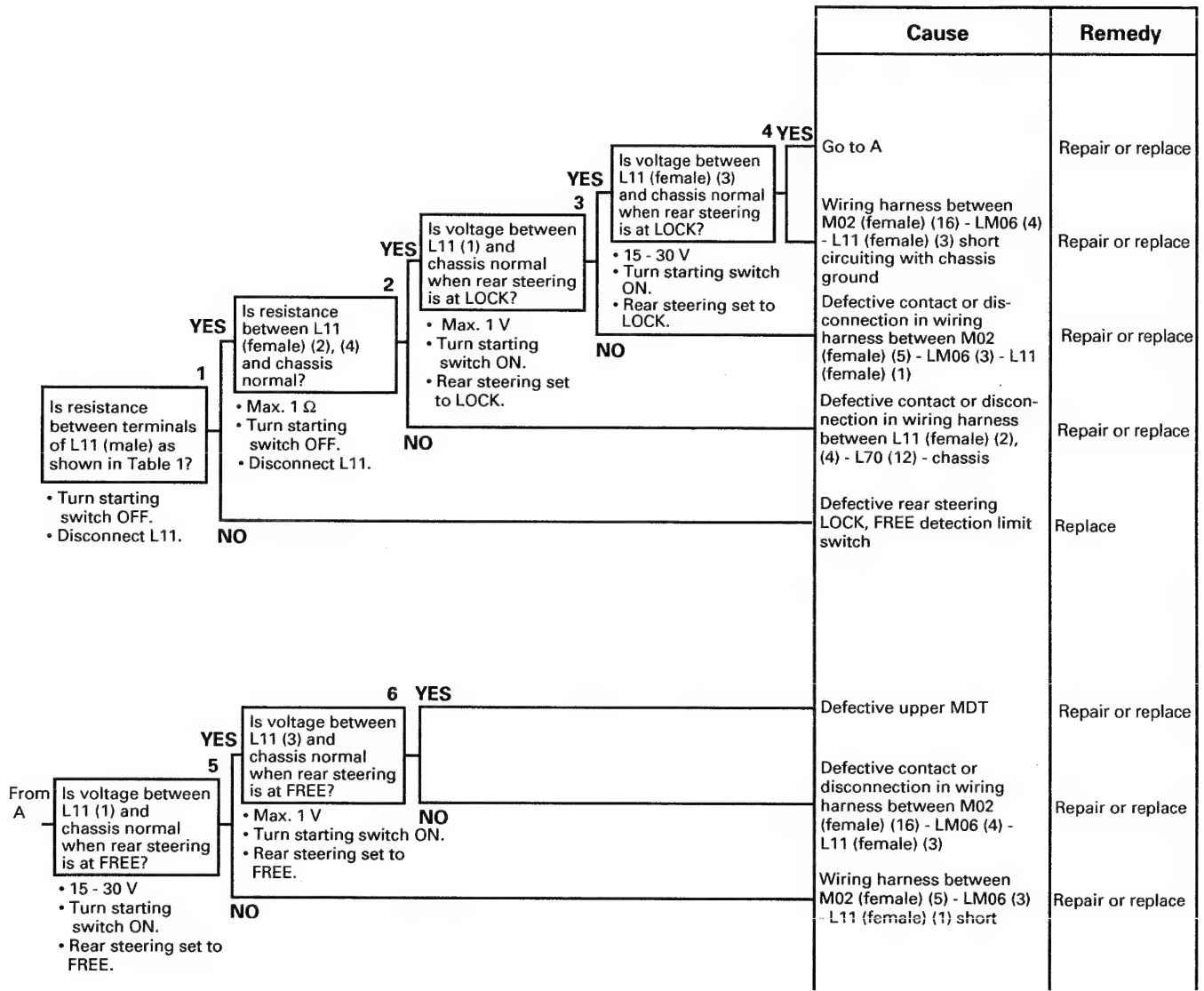
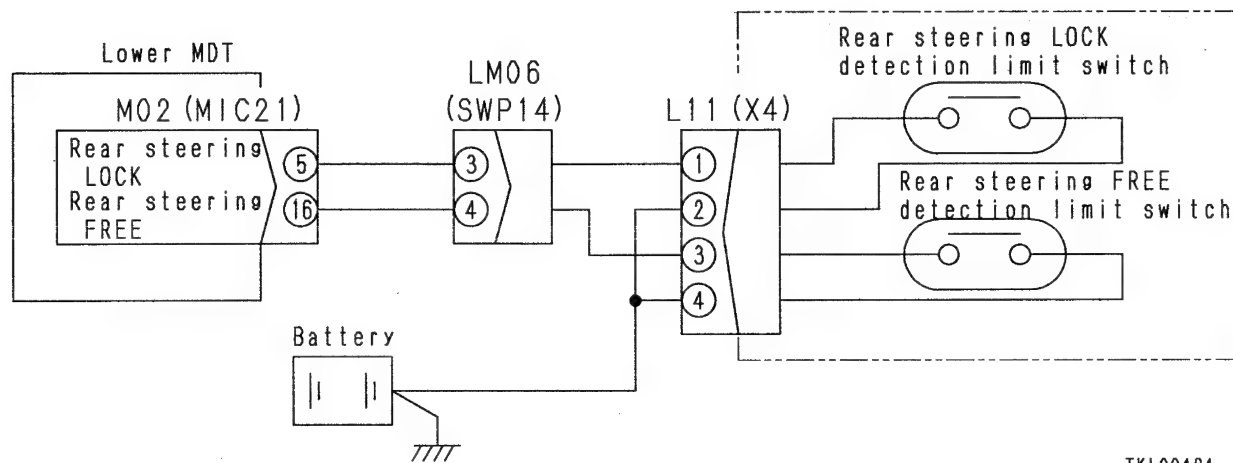


Table 1 {Resistance value between terminals of L11 (male)}

L11 (male) terminal	Rear steering LOCK	Rear steering FREE
Between (1) – (2)	Max. 1 Ω	Min. 1 MΩ
Between (1) – (3)	Min. 1 MΩ	Min. 1 MΩ
Between (1) – (4)	Min. 1 MΩ	Min. 1 MΩ
Between (2) – (3)	Min. 1 MΩ	Min. 1 MΩ
Between (2) – (4)	Min. 1 MΩ	Min. 1 MΩ
Between (3) – (4)	Min. 1 MΩ	Max. 1 Ω

EL-113 Related electric circuit diagram

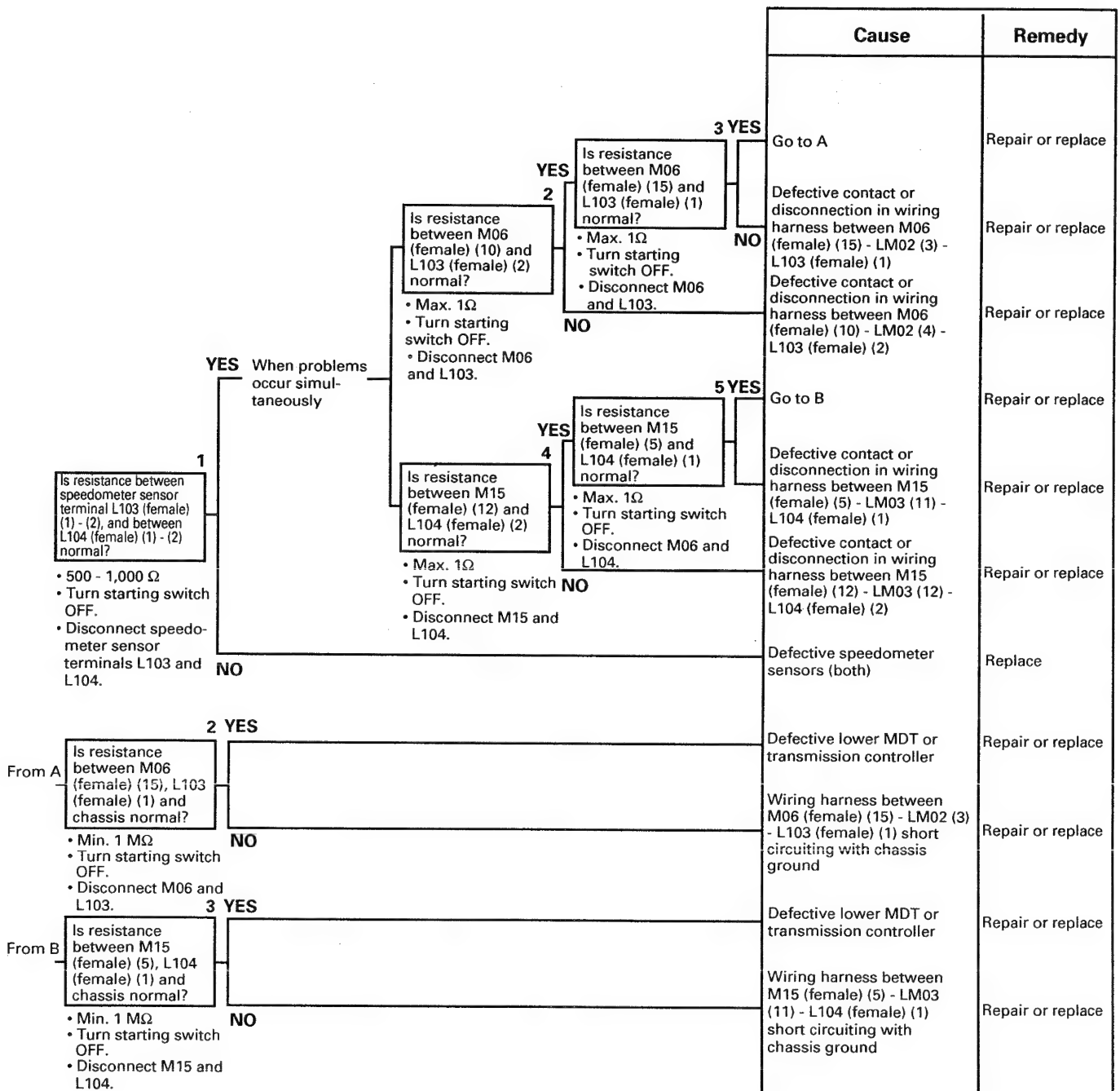


023S02

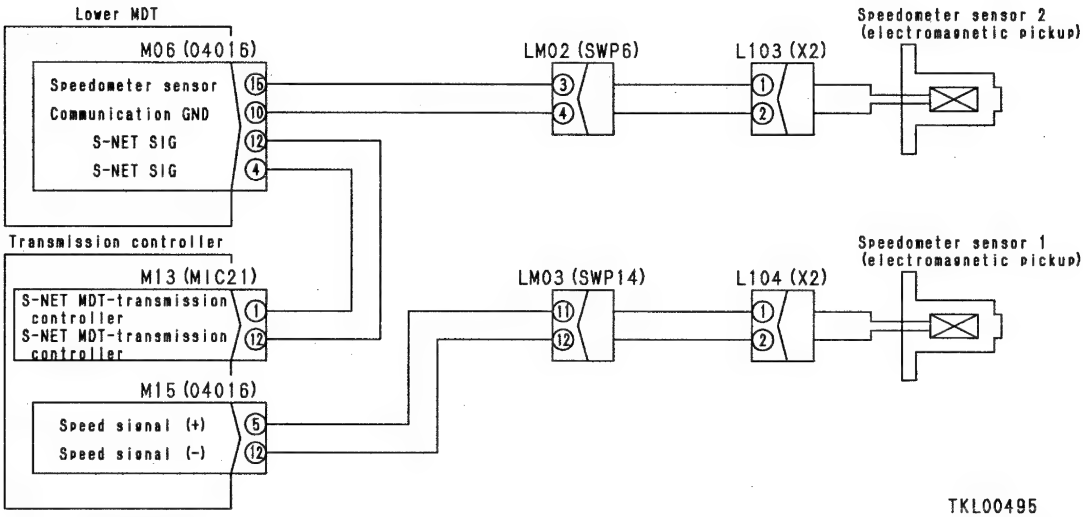
EL-114 MDTL error EEE (Failure of both speedometer sensors) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

023S02



EL-114 Related electric circuit diagram



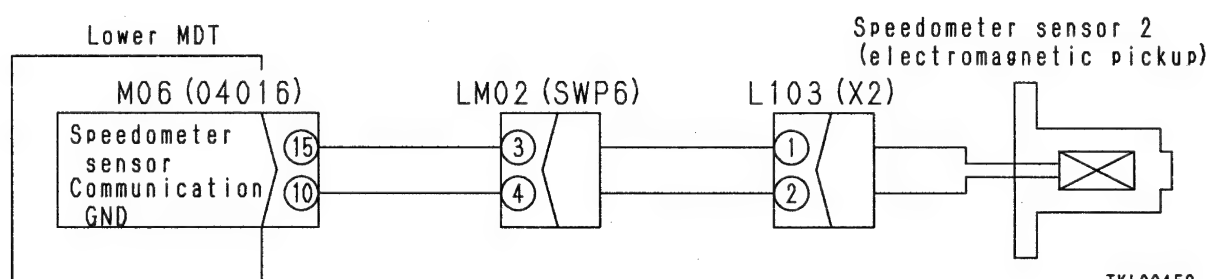
023S02

EL-115 MDTL error EEF (MDT speedometer sensor failure) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
023S02	<p>1</p> <p>Is resistance between speedometer sensor 2 terminal L103 (female) (1) and (2) normal?</p> <ul style="list-style-type: none"> • 500 - 1,000 Ω • Turn starting switch OFF. • Disconnect speedometer sensor terminal L103. <p>YES</p> <p>2</p> <p>Is resistance between M06 (female) (10), L103 (female) (2) and chassis normal?</p> <ul style="list-style-type: none"> • Max. 1 Ω • Turn starting switch OFF. • Disconnect M06 and L103. <p>NO</p> <p>3</p> <p>Is resistance between M06 (female) (15) and L103 (female) (1) normal?</p> <ul style="list-style-type: none"> • Max. 1 Ω • Turn starting switch OFF. • Disconnect M06 and M15. <p>YES</p> <p>4</p> <p>Is resistance between M06 (female) (10), L103 (female) (2) and chassis normal?</p> <ul style="list-style-type: none"> • Min. 1 MΩ • Turn starting switch OFF. • Disconnect M06 and L103. <p>NO</p> <p>5</p> <p>Is resistance between M06 (female) (15), L103 (female) (1) and chassis normal?</p> <ul style="list-style-type: none"> • Min. 1 MΩ • Turn starting switch OFF. • Disconnect M06 and L103. <p>NO</p>	<p>Go to A</p> <p>Wiring harness between M06 (female) (10) - LM02 (4) - L103 (female) (2) short circuiting with chassis ground</p> <p>Defective contact or disconnection in wiring harness between M06 (female) (15) - LM02 (3) - L103 (female) (1)</p> <p>Defective contact or disconnection in wiring harness between M06 (female) (10) - LM02 (4) - L103 (female) (2)</p> <p>Defective speedometer sensor 2 (L103)</p>	<p>Repair or replace</p> <p>Repair or replace</p> <p>Repair or replace</p> <p>Replace</p>
	<p>From A</p> <p>5 YES</p> <p>Is resistance between M06 (female) (15), L103 (female) (1) and chassis normal?</p> <ul style="list-style-type: none"> • Min. 1 MΩ • Turn starting switch OFF. • Disconnect M06 and L103. <p>NO</p>	<p>Defective lower MDT</p> <p>Wiring harness between M06 (female) (15) - LM02 (3) - L103 (female) (1) short circuiting with chassis ground</p>	<p>Repair or replace</p> <p>Repair or replace</p>

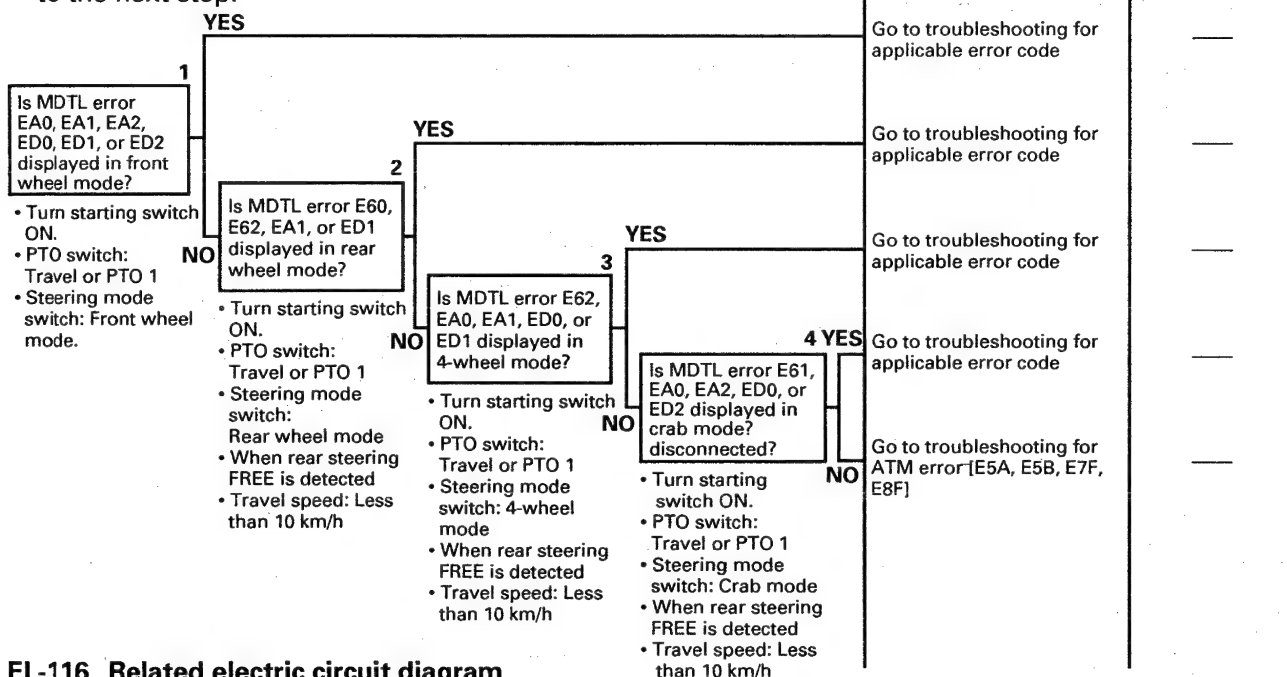
EL-115 Related electric circuit diagram



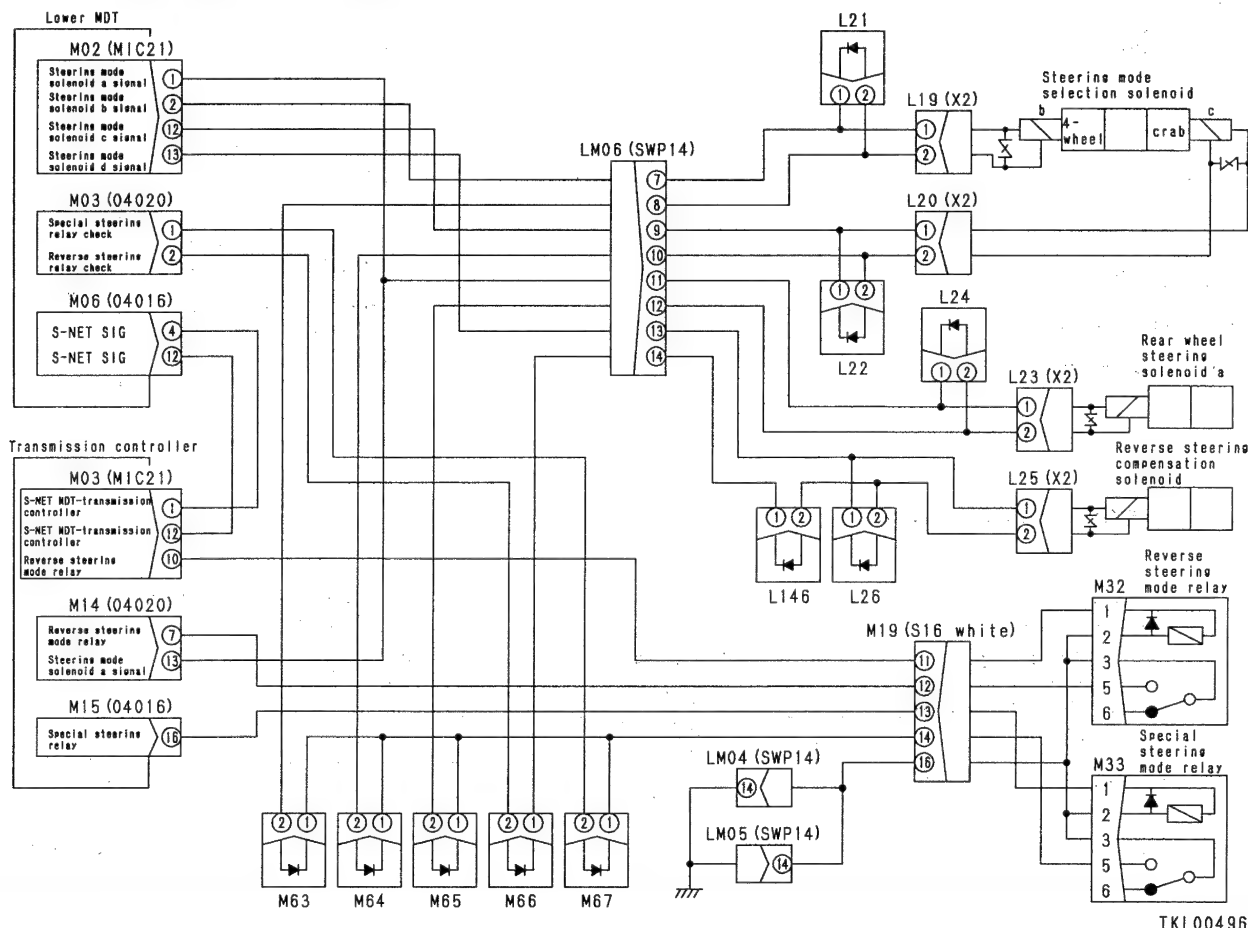
TKL00459

EL-116 MDTL error EF0 (Special steering failure emergency stop) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-116 Related electric circuit diagram

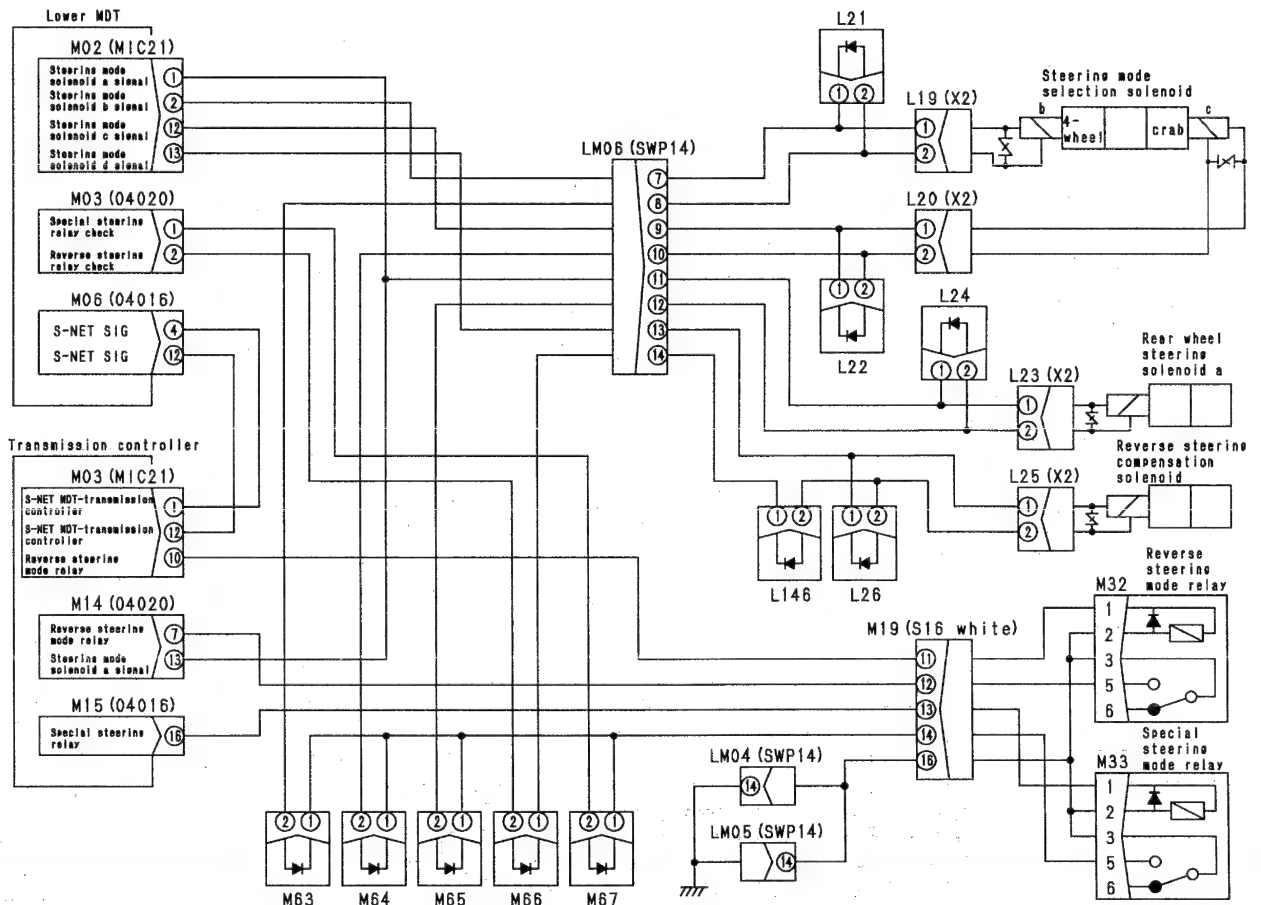


EL-117 MDTL error EF1 (Reverse steering failure emergency stop) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<p>1</p> <p>Is MDTL error EA3 or ED3 displayed in normal steering front wheel mode?</p> <p>YES</p>	Go to troubleshooting for applicable error code	—
<p>2 YES</p> <p>Is MDTL error E63 displayed in reverse steering front wheel mode?</p> <p>YES</p>	Go to troubleshooting for applicable error code	—
<p>NO</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Travel or PTO 1</p> <p>• Steering mode switch: Normal steering front wheel mode.</p> <p>• When rear steering FREE is detected</p> <p>• Swing angle: 180° (boom facing rear).</p> <p>NO</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Travel or PTO 1</p> <p>• Steering mode switch: Reverse steering front wheel mode.</p>	Go to troubleshooting for ATM error [E5C, E5D, E7B, E8B]	—

EL-117 Related electric circuit diagram



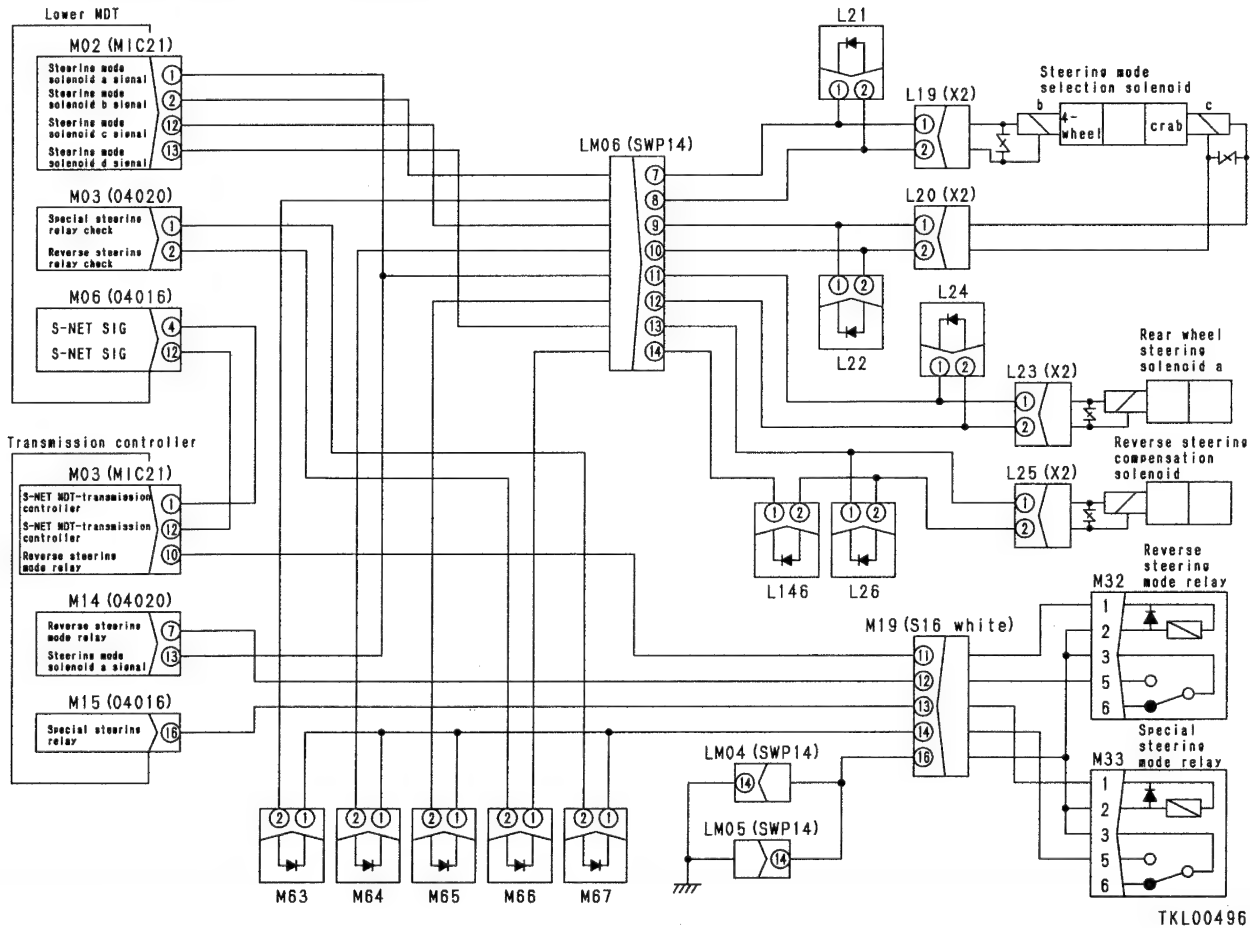
TKL00496

EL-118 MDTL error EF2 (Special steering failure) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

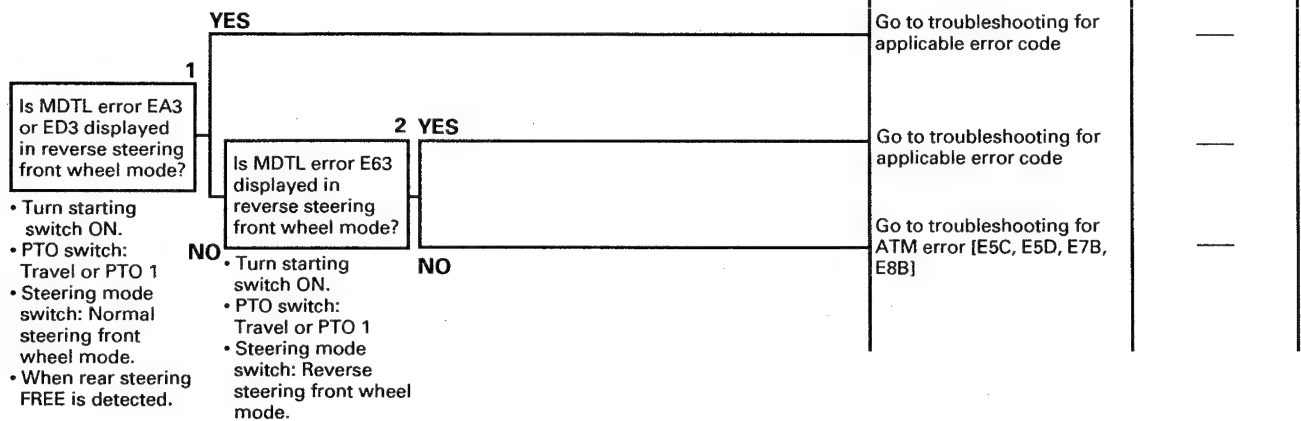
	Cause	Remedy
<div> 1 Is MDTL error EA0, EA1, EA2, ED0, ED1, or ED2 displayed in front wheel mode? </div> <div> • Turn starting switch ON. • PTO switch: Travel or PTO 1 • Steering mode switch: Front wheel mode. </div>	Go to troubleshooting for applicable error code	—
<div> 2 Is MDTL error E60, E62, EA1, or ED1 displayed in rear wheel mode? </div> <div> • Turn starting switch ON. • PTO switch: Travel or PTO 1 • Steering mode switch: Rear wheel mode. • When rear steering FREE is detected. </div>	Go to troubleshooting for applicable error code	—
<div> 3 Is MDTL error E62, EA0, EA1, ED0, or ED1 displayed in 4-wheel mode? </div> <div> • Turn starting switch ON. • PTO switch: Travel or PTO 1 • Steering mode switch: 4-wheel mode. • When rear steering FREE is detected. </div>	Go to troubleshooting for applicable error code	—
<div> 4 YES Is MDTL error E61, EA0, EA2, ED0, ED2 displayed at crab mode? </div> <div> • Turn starting switch ON. • PTO switch: Travel or PTO 1 • Steering mode switch: Crab mode. • When rear steering FREE is detected. </div>	Go to troubleshooting for applicable error code	—
	Go to troubleshooting for ATM error [E5A, E5B, E7F, E8F]	Repair or replace

EL-118 Related electric circuit diagram

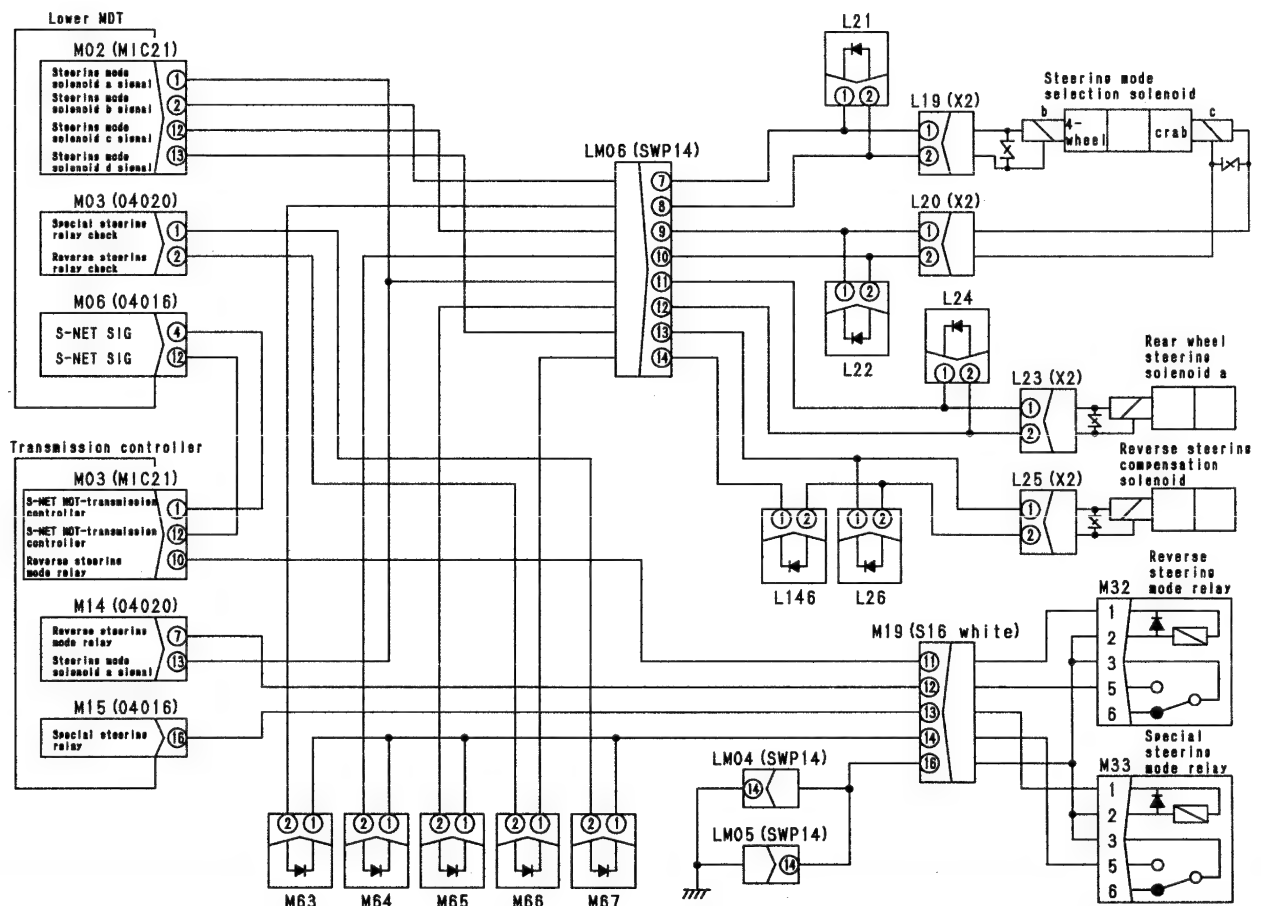


EL-119 MDTL error EF3 (Reverse steering failure 1, normal steering held) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EL-119 Related electric circuit diagram



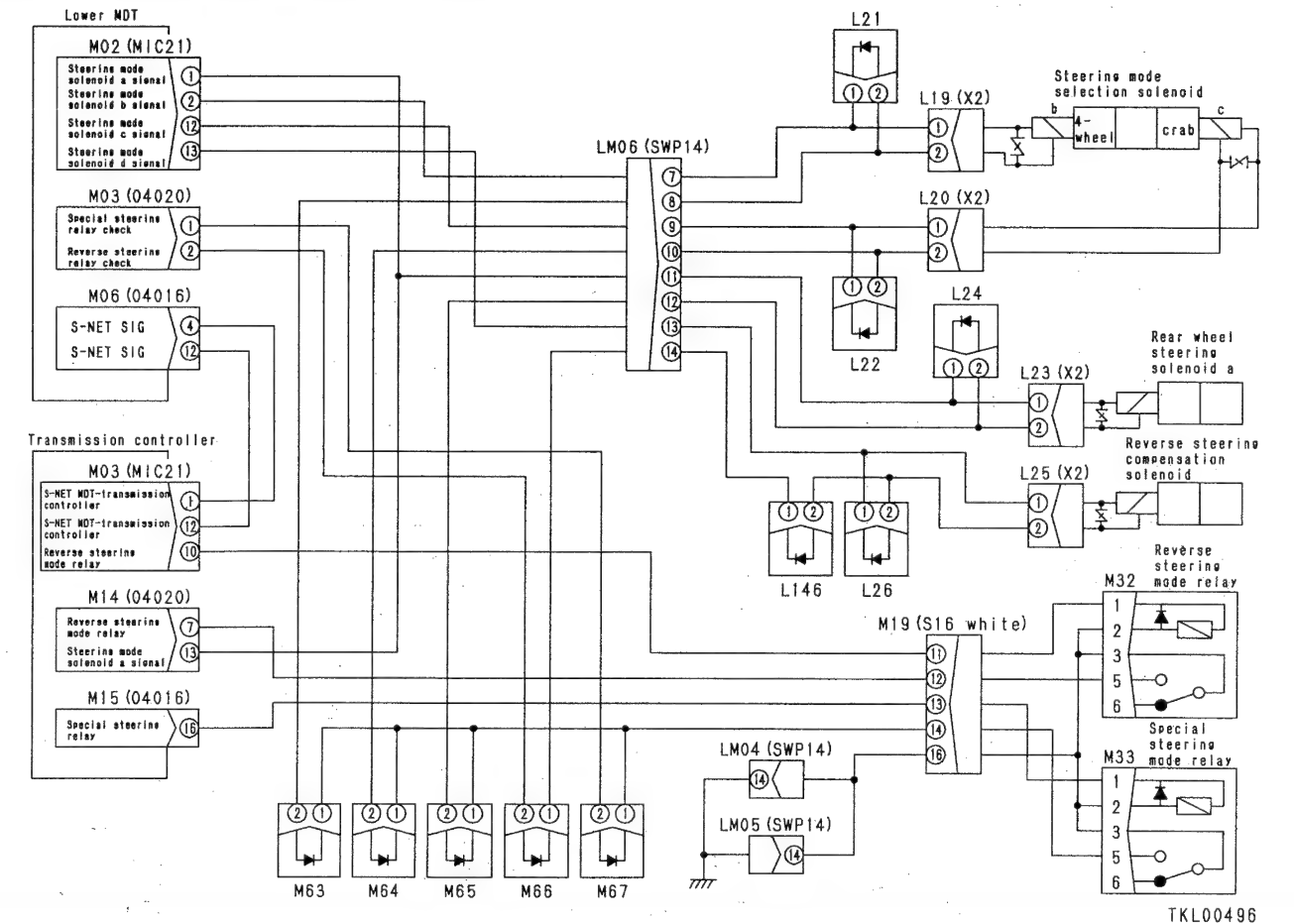
TKL00496

EL-120 MDTL error EF4 (Reverse steering failure 2, reverse steering held) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

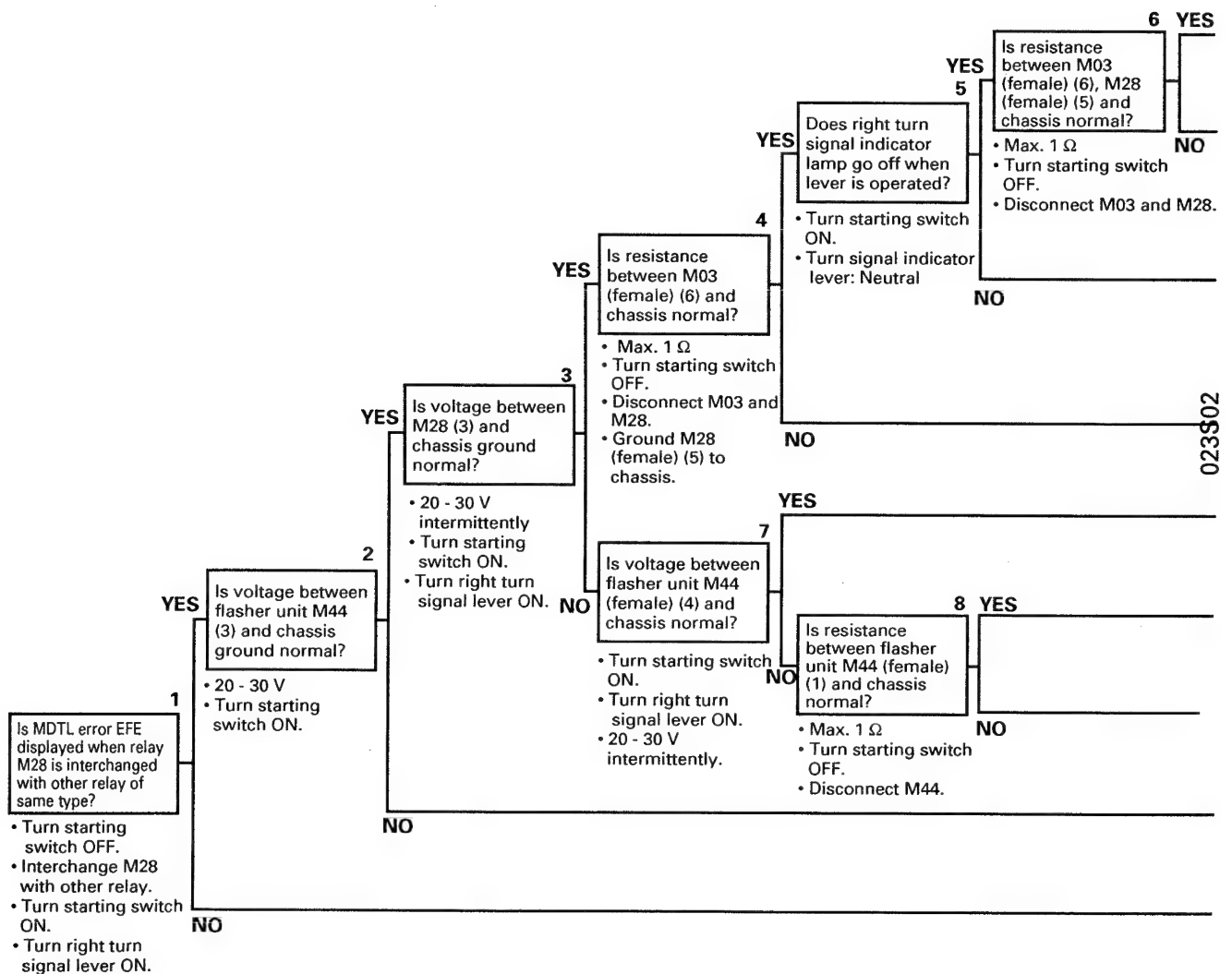
		Cause	Remedy
<div><div>1</div><div>Is MDTL error EA3 or ED3 displayed in reverse steering front wheel mode?</div><div><div>• Turn starting switch ON.</div><div>• PTO switch: Travel or PTO 1</div><div>• Steering mode switch: Normal steering front wheel mode.</div><div>• When rear steering FREE is detected.</div></div></div> <div><div>2</div><div>Is MDTL error E63 displayed in reverse steering front wheel mode?</div><div><div>• Turn starting switch ON.</div><div>• PTO switch: Travel or PTO 1</div><div>• Steering mode switch: Reverse steering front wheel mode.</div></div></div>	YES	Go to troubleshooting for applicable error code	—
	2 YES	Go to troubleshooting for applicable error code	—
	NO	Go to troubleshooting for ATM error [E5C, E5D, E7B, E8B]	—

EL-120 Related electric circuit diagram



EL-121 MDTL error EFE (Abnormality in right turn relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that bottom fuse III-3 is normal.

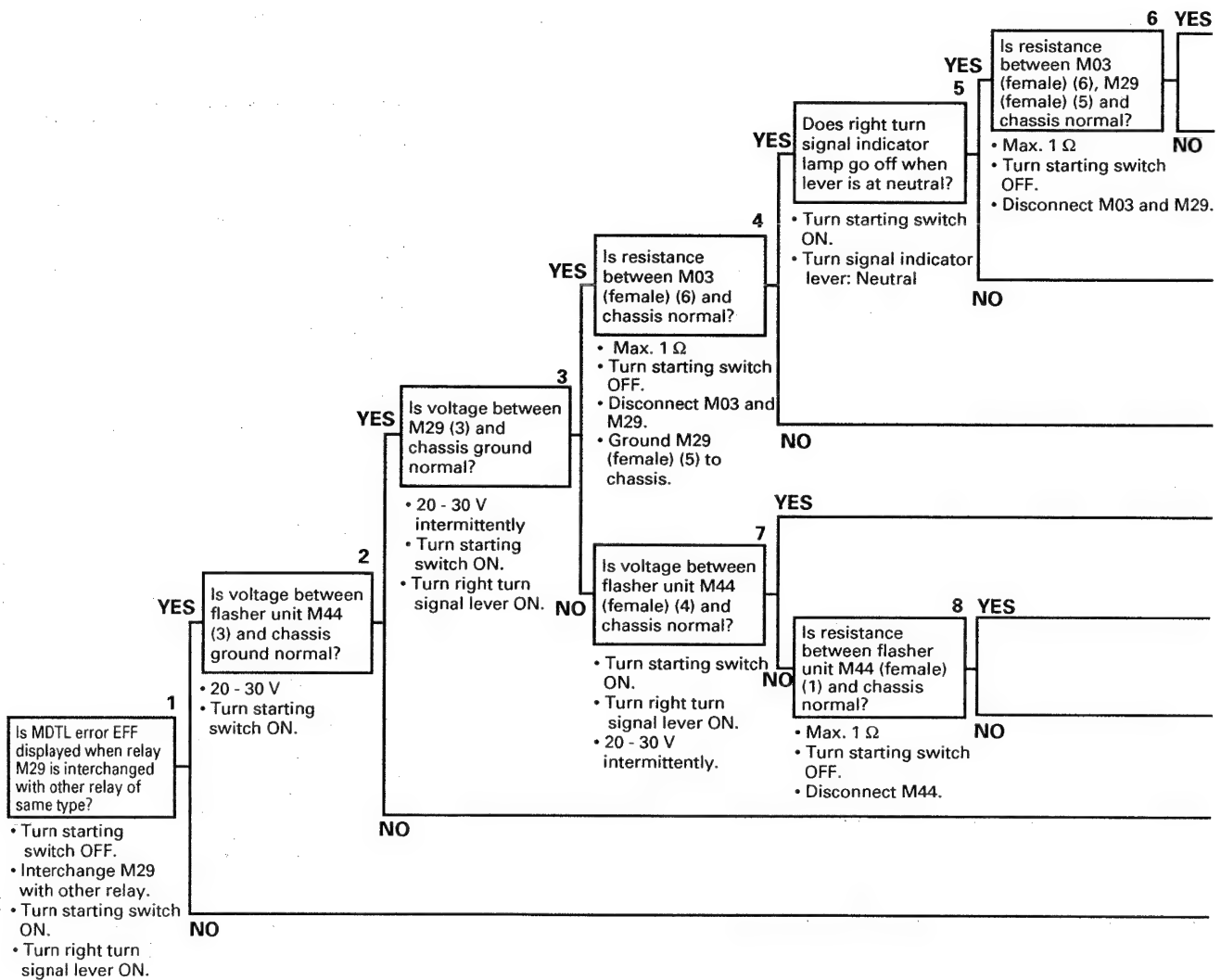


023S02

	Cause	Remedy
	Defective lower MDT	Replace
	Defective contact or disconnection in wiring harness between M03 (female) (6) - M20 (8) - M28 (female) (5)	Repair or replace
	Wiring harness between M03 (female) (6) - M20 (8) - M28 (female) (5) (- intermediate connecting point of M03 (female) (6) and M20 (female) (8) - LM04 (6) - L55 (female) (1) - L45 (4) - L46 (female) (1)) short circuiting with chassis ground	Repair or replace
	Wiring harness between M03 (female) (6) - M20 (8) - M28 (female) (5) (- intermediate connecting point of M03 (female) (6) and M20 (female) (8) - LM04 (6) - L55 (female) (1) - L45 (4) - L46 (female) (1)) short circuiting with power source	Repair or replace
	Defective wiring harness between M28 (female) (3) and M44 (female) (4)	Repair or replace
	Defective flasher unit	Replace
	Defective contact or disconnection in wiring harness between flasher unit M44 (female) (1) and chassis ground	Replace
	Defective contact or disconnection in wiring harness between bottom fuse III-3 and M44 (female) (3)	Repair or replace
	Defective right turn relay	Replace

EL-122 MDTL error EFF (Abnormality in left turn relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that bottom fuse III-3 is normal.

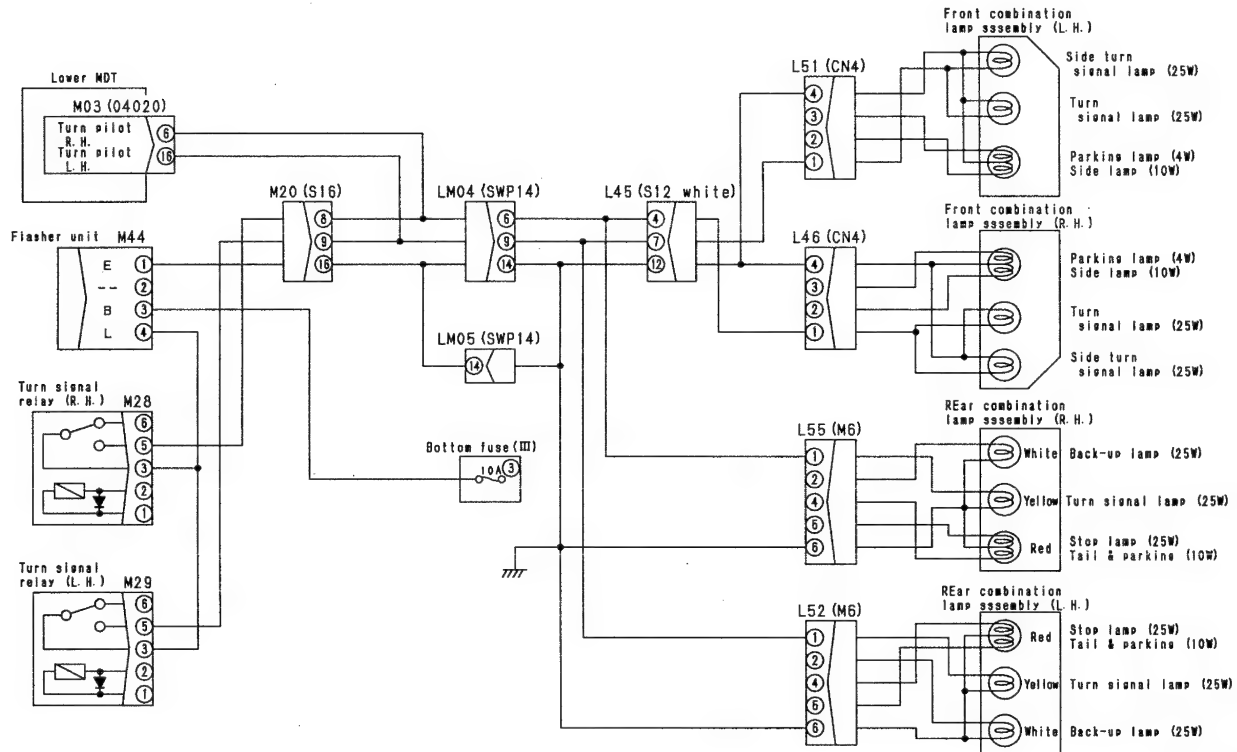


023S02

023S02

	Cause	Remedy
	Defective lower MDT	Replace
	Defective contact or disconnection in wiring harness between M03 (female) (16) - M20 (9) - M29 (female) (5)	Repair or replace
	Wiring harness between M03 (female) (16) - M20 (9) - M29 (female) (5) (- intermediate connecting point of M03 (female) (16) and M20 (female) (9) - LM04 (9) - L52 (female) (1) - L45 (7) - L51 (female) (1)) short circuiting with chassis ground	Repair or replace
	Wiring harness between M03 (female) (16) - M20 (9) - M29 (female) (5) (- intermediate connecting point of M03 (female) (16) and M20 (female) (9) - LM04 (9) - L52 (female) (1) - L45 (7) - L51 (female) (1)) short circuiting with power source	Repair or replace
	Defective wiring harness between M29 (female) (3) and M44 (female) (4)	Repair or replace
	Defective flasher unit	Replace
	Defective contact or disconnection in wiring harness between flasher unit M44 (female) (1) and chassis ground	Replace
	Defective contact or disconnection in wiring harness between bottom fuse III-3 and M44 (female) (3)	Repair or replace
	Defective left turn relay	Replace

EL-121, 122 Related electric circuit diagram



TKL00497

023S02

TROUBLESHOOTING OF MOMENT LIMITER CONTROLLER SYSTEM (EM MODE)

Table of error codes and troubleshooting codes	20-704
Action of controller and condition of machine when abnormality occurs	20-712
Judgement table for moment limiter controller, and hydraulic and mechanical systems	20-740
Electrical circuit diagram of moment limiter system	20-745
Electrical circuit diagram of outrigger system	20-746
EM- 1 OSS error E00 (Abnormality in communication (cut off) between moment limiter controller and monitor) is displayed	20-748
EM- 2 OSS error E01 (Panel system error) is displayed	20-749
EM- 3 OSS error E02 (Abnormality in panel rotary switch) is displayed	20-749
EM- 4 OSS error E10 (Moment limiter system error) is displayed	20-749
EM- 5 OSS error E20 (Abnormality in S-NET communication between moment limiter controller and MDT) is displayed	20-750
EM- 6 OSS error E21 (Abnormality in outrigger length sensor FL) is displayed	20-751
EM- 7 OSS error E22 (Abnormality in outrigger length sensor FR) is displayed	20-753
EM- 8 OSS error E23 (Abnormality in outrigger length sensor RL) is displayed	20-755
EM- 9 OSS error E24 (Abnormality in outrigger length sensor RR) is displayed	20-757
EM-10 OSS error E30 (Abnormality in communication (cut off) between moment limiter controller and jib transmission module) is displayed	20-759
EM-11 OSS error E31 (Abnormality in jib tilt angle sensor system) is displayed	20-760
EM-12 OSS error E41 (Abnormality in boom angle sensor system) is displayed	20-762
EM-13 OSS error E43 (Abnormality in boom length sensor system) is displayed	20-764
EM-14 OSS error E44 (Abnormality in hoist cylinder bottom pressure sensor system) is displayed	20-766
EM-15 OSS error E45 (Abnormality in hoist cylinder head pressure sensor system) is displayed	20-768
EM-16 OSS error E46 (Abnormality in swing angle sensor) is displayed	20-770
EM-17 OSS error E48 (Reverse rotation of hoist cylinder axis power) is displayed	20-772
EM-18 OSS error E50 (Main unload solenoid short circuited with ground) is displayed	20-773
EM-19 OSS error E51 (PPC unload solenoid short circuited with ground) is displayed	20-774
EM-20 OSS error E52 (Boom telescope selector solenoid short circuited with ground) is displayed	20-775
EM-21 OSS error E53 (Automatic stop cancel prohibition relay short circuited with ground) is displayed ...	20-776
EM-26 OSS error E58 (Jib automatic EXTEND/STOW relay short circuited with ground) is displayed	20-777
EM-27 OSS error E59 (Jib rotation permission relay short circuited with ground) is displayed	20-778
EM-30 OSS error E5C (Moment limiter buzzer short circuited with ground) is displayed	20-779
EM-31 OSS error E5D (Emergency alarm buzzer short circuited with ground) is displayed	20-780
EM-32 OSS error E68 (sensor 10 V power source short circuited with ground) is displayed	20-781
EM-33 OSS error E6A (sensor 15 V power source short circuited with ground) is displayed	20-782
EM-34 OSS error E70 (Main unload solenoid short circuited with power source) is displayed	20-783
EM-35 OSS error E71 (PPC unload solenoid short circuited with power source) is displayed	20-784
EM-36 OSS error E72 (Boom telescope selector solenoid short circuited with power source) is displayed	20-785
EM-37 OSS error E73 (Automatic stop cancel prohibition relay short circuited with power source) is displayed	20-786
EM-41 OSS error E78 (Jib automatic EXTEND/STOW relay short circuited with power source) is displayed	20-787
EM-42 OSS error E79 (Jib rotation permission relay short circuited with power source) is displayed	20-788
EM-43 OSS error E88 (Disconnection in main unload solenoid) is displayed	20-789
EM-44 OSS error E89 (Disconnection in PPC unload solenoid) is displayed	20-790

EM-45	OSS error E8A (Disconnection in boom telescope selector solenoid) is displayed	20-791
EM-46	OSS error E8B (Disconnection in automatic stop cancel prohibition relay) is displayed	20-792
EM-47	OSS error EA0 (Abnormality in swing over-front limit switch) is displayed	20-793
EM-48	OSS error EA1 (Abnormality in top boom stow limit switch) is displayed	20-794
EM-49	OSS error EA2 (Abnormality in boom selector switch) is displayed	20-795
EM-50	OSS error EA3 (Jib left lock pin proximity sensor short circuited with power source) is displayed ...	20-796
EM-52	OSS error EA5 (Abnormality in PTO mode switch [travel mode switch input]) is displayed	20-797
EM-53	OSS error EA6 (H/X selection doesn't match) is displayed	20-799
EM-54	OSS error EA7 (Specification selection rotary switch setting not available) is displayed	20-799
EM-55	OSS error EA8 (Boom RAISE PPC pressure switch short circuited with ground) is displayed	20-800
EM-56	OSS error EA9 (Boom LOWER PPC pressure switch short circuited with ground) is displayed	20-801
EM-57	OSS error EAA (Boom EXTEND PPC pressure switch short circuited with ground) is displayed	20-802
EM-58	OSS error EAB (Boom RETRACT PPC pressure switch short circuited with ground) is displayed	20-803
EM-59	OSS error EAC (Jib RAISE PPC pressure switch short circuited with ground) is displayed	20-804
EM-60	OSS error EAD (Jib LOWER PPC pressure switch short circuited with ground) is displayed	20-805
EM-61	OSS error EB0 (Boom RAISE + LOWER PPC pressure switch input simultaneously) is displayed	20-806
EM-62	OSS error EB1 (Boom EXTEND + RETRACT PPC pressure switch input simultaneously) is displayed	20-808
EM-63	OSS error EB2 (Jib RAISE + LOWER PPC pressure switch input simultaneously) is displayed	20-810
EM-64	OSS error EB3 (Swing left + right PPC pressure switch input simultaneously) is displayed	20-812
EM-65	OSS error EB4 (Main winch WIND IN + WIND OUT PPC pressure switch input simultaneously) is displayed	20-814
EM-66	OSS error EB5 (Auxiliary winch WIND IN + WIND OUT PPC pressure switch input simultaneously) is displayed	20-816
EM-101	Abnormality in moment limiter controller power source system	20-818
EM-102	Abnormality in moment limiter panel power source system	20-821
EM-103	Abnormality in jib communication module power source system	20-822
EM-104	Does not enter working mode (work equipment and winch do not work)	20-824
EM-106	Abnormality in winch overwind limit switch system	20-826
EM-106-1	Lifting capacity is limited (abnormality in top boom stow limit switch)	20-834
EM-106-2	Boom telescope cannot be selected (top or 2nd) (usual operations are normal) (defective boom selector switch system)	20-835
EM-106-3	Abnormality in swing over-front limit switch	20-836
EM-106-4	Abnormality in swing angle sensor (2) system	20-837
EM-107	Main winch does not enter free-fall or remains in free-fall condition (abnormality in main winch free-fall interlock solenoid system)	20-838
EM-108	Auxiliary winch does not switch to free-fall or remains in free-fall condition (abnormality in auxiliary winch free-fall interlock solenoid system)	20-840
EM-109	Abnormality in jib left lock pin proximity sensor system	20-842
EM-110	Abnormality in left lock pin completion indicator system	20-844
EM-111	Abnormality in jib cable connection signal system	20-845
EM-112	Abnormality in jib automatic EXTEND/STOW relay system	20-846
EM-113	Abnormality in jib rotation permission relay system	20-847
EM-114	Abnormality in jib selector solenoid system	20-848
EM-115	Abnormality in jib left lock pin solenoid (EXTEND) system	20-852
EM-116	Abnormality in jib left lock pin solenoid (STOW) system	20-860
EM-117	Abnormality in jib stow detection sensor system	20-868
EM-118	Abnormality in jib stow completion indicator system	20-872

EM-119	Abnormality in jib rotation solenoid (EXTEND) system	20-874
EM-120	Abnormality in jib rotation solenoid (STOW) system	20-882
EM-121	Abnormality in jib right lock pin solenoid (EXTEND) system	20-890
EM-122	Abnormality in jib right lock pin solenoid (STOW) system	20-898
EM-123	Abnormality in swing brake solenoid system	20-906
EM-124	Abnormality in swing FREE solenoid system	20-908
EM-125	Abnormality in main winch drum speed signal (abnormality in main winch drum speed sensor system)	20-910
EM-126	Abnormality in auxiliary winch drum speed display or abnormality in auxiliary winch speed buzzer	20-911
EM-127	Abnormality in main winch buzzer system	20-912
EM-128	Abnormality in auxiliary winch buzzer system	20-914
EM-129	Abnormality in automatic stop cancel prohibition relay system	20-916
EM-130	Abnormality in automatic stop cancel signal system	20-920
EM-131	Abnormality in pedal operation selector solenoid system	20-922
EM-132	Abnormality in accumulator pressure switch system	20-926
EM-133	Abnormality in main winch WIND IN PPC pressure switch system	20-928
EM-134	Abnormality in main winch WIND OUT PPC pressure switch system	20-929
EM-135	Abnormality in auxiliary winch WIND IN PPC pressure switch system	20-930
EM-136	Abnormality in auxiliary winch WIND OUT PPC pressure switch system	20-931
EM-137	Abnormality in swing left PPC pressure switch system	20-932
EM-138	Abnormality in swing right PPC pressure switch system	20-933
EM-139	Abnormality in moment limiter buzzer system	20-934
EM-140	Abnormality in emergency alarm buzzer system	20-935
EM-201	Abnormality in outrigger panel power source system	20-936
EM-202	Abnormality in outrigger power source relay (outrigger power source/bottom panel power source) system	20-938
EM-203	Abnormality in outrigger length sensor power source system	20-941
EM-204	Abnormality in outrigger mode system	20-942
EM-205	Defective operation of top outrigger EXTEND/STOW switch (EXTEND) system	20-943
EM-206	Defective operation of top outrigger EXTEND/STOW switch (STOW) system	20-945
EM-207	Defective operation of top outrigger SLIDE/JACK switch (SLIDE) system	20-947
EM-208	Defective operation of top outrigger SLIDE/JACK switch (JACK) system	20-949
EM-209	Defective operation of top outrigger ALL switch system	20-951
EM-210	Defective operation of top outrigger FL switch system	20-953
EM-211	Defective operation of top outrigger FR switch system	20-955
EM-212	Defective operation of top outrigger RL switch system	20-957
EM-213	Defective operation of top outrigger RR switch system	20-959
EM-214	Defective operation of bottom outrigger ALL switch system	20-961
EM-215	Defective operation of bottom outrigger control panel (RL jack) system	20-963
EM-216	Defective operation of bottom outrigger control panel (FL jack) system	20-965
EM-217	Defective operation of bottom outrigger control panel (RR jack) system	20-967
EM-218	Defective operation of bottom outrigger control panel (FR jack) system	20-969
EM-219	Defective operation of bottom outrigger control panel (RL slide) system	20-971
EM-220	Defective operation of bottom outrigger control panel (FL slide) system	20-972
EM-221	Defective operation of bottom outrigger control panel (RR slide) system	20-973
EM-222	Defective operation of bottom outrigger control panel (FR slide) system	20-974
EM-223	Abnormality in idle up switch system	20-975
EM-224	Abnormality in swing pump merge solenoid system	20-977

TABLE OF ERROR CODES AND TROUBLESHOOTING CODES

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
(Upper MDT related)			
MDTU error E00	MDT system error	Action impossible, travel, operation stopped	EU- 1
MDTU error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EU- 2
MDTU error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EU- 3
MDTU error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EU- 4
MDTU error E21	Top, bottom selection warning	Travel, operation stopped	EU- 5
MDTU error E24	Model doesn't match (application stopped)	Action impossible, travel, operation stopped	EU- 6
MDTU error E25	Model selection warning	Travel, operation stopped	EU- 7
MDTU error E28	Abnormality in C-NET communication between MDTs (output stopped)	Travel, operation stopped	EU- 8
MDTU error E29	Abnormality in S-NET communication between MDT and moment limiter	Operation stopped	EU- 9
MDTU error E40	Swing flasher output short circuited with ground	Swing flasher does not flash	EU-10
MDTU error E41	Power source for outrigger panel short circuited with ground	Top outrigger cannot be operated	EU-11
MDTU error E43	Outrigger mode power source short circuited with ground	Outrigger cannot be operated	EU-13
MDTU error E44	Crab mode LED short circuited with ground	Crab mode LED does not light up	EU-14
MDTU error E45	Front wheel mode LED short circuited with ground	Front wheel mode LED does not light up	EU-15
MDTU error E46	Rear wheel mode LED short circuited with ground	Rear wheel mode LED does not light up	EU-16
MDTU error E47	4-wheel mode LED short circuited with ground	4-wheel mode LED does not light up	EU-17
MDTU error E48	Rear steering LOCK LED short circuited with ground	Rear steering LOCK LED does not light up	EU-18
MDTU error E49	Rear steering FREE LED short circuited with ground	Rear steering FREE LED does not light up	EU-19
MDTU error E4A	Rear steering CENTER LED short circuited with ground	Rear steering CENTER LED does not light up	EU-20
MDTU error E4B	Reverse steering display lamp short circuited with ground	Reverse steering display lamp does not light up	EU-21
MDTU error E4C	Winch rotation buzzer (main winch) short circuited with ground	Main winch buzzer does not sound	EU-22
MDTU error E4D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	EU-23
MDTU error E4E	Winch rotation buzzer (auxiliary winch) short circuited with ground	Auxiliary winch buzzer does not sound	EU-24
MDTU error E4F	Monitor central buzzer short circuited with ground	Monitor central buzzer does not sound	EU-25
MDTU error E50	Tachometer signal output short circuited	Tachometer does not work	EU-26
MDTU error E51	Speedometer signal output short circuited	Speedometer does not work	EU-27
MDTU error E52	Fuel level signal output short circuited	Fuel gauge does not work	EU-28
MDTU error E53	Engine water temperature signal output short circuited	Engine water temperature gauge does not work	EU-29
MDTU error E55	Torque converter oil temperature output short circuited	Torque converter overheat caution lamp does not light up	EU-30
MDTU error E56	Engine oil pressure output short circuited	Engine oil pressure caution lamp does not light up	EU-31
MDTU error E57	Preheating pilot output short circuited	Glow lamp (preheating pilot lamp) does not light up	EU-32
MDTU error E58	Parking brake actuation lamp output short circuited	Parking brake indicator lamp does not light up	EU-33

023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTU error E59	Retarder lamp output short circuited	Magnetic retarder lamp does not light up	EU-34
MDTU error E5A	Hi beam pilot output short circuited with ground	Hi beam pilot lamp does not light up	EU-35
MDTU error E5B	Hourmeter output short circuited with ground	Service meter does not work	EU-36
MDTU error E5C	Charge lamp output short circuited with ground	Battery charge caution lamp does not light up	EU-37
MDTU error E5D	Brake fluid level output short circuited with ground	Brake fluid (oil) level lamp does not light up	EU-38
MDTU error E5E	Right turn pilot output short circuited with ground	Right turn pilot lamp does not flash	EU-39
MDTU error E5F	Left turn pilot output short circuited with ground	Left turn pilot lamp does not flash	EU-40
MDTU error E72	LED dimmer 1 short circuited with ground	Shift position LED is not dimmed when using night lighting (lamp ON)	EU-41
MDTU error E73	LED dimmer 1 short circuited with power source	Shift position LED goes out or becomes excessively dim	EU-42
MDTU error E74	LED dimmer 2 short circuited with ground	Rear steering LOCK LED is not dimmed when using night lighting (lamp ON)	EU-43
MDTU error E75	LED dimmer 2 short circuited with power source	Rear steering LOCK LED goes out or becomes excessively dim	EU-44
MDTU error E80	Swing flasher output short circuited with power source	Swing flasher lamp does not go out	EU-46
MDTU error E83	Outrigger mode power source short circuited with power source	Bottom outrigger operation possible at position other than Operation 1 (PTO 1)	EU-47
MDTU error EB3	Disconnection in outrigger mode power source	Outrigger cannot be operated	EU-48
MDTU error EE0	PTO mode doesn't match	Action impossible (controller at PTO 1) travel, operation stopped	EU-49
MDTU error EE1	Abnormality in 2WD Hi/4WD Hi/4WD Lo input	Action impossible (controller at 4WD Hi)	EU-50
MDTU error EE3	Abnormality in service brake input	Possible to apply parking brake	EU-51
MDTU error EE4	Abnormality in suspension lift switch	Impossible to use suspension lift	EU-52
MDTU error EE5	Abnormality in outrigger control switch	Top outrigger cannot be operated	EU-53
MDTU error EE6	Outrigger EXTEND + RETRACT inputsimultaneously, JACK + SLIDE input simultaneously	Top outrigger cannot be operated	EU-54
MDTU error EEA	Abnormality in steering mode switch input	Steering mode does not switch	EU-55
MDTU error EEC	Rear steering LOCK + FREE command input simultaneously	Rear steering LOCK/FREE cannot be operated	EU-56
(Lower MDT related)			
MDTL error E00	MDT system error	Action impossible, travel, operation stopped	EL- 1
MDTL error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EL- 2
MDTL error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EL- 3
MDTL error E18	Disconnection in tachometer sensor	Tachometer does not work	EL- 4
MDTL error E19	Disconnection in speedometer sensor	Speedometer does not work	EL- 5
MDTL error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EL- 6
MDTL error E21	Top, bottom selection warning	Travel, operation stopped	EL- 7
MDTL error E24	Model doesn't match (application stopped)	Travel, operation stopped	EL- 8
MDTL error E25	Model selection warning	Travel, operation stopped	EL- 9
MDTL error E28	Abnormality in C-NET communication between MDTs	Travel, operation stopped	EL-10
MDTL error E29	Abnormality in S-NET communication between MDT and transmission controller	Travel, operation stopped	EL-11

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E40	Outrigger jack RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-22
MDTL error E41	Outrigger jack FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-23
MDTL error E42	Outrigger jack RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-24
MDTL error E43	Outrigger jack FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-25
MDTL error E44	Outrigger slide RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-26
MDTL error E45	Outrigger slide FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-27
MDTL error E46	Outrigger slide RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-28
MDTL error E47	Outrigger slide FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-29
MDTL error E48	Outrigger selector EXTEND short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-30
MDTL error E49	Outrigger selector RETRACT short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-31
MDTL error E4A	Rear steering LOCK solenoid short circuited with ground	Rear steering LOCK cannot be operated	EL-32
MDTL error E4B	Rear steering FREE solenoid short circuited with ground	Rear steering FREE cannot be operated	EL-33
MDTL error E4C	Service brake short circuited with ground	Auxiliary brake cannot be applied	EL-34
MDTL error E4D	Exhaust brake short circuited with ground	Exhaust brake cannot be applied	EL-35
MDTL error E4E	Retarder short circuited with ground	Retarder brake cannot be applied	EL-36
MDTL error E4F	Preheating short circuited with ground	Preheating does not work	EL-37
MDTL error E51	Retarder speed output short circuited with ground	Retarder brake cannot be applied	EL-39
MDTL error E5A	Head lamp Hi relay short circuited with ground	Hi beam does not work	EL-43
MDTL error E5B	Head lamp Lo relay short circuited with ground	Lo beam does not work	EL-44
MDTL error E5C	Side lamp relay short circuited with ground	Side lamp does not work	EL-45
MDTL error E5D	Service lamp relay short circuited with ground	Service lamp does not work	EL-46
MDTL error E5E	Right turn relay short circuited with ground	Turn signal indicator does not work	EL-47
MDTL error E5F	Left turn relay short circuited with ground	Turn signal indicator does not work	EL-48
MDTL error E60	Steering mode solenoid a short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-49
MDTL error E61	Steering mode solenoid c short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-50
MDTL error E62	Steering mode solenoid b short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-51
MDTL error E63	Steering mode solenoid d short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-52
MDTL error E64	Pump merge solenoid short circuited with ground	Lack of speed when outrigger ALL switch is operated	EL-53
MDTL error E67	Suspension lift solenoid short circuited with ground	Impossible to use suspension lift	EL-55
MDTL error E76	5V output short circuited with ground	Outrigger cannot be set, possible to actuate in emergency setting	EL-56
MDTL error E80	Outrigger jack RL short circuited with power source	Abnormal telescoping of outrigger	EL-57
MDTL error E81	Outrigger jack FL short circuited with power source	Abnormal telescoping of outrigger	EL-58
MDTL error E82	Outrigger jack RR short circuited with power source	Abnormal telescoping of outrigger	EL-59
MDTL error E83	Outrigger jack FR short circuited with power source	Abnormal telescoping of outrigger	EL-60

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E84	Outrigger slide RL short circuited with power source	Abnormal telescoping of outrigger	EL-61
MDTL error E85	Outrigger slide FL short circuited with power source	Abnormal telescoping of outrigger	EL-62
MDTL error E86	Outrigger slide RR short circuited with power source	Abnormal telescoping of outrigger	EL-63
MDTL error E87	Outrigger slide FR short circuited with power source	Abnormal telescoping of outrigger	EL-64
MDTL error E88	Outrigger selector EXTEND short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-65
MDTL error E89	Outrigger selector RETRACT short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-66
MDTL error E8A	Rear steering LOCK solenoid short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-67
MDTL error E8B	Rear steering FREE solenoid short circuited with power source	Rear steering FREE (travel carefully)	EL-68
MDTL error E8C	Service brake short circuited with power source	Impossible to release auxiliary brake	EL-69
MDTL error E8D	Exhaust brake short circuited with power source	Impossible to release exhaust brake	EL-70
MDTL error E8E	Retarder short circuited with power source	Impossible to release retarder brake	EL-71
MDTL error E8F	Preheating short circuited with power source	Preheating continues, abnormal engine exhaust color, drop in horsepower	EL-72
MDTL error E9A	Head lamp Hi short circuited with power source	Stays lighted at Hi beam	EL-73
MDTL error E9B	Head lamp Lo short circuited with power source	Stays lighted at Lo beam	EL-74
MDTL error E9C	Side lamp short circuited with power source	Side lamp stays lighted up	EL-75
MDTL error E9E	Right turn relay short circuited with power source	Turn signal remains actuated	EL-76
MDTL error E9F	Left turn relay short circuited with power source	Turn signal remains actuated	EL-77
MDTL error EA0	Steering mode solenoid a short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-78
MDTL error EA1	Steering mode solenoid c short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-79
MDTL error EA2	Steering mode solenoid b short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-80
MDTL error EA3	Steering mode solenoid d short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-81
MDTL error EA4	Pump merge solenoid short circuited with power source	Impossible to operate swing	EL-82
MDTL error EA7	Suspension lift solenoid short circuited with power source	Impossible to extend outrigger	EL-83
MDTL error EB0	Disconnection in outrigger jack RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-84
MDTL error EB1	Disconnection in outrigger jack FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-85
MDTL error EB2	Disconnection in outrigger jack RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-86
MDTL error EB3	Disconnection in outrigger jack FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-87
MDTL error EB4	Disconnection in outrigger slide RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-88
MDTL error EB5	Disconnection in outrigger slide FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-89
MDTL error EB6	Disconnection in outrigger slide RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-90
MDTL error EB7	Disconnection in outrigger slide FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-91
MDTL error EB8	Disconnection in outrigger selector EXTEND	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-92
MDTL error EB9	Disconnection in outrigger selector RETRACT	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-93
MDTL error EBA	Disconnection in rear steering LOCK solenoid	Impossible to set rear steering to LOCK (when at LOCK, impossible to rear steering to FREE)	EL-94

023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error EBB	Disconnection in rear steering FREE solenoid	Impossible to set rear steering to FREE	EL- 95
MDTL error EBC	Disconnection in service brake	Impossible to operate auxiliary brake	EL- 96
MDTL error EBD	Disconnection in exhaust brake	Impossible to operate exhaust brake	EL- 97
MDTL error EBF	Disconnection in preheating	Impossible to operate preheating	EL- 98
MDTL error ECA	Disconnection in head lamp Hi relay	Impossible to operate Hi beam	EL- 99
MDTL error ECB	Disconnection in head lamp Lo relay	Impossible to operate Lo beam	EL-100
MDTL error ECC	Disconnection in side lamp relay	Impossible to operate side lamp	EL-101
MDTL error ECE	Disconnection in right turn relay	Impossible to operate turn signal	EL-102
MDTL error ECF	Disconnection in left turn relay	Impossible to operate turn signal	EL-103
MDTL error ED0	Disconnection in steering mode solenoid a	Rear steering set to LOCK, travel with front 2-wheel steering	EL-104
MDTL error ED1	Disconnection in steering mode solenoid c	Rear steering set to LOCK, travel with front 2-wheel steering	EL-105
MDTL error ED2	Disconnection in steering mode solenoid b	Rear steering set to LOCK, travel with front 2-wheel steering	EL-106
MDTL error ED3	Disconnection in steering mode solenoid d	Rear steering set to LOCK, travel with front 2-wheel steering	EL-107
MDTL error ED4	Disconnection in pump merge solenoid	Lack of speed when outrigger ALL switch is operated	EL-108
MDTL error ED7	Disconnection in suspension lift	Impossible to use suspension lift	EL-109
MDTL error EE7	Outrigger control signal short circuited with power source	Immediately stops travel, impossible to operate steering, actuates emergency steering	EL-110
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	Takes no particular action, impossible to detect occurrence of secondary problem	EL-111
MDTL error EE9	Disconnection in fuel sensor	Fuel level unknown	EL-112
MDTL error EEB	Abnormality in rear steering LOCK limit switch/FREE limit switch/CENTER limit switch	Rear steering set to LOCK, travel with front 2-wheel steering	EL-113
MDTL error EEE	Failure of both speedometer sensors	No speedometer display, rear steering set to LOCK, travel with front 2-wheel steering	EL-114
MDTL error EEF	MDT speedometer sensor failure	Rear steering set to LOCK, travel with front 2-wheel steering	EL-115
MDTL error EF0	Special steering failure (emergency stop mode)	Immediately stops travel	EL-116
MDTL error EF1	Reverse steering failure (emergency stop mode)	Immediately stops travel	EL-117
MDTL error EF2	Special steering failure	Immediately stops travel, rear steering set to LOCK, travel with front 2-wheel steering	EL-118
MDTL error EF3	Reverse steering failure 1	Travels with normal steering, cannot set to reverse steering	EL-119
MDTL error EF4	Reverse steering failure 2	Immediately stops travel, rear steering set to LOCK, travel with normal steering	EL-120
MDTL error EFE	Abnormality in right turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-121
MDTL error EFF	Abnormality in left turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-122
(Moment limiter controller related)			
OSS error E00	Abnormality in panel communication	Impossible to change working mode	EM- 1
OSS error E01	Panel system error	Impossible to change working mode	EM- 2
OSS error E02	Abnormality in panel rotary switch	Impossible to change working mode	EM- 3
OSS error E10	Moment limiter system error	Action impossible, stops work	EM- 4
OSS error E20	Abnormality in S-NET (communication between MDTs)	Action impossible, stops work	EM- 5

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
OSS error E21	Abnormality in outrigger length sensor FL system	Outrigger cannot be set, outrigger emergency setting mode	EM- 6
OSS error E22	Abnormality in outrigger length sensor FR system	Outrigger cannot be set, outrigger emergency setting mode	EM- 7
OSS error E23	Abnormality in outrigger length sensor RL system	Outrigger cannot be set, outrigger emergency setting mode	EM- 8
OSS error E24	Abnormality in outrigger length sensor RR system	Outrigger cannot be set, outrigger emergency setting mode	EM- 9
OSS error E30	Abnormality in jib transmission module communication	Impossible to operate jib	EM-10
OSS error E31	Abnormality in tilt angle sensor system	Impossible to operate jib, jib angle unknown	EM-11
OSS error E41	Abnormality in boom angle sensor system	Impossible to operate boom, boom angle unknown, hook load unknown	EM-12
OSS error E43	Abnormality in boom length sensor system	Impossible to operate boom, boom length unknown, hook load unknown	EM-13
OSS error E44	Abnormality in bottom pressure sensor system	Impossible to operate boom, hook load unknown	EM-14
OSS error E45	Abnormality in head pressure sensor system	Impossible to operate boom, hook load unknown	EM-15
OSS error E46	Abnormality in swing angle sensor system	Impossible to operate boom, swing position unknown	EM-16
OSS error E48	Reverse rotation of hoist cylinder axis power	Boom hoist cylinder stroke end, impossible to operate boom, hook load unknown	EM-17
OSS error E50	Main unload solenoid short circuited with ground	Work equipment does not move	EM-18
OSS error E51	PPC unload solenoid short circuited with ground	Jib tilt does not work	EM-19
OSS error E52	Jib telescope selector solenoid short circuited with ground	Top telescope cylinder does not work	EM-20
OSS error E53	Automatic stop cancel prohibition relay short circuited with ground	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	EM-21
OSS error E58	Jib EXTEND/STOW relay short circuited with ground	Impossible to extend or stow jib	EM-26
OSS error E59	Jib rotation permission relay short circuited with ground	Impossible to extend or stow jib (impossible to rotate	EM-27
OSS error E5C	Moment limiter buzzer short circuited with ground	Moment limiter buzzer does not sound	EM-30
OSS error E5D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	EM-31
OSS error E68	10 V power source short circuited with ground	Impossible to operate boom, hook load unknown	EM-32
OSS error E6A	15 V power source short circuited with ground	Impossible to operate boom, hook load unknown	EM-33
OSS error E70	Main unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop	EM-34
OSS error E71	PPC unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop (jib LOWER only)	EM-35
OSS error E72	Jib telescope selector solenoid short circuited with power source	2nd boom telescope cylinder does not move	EM-36
OSS error E73	Automatic stop cancel prohibition relay short circuited with power source	Impossible to use automatic stop cancel	EM-37
OSS error E78	Jib EXTEND/STOW relay short circuited with power source	Impossible to operate jib	EM-41
OSS error E79	Jib rotation permission relay short circuited with power source	Impossible to extend or stow jib	EM-42
OSS error E88	Disconnection in main unload solenoid	Stays at automatic stop	EM-43
OSS error E89	Disconnection in PPC unload solenoid	Stays at automatic stop (jib LOWER only)	EM-44
OSS error E8A	Disconnection in jib telescope selector solenoid	Top boom telescope cylinder does not move	EM-45
OSS error E8B	Disconnection in automatic stop cancel prohibition relay	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	EM-46
OSS error EA0	Abnormality in over-front limit switch	For on-tire operation, traveling with raised load, over-front load table is not given	EM-47
OSS error EA1	Abnormality in top boom stow limit switch	Boom telescope abnormal, rated load limited	EM-48

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
OSS error EA2	Abnormality in boom selector switch	Manual telescope impossible	EM-49
OSS error EA3	Left lock pin input short circuited with power source	Abnormality in jib EXTEND/STOW	EM-50
OSS error EA5	Abnormality in PTO switch	Action impossible (controller at PTO 1 condition)	EM-52
OSS error EA6	H/X selection doesn't match (outrigger)	Action impossible (controller at X-shape condition)	EM-53
OSS error EA7	Specification selection rotary switch setting not available	Action impossible, stops work	EM-54
OSS error EA8	Boom RAISE PPC pressure switch short circuited with ground	Automatic stop	EM-55
OSS error EA9	Boom LOWER PPC pressure switch short circuited with ground	Automatic stop	EM-56
OSS error EAA	Boom EXTEND PPC pressure switch short circuited with ground	Automatic stop	EM-57
OSS error EAB	Boom RETRACT PPC pressure switch short circuited with ground	Automatic stop	EM-58
OSS error EAC	Jib RAISE PPC pressure switch short circuited with ground	Automatic stop	EM-59
OSS error EAD	Jib LOWER PPC pressure switch short circuited with ground	Automatic stop	EM-60
OSS error EB0	PPC pressure switch boom RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-61
OSS error EB1	PPC pressure switch boom EXTEND + RETRACT input simultaneously	Automatic stop reset impossible	EM-62
OSS error EB2	PPC pressure switch jib RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-63
OSS error EB3	PPC pressure switch swing left + right input simultaneously	Automatic stop reset impossible	EM-64
OSS error EB4	PPC pressure switch main winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-65
OSS error EB5	PPC pressure switch auxiliary winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-66
(Transmission controller related)			
ATM error E11	Disconnection in tachometer sensor	Shock when shifting gear but travel possible	ET- 1
ATM error E12	Disconnection in speed sensor 1	Nothing in particular (emergency stop when secondary problem occurs)	ET- 2
ATM error E13	Disconnection in speed sensor 2	Nothing in particular (emergency stop when secondary problem occurs)	ET- 3
ATM error E14	Disconnection in accelerator potentiometer	Shock when shifting gear but travel possible	ET- 4
ATM error E17	Disconnection in shift lever	Time lag when shifting gear	ET- 5
ATM error E18	Disconnection in FR signal for interlock	Time lag when shifting gear	ET- 6
ATM error E19	No input for solenoid power source monitor	Normal travel possible (detection impossible when secondary problem occurs)	ET- 7
ATM error E24	Accelerator potentiometer short circuited	Shock when shifting gear but travel possible	ET- 8
ATM error E25	Abnormality in emergency gear shift switch or abnormality in PTO 2 switch	Emergency travel impossible, operate valve in emergency	ET- 9
ATM error E32	Abnormality in speed sensor 1	Normal travel possible (emergency stop when secondary problem occurs)	ET-10
ATM error E33	Abnormality in speed sensor 2	Normal travel possible (emergency stop when secondary problem occurs)	ET-11
ATM error E35	MDT at other than N with interlock signal N	Travel possible in emergency gear shift mode	ET-12
ATM error E37	Abnormality in shift lever (2 or more signals ON)	Travel possible in emergency gear shift mode from neutral	ET-13
ATM error E38	Interlock F + R signals ON simultaneously	Travel possible (time lag when shifting gear)	ET-14
ATM error E39	Interlock signal F or R but MDT at N	Travel possible in emergency gear shift mode	ET-15
ATM error E3F	Abnormality in S-NET (communication between MDTs)	Travel possible under certain conditions (★)	ET-16

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
ATM error E53	Overrun	Normal travel possible (overrun warning only)	ET-17
ATM error E55	Drop in battery voltage	Stop, travel possible with emergency gear shift mode	ET-18
ATM error E5A	Special steering system short circuited with ground	Normal travel possible	ET-19
ATM error E5B	Disconnection in special steering system	Impossible to change from front wheel mode	ET-20
ATM error E5C	Reverse steering system short circuited with ground	Normal travel possible	ET-21
ATM error E5D	Disconnection in reverse steering system	Impossible to change to reverse steering mode	ET-22
ATM error E70	Disconnection in R solenoid (ECMV) system	Cannot travel in reverse	ET-23
ATM error E71	Disconnection in F2 solenoid (ECMV) system	Cannot travel forward	ET-24
ATM error E72	Disconnection in F1 solenoid (ECMV) system	Cannot travel forward	ET-25
ATM error E73	Disconnection in F3 solenoid (ECMV) system	Cannot travel forward	ET-26
ATM error E74	Disconnection in lock-up solenoid (ECMV) system	Torque converter lock-up impossible	ET-27
ATM error E78	Disconnection in Lo solenoid system	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-28
ATM error E79	Disconnection in 4WD solenoid system	4WD travel impossible (travel possible in 2WD Hi)	ET-29
ATM error E7B	Disconnection in reverse steering compensation relay system	Travel possible except in reverse steering mode	ET-30
ATM error E7C	Disconnection in F2, R solenoid cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-31
ATM error E7D	Disconnection in back-up lamp relay	Back-up lamp does not light up in REVERSE	ET-32
ATM error E7E	Disconnection in F1, F3 solenoid (ECMV) cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-33
ATM error E7F	Disconnection in special steering relay system	Travel possible in front wheel mode	ET-34
ATM error E80	R solenoid (ECMV) system short circuited	Cannot travel in reverse	ET-35
ATM error E81	F2 solenoid (ECMV) system short circuited	Cannot travel forward	ET-36
ATM error E82	F1 solenoid (ECMV) system short circuited	Cannot travel forward	ET-37
ATM error E83	F3 solenoid (ECMV) system short circuited	Cannot travel forward	ET-38
ATM error E84	Lock-up solenoid (ECMV) system short circuited	Torque converter lock-up impossible	ET-39
ATM error E88	Lo solenoid system short circuited	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-40
ATM error E89	4WD solenoid system short circuited	4WD travel impossible (travel possible in 2WD Hi)	ET-41
ATM error E8B	Reverse steering compensation system short circuited	Travel possible except in reverse steering mode	ET-42
ATM error E8C	F2, R solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-43
ATM error E8D	Back-up lamp relay system short circuited	Back-up lamp does not light up in REVERSE	ET-44
ATM error E8E	F1, F3 solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-45
ATM error E8F	Special steering mode relay system short circuited	Travel possible in front wheel mode	ET-46
ATM error E90,E91	R or F2 solenoid system short circuited with power source	Cannot travel	ET-47
ATM error E92,E93	F3 or F1 solenoid system short circuited with power source	Cannot travel forward	ET-48
ATM error E94	Lock-up solenoid system short circuited with power source	Torque converter lock-up impossible	ET-49

★ For "certain conditions" for ATM error E3F in the Problem on machine column, see the transmission controller related section in ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS.

ACTION OF CONTROLLER AND CONDITION OF MACHINE
WHEN ABNORMALITY OCCURS

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
1	Automatic stop output	OSS error E50	1) Defective main unload solenoid 2) Wiring harness between C11 (female) (5) – CR9 (4) – R54 (female) (1) {– R53 (female) (1) – intermediate connecting point of C11 (female) (5) and CR9 (female) (4) – C22 (13) – C49 (female) (1)} short circuiting with chassis ground 3) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Solenoid resistance value: 10 – 40 Ω Voltage (between C11 (5) and chassis) • When main unload solenoid is actuated: 20 – 30 V
2		OSS error E88	1) Defective main unload solenoid 2) Defective contact or disconnection in wiring harness between C11 (female) (5) – CR9 (4) – R54 (female) (1) 3) Defective contact or disconnection in wiring harness between R54 (female) (2) and chassis 4) Defective moment limiter controller	Load resistance is more than 900 Ω (detected when output is OFF)	Solenoid resistance value: 10 – 40 Ω Voltage (between C11 (5) and chassis) • When main unload solenoid actuation conditions are OK (not operated): Max. 1 V
3		OSS error E70	1) Wiring harness between C11 (female) (5) – CR9 (4) – R54 (female) (1) {– R53 (female) (1) – intermediate connecting point of C11 (female) (5) and CR9 (female) (4) – C22 (13) – C49 (female) (1)} short circuiting with chassis ground 2) Defective moment limiter controller	Output voltage when output is OFF is more than 8.5 V and automatic stop cancel switch input GND	Voltage (between C11 (5) and chassis) • When starting switch is ON: Max. 1 V
4	Automatic stop cancel prohibition output	OSS error E53	1) Defective automatic stop cancel prohibition relay 2) Wiring harness between C11 (female) (7) – C22 (12) – C41 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Solenoid resistance value: 200 – 400 Ω Voltage (between C11 (7) and chassis) • When automatic stop cancel prohibition relay is actuated: 20 – 30 V
5		OSS error E8B	1) Defective automatic stop cancel prohibition relay 2) Defective contact or disconnection in wiring harness between C11 (female) (7) – C22 (12) – C41 (female) (1) 3) Defective contact or disconnection in wiring harness between C41 (female) (2) – C23 (12) – chassis 4) Defective moment limiter controller	Load resistance is more than 900 Ω (detected when output is OFF)	Solenoid resistance value: 200 – 400 Ω Voltage (between C11 (7) and chassis) • When automatic stop cancel prohibition relay actuation conditions are OK (not operated): Max. 1 V
6		OSS error E73	1) Wiring harness between C11 (female) (7) – C22 (12) – C41 (female) (1) short circuiting with power source 2) Defective moment limiter controller	Output voltage when output is OFF is more than 8.5 V	Voltage (between C11 (7) and chassis) • When starting switch is ON: Max. 1 V
7	Boom operation output	OSS error E52	1) Defective boom telescope selector solenoid valve 2) Wiring harness between C11 (female) (17) – CR9 (1) – R48 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Solenoid resistance value: 10 – 40 Ω Voltage (between C11 (17) and chassis) • When boom telescope selector solenoid is actuated: 20 – 30 V
8		OSS error E8A	1) Defective boom telescope selector solenoid valve 2) Defective contact or disconnection in wiring harness between C11 (female) (17) – CR9 (1) – R48 (female) (1) 3) Defective contact or disconnection in wiring harness between R48 (female) (2) and chassis 4) Defective moment limiter controller	Load resistance is more than 900 Ω (detected when output is OFF)	Solenoid resistance value: 10 – 40 Ω Voltage (between C11 (17) and chassis) • When boom telescope selector solenoid actuation conditions are OK (not operated): Max. 1 V

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
Output OFF	○	×	×	○	×	○	Work equipment does not move (except swing)	Working mode		EM-18
	○	×	×	○	×	×	Work equipment does not move (except swing)	Working mode		EM-43
	○	○	×	○	○	○	Does not carry out automatic stop	Working mode		EM-34
Output OFF	○	×	×	○	×	○	Automatic stop cancel prohibition impossible	Working mode		EM-21
	○	×	×	○	×	○	Automatic stop cancel prohibition impossible	Working mode		EM-46
	×	×	×	○	×	×	Automatic stop cancel impossible	Working mode		EM-37
Output OFF	○	×	×	○	×	○	No. 2 cylinder does not telescope	Working mode		EM-20
	○	×	×	○	×	×	No. 2 cylinder does not telescope	Working mode		EM-45

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
9	Boom operation output	OSS error E72	1) Defective boom telescope selector solenoid valve 2) Wiring harness between C11 (female) (17) – CR9 (1) – R48 (female) (1) not short circuiting 3) Defective moment limiter controller	When output is ON, output voltage is more than 8.5 V	Voltage (between C11 (17) and chassis) • When starting switch is ON: Max. 1 V
10	Jib operation output	OSS error E51	1) Defective PPC unload solenoid valve 2) Wiring harness between C11 (female) (6) – CR9 (3) – R52 (female) (1) {– R51 (female) (1) – intermediate connecting point of C11 (female) (6) and CR9 (female) (3) – C23 (9) – C38 (female) (1)} short circuiting with chassis ground 3) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Solenoid resistance value: 30 – 80 Ω Voltage (between C11 (6) and chassis) • When PPC unload solenoid is actuated: 20 – 30 V
11		OSS error E89	1) Defective PPC unload solenoid valve 2) Defective contact or disconnection in wiring harness between C11 (female) (6) – CR9 (3) – R52 (female) (1) 3) Defective contact or disconnection in wiring harness between R52 (female) (2) and chassis 4) Defective moment limiter controller	Load resistance is more than 900 Ω (detected when output is OFF)	Solenoid resistance value: 30 – 80 Ω Voltage (between C11 (6) and chassis) • When PPC unload solenoid actuation conditions are OK (not operated): Max. 1 V
12		OSS error E71	1) Wiring harness between C11 (female) (6) – CR9 (3) – R52 (female) (1) {– R51 (female) (1) – intermediate connecting point of C11 (female) (6) and CR9 (female) (3) – C23 (9) – C38 (female) (1)} short circuiting with power source 2) Defective moment limiter controller	Output voltage when output is OFF is more than 8.5 V and automatic stop cancel switch input GND	Voltage (between C11 (6) and chassis) • When starting switch is ON: Max. 1 V
13		OSS error E58	1) Defective jib automatic EXTEND/STOW relay 2) Wiring harness between C11 (female) (20) – C23 (1) – C35 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Relay resistance value: 200 – 400 Ω Voltage (between C11 (20) and chassis) • When jib automatic EXTEND/STOW relay is actuated: 17 – 30
14		—	1) Defective jib automatic EXTEND/STOW relay 2) Defective contact or disconnection in wiring harness between C11 (female) (20) – C23 (1) – C35 (female) (1) 3) Defective contact or disconnection in wiring harness between C35 (female) (2) – C23 (12) – chassis 4) Defective moment limiter controller		Relay resistance value: 200 – 400 Ω Voltage (between C11 (20) and chassis) • When jib automatic EXTEND/STOW relay actuation conditions are OK (not operated): Max. 1 V
15		OSS error E78	1) Wiring harness between C11 (female) (20) – C23 (1) – C35 (female) (1) short circuiting with power source 2) Defective moment limiter controller	Input 24 V when output is OFF	Voltage (between C11 (20) and chassis) • When starting switch is ON: Max. 1 V
16		OSS error E59	1) Defective jib rotation permission relay 2) Wiring harness between C11 (female) (10) – C23 (8) – C37 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Solenoid resistance value: 200 – 400 Ω Voltage (between C11 (10) and chassis) • When jib rotation permission relay is actuated: 17 – 30 V

023502

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
Output OFF	○	×	×	○	×	×	No. 1 cylinder does not telescope	Working mode		EM-36
Output OFF	○	×	×	○	×	○	Impossible to lower jib	Working mode		EM-19
	○	×	×	○	×	○	Impossible to lower jib	Working mode		EM-44
	○	×	×	○	×	○	Possible to lower jib when carrying out boom operations	Working mode		EM-35
	○	×	×	○	×	○	Impossible to extend or stow jib	Working mode	Standard mode	EM-26
	—	—	—	—	—	—	Impossible to extend or stow jib			EM-112
	○	○	×	○	×	×	Possible to extend or stow jib except in preparation mode	Working mode		EM-41
	○	×	×	○	×	○	Jib rotation permission impossible	Working mode	Standard mode	EM-27

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
17	Jib operation output	—	1) Defective jib rotation permission relay 2) Defective contact or disconnection in wiring harness between C11 (female) (10) – C23 (8) – C37 (female) (1) 3) Defective contact or disconnection in wiring harness between C37 (female) (2) – C23 (12) – chassis 4) Defective moment limiter controller	—	Solenoid resistance value: 200 – 400 Ω Voltage (between C11 (10) and chassis) • When jib rotation permission relay actuation conditions are OK (not operated): Max. 1 V
18		OSS error E79	1) Wiring harness between C11 (female) (10) – C23 (8) – C37 (female) (1) short circuiting with power source 2) Defective moment limiter controller	When output is ON, voltage is more than 8.5 V	Voltage (between C11 (10) and chassis) • When starting switch is ON: Max. 1 V
31	Jib operation output	OSS error E5C	1) Defective moment limiter buzzer 2) Wiring harness between C12 (female) (12) and C111 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Voltage (between C12 (12) and chassis) • When starting switch is ON and PTO switch is at Operation 1 or Operation 2, for 3 sec after check mode IN (when buzzer sounds): 20 – 30 V
32		—	1) Defective moment limiter buzzer 2) Defective contact or disconnection in wiring harness between C111 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between C12 (female) (12) – C111 (female) (1) 4) Defective moment limiter controller	—	Voltage (between C12 (12) and chassis) • When starting switch is ON and PTO switch is at Operation 1 or Operation 2: Max. 1 V
33		—	1) Wiring harness between C12 (female) (12) and C111 (female) (1) short circuiting with power source 2) Defective moment limiter controller	—	Voltage (between C12 (12) and chassis) • When starting switch is ON: Max. 1 V
34		OSS error E5D	1) Defective emergency alarm buzzer 2) Wiring harness between C136 (female) (1) and C110 (female) (1) short circuiting with chassis ground 3) Wiring harness between C12 (female) (1) – C136 (2) – C110 (female) (1) short circuiting with chassis ground 4) Defective moment limiter controller	When output is ON, output voltage is less than 3.5 V (output voltage input inside controller)	Voltage (between C12 (1) and chassis) • When starting switch is ON and PTO switch is at Operation 1 or Operation 2, for 3 sec after check mode IN (when buzzer sounds): 20 – 30 V
35		—	1) Defective emergency alarm buzzer 2) Defective contact or disconnection in wiring harness between C110 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between C12 (female) (1) – C136 (2), (1) – C110 (female) (1) 4) Defective contact or disconnection in wiring harness between C01 (female) (20) – C155 (2), (1) – C110 (female) (1) 5) Defective upper MDT or moment limiter controller	—	Voltage (between C12 (1) and chassis) • When starting switch is ON and PTO switch is at Operation 1 or Operation 2: Max. 1 V
36		—	1) Wiring harness between C01 (female) (20) – C155 (2), (1) – C110 (female) (1) or wiring harness between C12 (female) (1) – C136 (2), (1) – C110 (female) (1) short circuiting with power source 2) Defective upper MDT or moment limiter controller	—	Voltage (between C12 (1) and chassis) • When starting switch is ON: Max. 1 V

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
Output OFF	—	—	—	—	—	—	Jib rotation permission impossible	Working mode		EM-113
	○	○	×	○	×	×	Jib rotation permission always possible	Working mode		EM-42
Output OFF	×	×	×	○	×	○	Moment limiter buzzer does not sound	Working mode		EM-30
—	—	—	—	—	—	—	Moment limiter buzzer does not sound	Working mode		EM-139
—	—	—	—	—	—	—	Moment limiter buzzer does not stop sounding	Working mode		EM-139
Output OFF, substitute moment limiter buzzer	×	×	×	○	×	○	Emergency alarm buzzer does not sound	Working mode		EM-31
—	—	—	—	—	—	—	Emergency alarm buzzer does not sound	Working mode		EM-140
—	—	—	—	—	—	—	Emergency alarm buzzer does not stop sounding	Working mode		EM-140

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
61	ON/OFF input	—	1) Defective main winch overwind limit switch 2) Defective auxiliary winch overwind limit switch (for boom) 3) Wiring harness between C14 (female) (1) – cord reel – B08 (1),(2) – B10 (female) (1) system short circuiting with chassis ground 4) Defective moment limiter controller 5) Defective cord reel	—	Voltage (between C14 (1) and chassis) • When main (auxiliary) winch overwind limit switch is ON (at maximum wind-in): 15 – 30 V
62		—	1) Defective main winch overwind limit switch 2) Defective auxiliary winch overwind limit switch (for boom) 3) Defective contact or disconnection in wiring harness between C14 (female) (1) – cord reel – B08 4) Defective contact or disconnection in wiring harness between B08 (female) (2) and B10 (female) (1) 5) Defective contact or disconnection in wiring harness between B10 (female) (2) and chassis 6) Defective moment limiter controller 7) Defective cord reel	—	Voltage (between C14 (1) and chassis) • Except when main (auxiliary) winch overwind limit switch is ON (at maximum wind-in): Max. 1 V
63		OSS error EA0	1) Defective over-front limit switch 2) Wiring harness between C14 (female) (11) – CR6 (12) – R40 (female) (1) 3) Defective moment limiter controller	Swing angle over-front $\pm 5^\circ$ or more and limit switch ON and no swing sensor error	Voltage (between C14 (11) and chassis) • Except for on-tire operations facing front: 15 – 30 V
64		—	1) Defective swing over-front limit switch 2) Defective contact or disconnection in wiring harness between L03 (female) (1),(2), L04 (female) (1) – battery (-) – chassis 3) Defective contact or disconnection in wiring harness between R40 (female) (3) – CR6 (14) – CR1 (50, CR3 (13),(14) – R04 (female) (1), R03 (female) (1),(2) 4) Defective contact or disconnection in wiring harness between C14 (female) (11) – CR6 (12) – R40 (female) (1) 5) Wiring harness between C14 (female) (11) – CR6 (12) – R40 (female) (1) short circuiting with power source 6) Defective moment limiter controller	—	Voltage (between C14 (11) and chassis) • On-tire operations facing front (limit switch ON): Max. 1 V
65		OSS error EA1	1) Defective top boom stow limit switch 2) Wiring harness between C14 (female) (2) – CR10 (5) – BR2 (female) (2) – B13 (female) (2) system short circuiting with chassis ground 3) Wiring harness between B01 (male) (2) and B07 (female) (1) short circuiting with chassis ground 4) Defective moment limiter controller 5) Defective cord reel	Boom length more than 15m and limit switch stow (GND) and no boom upper limit error LS OPEN (24V) detected, reset from error	Voltage (between C14 (2) and chassis) • Top boom extended: 15 – 30 V
66		—	1) Defective top boom stow limit switch 2) Defective contact or disconnection in wiring harness between B01 (male) (2) and B07 (female) (1) 3) Defective contact or disconnection in wiring harness between B07 (female) (3) and chassis 4) Defective contact or disconnection in wiring harness between C14 (female) (2) – CR10 (5) – BR2 (female) (2) – B13 (female) (2) 5) Wiring harness between C14 (female) (2) – CR10 (5) – BR2 (female) (2) – B13 (female) (2) – cord reel – B01 (2 B07 (female) (1) short circuiting with power source 6) Defective moment limiter controller	—	Voltage (between C14 (2) and chassis) • Top boom stowed (limit switch ON): Max. 1 V
67		—	1) Defective work equipment lever stand RAISE/LOWER limit switch 2) Wiring harness between C14 (female) (12) – C137 (2),(1) – C116 (5) – C126 (male) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C14 (12) and chassis) • Work equipment lever stand lowered: 15 – 30 V

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
—	—	—	—	—	—	—	Overwind detection impossible	Working mode		EM-106
—	—	—	—	—	—	—	Always in overwind condition	Working mode		EM-106
Controls as 360°	○	○	×	○	×	×	In on-tire operations, displays error when work equipment faces front	Working mode	During on-tire operations	EM-47
—	—	—	—	—	—	—	Does not recognize over-front during on-tire operations	Working mode	During on-tire operations	EM-106-2
Limits rated load to 14.5 tons	×	×	×	○	×	×	Rated load is limited to 14.5 tons	Working mode		EM-48
(When at LS OPEN (24V), limits rated load to 14.5 tons	—	—	—	—	—	—	Rated load is limited to 14.5 tons	Working mode		EM-106-1
—	—	—	—	—	—	—	Does not carry out automatic stop when work equipment lever stand is lowered	Working mode		EM-104

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
68	ON/OFF input	—	1) Defective work equipment lever stand RAISE/LOWER limit switch 2) Defective contact or disconnection in wiring harness between C14 (female) (12) – C137 (2),(1) – C116 (5) – C126 (male) 3) Defective contact or disconnection in wiring harness between C126 (male) – C116 (2) – chassis 4) Defective moment limiter controller	—	Voltage (between C14 (12) and chassis) • Work equipment lever stand raised: Max. 1 V
69		OSS error EA2	1) Defective boom selector switch (top) 2) Wiring harness between C14 (female) (14) – CP11 (3) – P53 (male) (1) short circuiting with chassis ground 3) Defective moment limiter controller	Input voltage for top and 2nd selector switches simultaneously less than 3.5 V Error canceled when both top and are 2nd OPEN	Voltage (between C14 (14) and chassis) • Boom selector switch neutral: 15 – 30 V
70		—	1) Defective boom selector switch (top) 2) Defective contact or disconnection in wiring harness between C14 (female) (14) – CP11 (3) – P53 (male) (1) or short circuit with power source 3) Defective moment limiter controller	—	Voltage (between C14 (14) and chassis) • Boom selector switch top ON (pressed): Max. 1 V
71		OSS error EA2	1) Defective boom selector switch (2nd) 2) Defective contact or disconnection in wiring harness between C14 (female) (4) – CP11 (4) – P53 (male) (2) or short circuit with power source 3) Defective moment limiter controller	Input voltage for top and 2nd selector switches simultaneously less than 3.5 V Error canceled when both top and are 2nd OPEN	Voltage (between C14 (4) and chassis) • Boom selector switch neutral: 15 – 30 V
72		—	1) Defective boom selector switch (2nd) 2) Wiring harness between C14 (female) (4) – CP11 (4) – P5 (male) (2) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C14 (4) and chassis) • Boom selector switch 2nd ON (pressed): Max. 1 V
73		—	1) Defective jib left lock pin proximity sensor 2) Defective contact or disconnection in wiring harness between C14 (female) (5) – CR11 (11) – BR3 (7) – B05 (female) (6) 3) Defective contact or disconnection in wiring harness between top fuse 3 – C20 (16) – CR11 (1) – BR2 (7) – B11 (female) (1) 4) Defective contact or disconnection in wiring harness between BJ1 (male) (1) and J16 (female) (1) 5) Defective contact or disconnection in wiring harness between B05 (female) (8) – BR3 (12) – chassis 6) Defective contact or disconnection in wiring harness between J16 (female) (3) and BJ2 (male) (8) 7) Defective contact or disconnection in wiring harness between BJ2 (male) (6) and J16 (female) (2) 8) Wiring harness between BJ2 (male) (6) and J16 (female) (2) short circuiting with chassis ground 9) Wiring harness between top fuse 3 – C20 (16) – CR11 (1) – BR2 (7) – B11 (female) (1) short circuiting with chassis ground 10) Wiring harness between BJ1 (male) (1) and J16 (female) (1) short circuiting with chassis ground 11) Wiring harness between C14 (female) (5) – CP10 (6) – P40 (female) or between CR11 (11) – BR3 (7) – B05 (female) (6) short circuiting with chassis ground 12) Defective left lock pin completion indicator 13) Defective moment limiter controller	—	Voltage (between C14 (5) and chassis) • When starting switch is ON, PTO switch is at Operation 1 or Operation 2, and jib wiring harness is connected: Left lock pin locked: 15 – 30 V Left lock pin not locked: Max. 1 V

023502

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
—	—	—	—	—	—	—	Even when PTO switch is set to Operation, work equipment does not move When lever stand is raised, "Lever stand lowered" message appears	Working mode		EM-104
—	×	×	×	○	×	×	Impossible to telescope 2nd boom	Working mode		EM-49
—	—	—	—	—	—	—	Impossible to select top	Working mode		EM-106-2
—	×	×	×	○	×	×	Impossible to telescope top boom	Working mode		EM-49
—	—	—	—	—	—	—	Impossible to select 2nd	Working mode		EM-106-2
—	—	—	—	—	—	—	Impossible to detect lock input Impossible to extend jib	Working mode		EM-109

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
74	ON/OFF input	OSS error EA3	1) Wiring harness between BJ2 (male) (6) and J16 (female) (2) short circuiting with power source 2) Wiring harness between C14 (female) (5) – CP10 (6) – P40 (female) or between CR11 (11) – BR3 (7) – B05 (female) (6) short circuiting with power source 3) Defective left lock pin completion indicator 4) Defective moment limiter controller	When jib extension wiring harness is not connected, left lock pin completion signal is more than 8.5 V	Voltage (between C14 (5) and chassis) • When starting switch is ON: Max. 1 V
75		—	1) Defective automatic stop cancel switch 2) Wiring harness between CP3 (female) (12) – C25 (16) – C41 (female) (3) short circuiting with chassis ground 3) Defective contact or disconnection in wiring harness between CP3 (female) (12) – C25 (16) – C41 (female) (3) 4) Defective contact or disconnection in wiring harness between C41 (female) (6) and C38 (female) (2), C49 (female) (2)	—	Voltage (between C14 (15) and chassis) • When starting switch is ON, PTO switch is at Operation 1 or Operation 2, and work equipment lever stand is raised: Automatic stop cancel switch At CANCEL: 20 – 30 V At AUTOMATIC: Max. 1 V
76		—	1) Wiring harness between CP3 (female) (12) and C14 (female) (15) short circuiting with power source 2) Wiring harness between CP3 (female) (12) – C25 (16) – C41 (3), (6) – C38 (female) (2), C49 (female) (2) short circuiting with power source	—	• Starting switch at ON: Max. 1 V
79		OSS error EA3	1) Defective PTO mode switch 2) Defective contact or disconnection in wiring harness between P04 – CP2 (2) – C04 (female) (1) or between P02 – CP2 (5) – C14 (female) (8) 3) Defective contact or disconnection in wiring harness between P06 – CP2 (4) – C04 (female) (2) or between P06 – CP2 (4) – C14 (female) (18) 4) Wiring harness between P06 – CP2 (4) – C14 (female) (18) (including wiring harness between connecting point between CP2 (female) (4) and C14 (female) (18) – C159 (2)) short circuiting with power source 5) Wiring harness between P04 – CP2 (2) – C04 (female) (1) or between P02 – CP2 (5) – C14 (female) (8) short circuiting with power source 6) Defective upper MDT or moment limiter controller	Simultaneous input voltage when MDT input does not match or at Operation and Trave is more than 8.5 V or simultaneous input voltage is less than 3.5 V	See Tables 1 and 2 of EM-52 Troubleshooting flow chart
81		—	1) Defective cord reel 2) Wiring harness between C13 (female) (12) – CR11 (5) – BR3 (8) – B05 (female) (7) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C13 (12) and chassis) • When starting switch is ON and PTO switch is at Operation 1 or Operation 2: Jib wiring harness not connected: 15 – 30 V
82		OSS error EA3	1) Defective cord reel 2) Defective contact or disconnection in wiring harness between B05 (female) (8) – BR3 (12) – chassis 3) Defective contact or disconnection in wiring harness between BJ2 (female) (7) and (8) 4) Defective contact or disconnection in wiring harness between C13 (female) (12) – CR11 (5) – BR3 (8) – B05 (female) (7) or short circuit with power source 5) Defective moment limiter controller	When input voltage of left lock pin input completion limit switch is more than 8.5 V: same as input voltage less than 3.5 V left lock pin input completion limit switch short circuiting with power source	Voltage (between C13 (12) and chassis) • When starting switch is ON and PTO switch is at Operation 1 or Operation 2: Jib wiring harness connected: Max. 1 V
83		OSS error EA8	1) Defective boom RAISE PPC pressure switch 2) Wiring harness between C13 (female) (1) – CR9 (8) – R58 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller Error is reset with boom RAISE PPC pressure switch operation (min. 8.5 V) input	When there is neutral input for boom RAISE and LOWER PPC pressure switches (simultaneous input voltage: less than 3.5 V) and boom angle increases 5 x and there is no error in boom angle upper limit	Voltage (between C13 (1) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom operated to RAISE: 15 – 30 V

★ When operating the work equipment control lever or swing lever, it is possible to operate in small movements (enough to be able to detect the PPC pressure).

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
—	×	×	×	○	×	×	Jib wiring harness not connected, but lock input detected	Working mode		EM-50
—	—	—	—	—	—	—	Disconnection between cancel switch and cancel relay: Automatic stop cancel impossible Disconnection between cancel relay and moment limiter: E70, 71 output at automatic stop cancel Short circuiting with chassis ground: Automatic stop cancel impossible, fuse blown	Working mode		EM-129
—	—	—	—	—	—	—	Automatic stop impossible, not canceled, but "Automatic stop being canceled" message is displayed	Working mode		EM-129
Judged as working mode	○	○	○	○	○	×	Carries out motion cut	Working mode		EM-52
—	—	—	—	—	—	—	In jib mode, boom cannot be extended more than 11.6 m Wiring harness is not connected, but "Confirm jib wiring harness" message is displayed	Working mode		EM-111
—	—	—	—	—	—	—	Impossible to detect wiring harness connection input When jib is extended, if left lock pin is inserted, error message is displayed	Working mode		EM-111
When error occurs, control is carried out for RAISE operation However, if LOWER operation is input, control is carried out for LOWER operation	×	×	×	○	×	×	Cautions and warnings which usually appear only during RAISE operations are displayed although no operation is being carried out When RAISE operation prohibition condition occurs, work equipment does not move	Working mode		EM-55

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
84	ON/OFF input	OSS error EB0	1) Defective boom RAISE PPC pressure switch or boom LOWER PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (1) – CR9 (8) – R58 (female) (1) or between C13 (female) (9) – CR9 (7) – R57 (female) (1) 3) Defective contact or disconnection in wiring harness between L03 (female) (1),(2), L04 (female) (1) – battery (-) – chassis 4) Defective contact or disconnection in wiring harness between R58 (female) (2), R57 (female) (2) – CR1 (5), CR3 (13),(14) – R04 (female) (1), R03 (female) (1),(2) 5) Defective slip ring 6) Defective moment limiter controller	Boom RAISE and LOWER detected simultaneously	Voltage (between C13 (1),(9) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom hoist lever at HOLD: Max. 1 V
85		OSS error EA9	1) Defective boom LOWER PPC pressure switch 2) Wiring harness between C13 (female) (9) – CR9 (7) – R57 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When there is neutral input for boom RAISE and LOWER PPC pressure switches (simultaneous input voltage: less than 3.5 V) and boom angle decreases 5 x and there is no error in boom angle lower limit Error is reset with boom LOWER PPC pressure switch operation (min. 8.5 V) input	Voltage (between C13 (9) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom operated to LOWER: 15 – 30 V
86		—	1) Defective boom RAISE PPC pressure switch or boom LOWER PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (1) – CR9 (8) – R58 (female) (1) or between C13 (female) (9) – CR9 (7) – R57 (female) (1) 3) Defective contact or disconnection in wiring harness between L03 (female) (1),(2), L04 (female) (1) – battery (-) – chassis 4) Defective contact or disconnection in wiring harness between R58 (female) (2), R57 (female) (2) – CR1 (5), CR3 (13),(14) – R04 (female) (1), R03 (female) (1),(2) 5) Defective slip ring 6) Defective moment limiter controller	Same as disconnection in boom RAISE and LOWER PPC pressure switch inputs	Voltage (between C13 (1) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom hoist lever at HOLD: Max. 1 V
87		OSS error EAA	1) Defective boom EXTEND PPC pressure switch 2) Wiring harness between C13 (female) (2) – CR9 (9) – R59 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When there is neutral input for boom EXTEND and RETRACT PPC pressure switches (simultaneous input voltage: less than 3.5 V) and boom length increases 30 cm and there is no error in boom length upper limit Error is reset with boom EXTEND PPC pressure switch operation (min. 8.5 V) input	Voltage (between C13 (2) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom operated to EXTEND: 15 – 30 V
88		OSS error EB1	1) Defective boom EXTEND PPC pressure switch or boom RETRACT PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (2) – CR9 (9) – R59 (female) (1) or between C13 (female) (10) – CR9 (12) – R62 (female) (1) 3) Defective contact or disconnection in wiring harness between L03 (female) (1),(2), L04 (female) (1) – battery (-) – chassis 4) Defective contact or disconnection in wiring harness between R59 (female) (2), R62 (female) (2) – CR1 (5), CR3 (13),(14) – R04 (female) (1), R03 (female) (1),(2) 5) Defective slip ring 6) Defective moment limiter controller	Boom EXTEND and RETRACT input detected simultaneously	Voltage (between C13 (2), (10) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom telescope lever at HOLD: Max. 1 V

★ When operating the work equipment control lever or swing lever, it is possible to operate in small movements (enough to be able to detect the PPC pressure).

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
	○	×	×	○	×	×	Cautions and warnings which usually appear during RAISE or LOWER operations are displayed although no operation is being carried out When RAISE or LOWER operation prohibition condition occurs, work equipment does not move During RAISE or LOWER operations, error is detected	Working mode		EM-61
When error occurs, control is carried out for LOWER operation However, if RAISE operation is input, control is carried out for RAISE operation	×	×	×	○	×	×	Cautions and warnings which usually appear only during LOWER operations are displayed although no operation is being carried out When LOWER operation prohibition condition occurs, work equipment does not move	Working mode		EM-56
—	—	—	—	—	—	—	Cautions and warnings which usually appear during RAISE or LOWER operations are displayed although no operation is being carried out (When hoist lever is at neutral)	Working mode		EM-61
When error occurs, control is carried out for EXTEND operation However, if RETRACT operation is input, control is carried out for RETRACT operation	×	×	×	○	×	×	Cautions and warnings which usually appear only during EXTEND operations are displayed although no operation is being carried out When EXTEND operation prohibition condition occurs, work equipment does not move	Working mode		EM-57
Error code EB1 is displayed, buzzer sounds	○	×	×	○	×	×	Cautions and warnings which usually appear during EXTEND or RETRACT operations are displayed although no operation is being carried out When EXTEND or RETRACT operation prohibition condition occurs, work equipment does not move During EXTEND or RETRACT operations, error is detected	Working mode		EM-62

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
89	ON/OFF input	OSS error EAB	1) Defective boom RETRACT PPC pressure switch 2) Wiring harness between C13 (female) (10) – CR9 (12) – R62 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When there is neutral input for boom EXTEND and RETRACT PPC pressure switches (simultaneous input voltage: less than 3.5 V) and boom length decreases 30 cm and there is no error in boom length lower limit Error is reset with boom RETRACT PPC pressure switch operation (min. 8.5 V) input	Voltage (between C13 (10) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom operated to RETRACT: 15 – 30 V
90		—	1) Defective boom RETRACT PPC pressure switch or boom EXTEND PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (2) – CR9 (9) – R59 (female) (1) or between C13 (female) (10) – CR9 (12) – R62 (female) (1) or short circuit with power source 3) Defective contact or disconnection in wiring harness between R59 (female) (2), R62 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L03 (female) (1), (2), L04 (female) (1) – battery (-) – chassis 5) Defective slip ring 6) Defective moment limiter controller	Same as disconnection in boom EXTEND and RETRACT PPC pressure switch inputs	Voltage (between C13 (2), (10) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Boom telescope lever at HOLD: Max. 1 V
91		OSS error EAC	1) Defective jib PPC pressure switch 2) Wiring harness between C13 (female) (3) – CR9 (5) – R55 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When there is neutral input for jib RAISE and LOWER PPC pressure switches (simultaneous input voltage: less than 3.5 V) and jib angle increases 5 x and there is no error in jib angle upper limit Error is reset with jib RAISE PPC pressure switch operation (min. 8.5 V) input	Voltage (between C13 (3) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Jib operated to RAISE: 15 – 30 V
92		OSS error EB2	1) Defective jib RAISE PPC pressure switch or jib LOWER PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (3) – CR9 (5) – R55 (female) (1) or between C13 (female) (11) – CR9 (6) – R56 (female) (1) 3) Defective contact or disconnection in wiring harness between R55 (female) (2) – R56 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) and chassis 5) Defective slip ring 6) Defective moment limiter controller	Jib RAISE and LOWER input detected simultaneously	Voltage (between C13 (3), (11) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Jib hoist lever at HOLD: Max. 1 V
93		OSS error EAD	1) Defective jib LOWER PPC pressure switch 2) Wiring harness between C13 (female) (11) – CR9 (6) – R56 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	When there is neutral input for jib RAISE and LOWER PPC pressure switches (simultaneous input voltage: less than 3.5 V) and jib angle decreases 5 x and there is no error in jib angle lower limit Error is reset with jib LOWER PPC pressure switch operation (input voltage: min. 8.5 V) input	Voltage (between C13 (11) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Jib operated to LOWER: 15 – 30 V
94		—	1) Defective jib RAISE PPC pressure switch or jib LOWER PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (3) – CR9 (5) – R55 (female) (1) or between C13 (female) (11) – CR9 (6) – R56 (female) (1) 3) Defective contact or disconnection in wiring harness between R55 (female) (2) – R56 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) and chassis 5) Defective slip ring 6) Defective moment limiter controller	Same as disconnection in jib RAISE and LOWER PPC pressure switch inputs	Voltage (between C13 (3), (11) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Jib hoist lever at HOLD: Max. 1 V
95		—	1) Defective swing right PPC pressure switch 2) Wiring harness between C13 (female) (5) – CR7 (3) – R26 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C13 (5) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Swing operated to right: 15 – 30 V

★ When operating the work equipment control lever or swing lever, it is possible to operate in small movements (enough to be able to detect the PPC pressure).

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
When error occurs, control is carried out for RETRACT operation However, if EXTEND operation is input, control is carried out for EXTEND operation	×	×	×	○	×	×	Cautions and warnings which usually appear only during RETRACT operations are displayed although no operation is being carried out When RETRACT operation prohibition condition occurs, work equipment does not move	Working mode		EM-58
—	—	—	—	—	—	—	Cautions and warnings which usually appear during EXTEND or RETRACT operations are displayed although no operation is being carried out (When telescope lever is at neutral)	Working mode		EM-62
When error occurs, control is carried out for RAISE operation However, if LOWER operation is input, control is carried out for LOWER operation	×	×	×	○	×	×	Cautions and warnings which usually appear only during RAISE operations are displayed although no operation is being carried out When RAISE operation prohibition condition occurs, work equipment does not move	Working mode		EM-59
	○	×	×	○	×	×	Cautions and warnings which usually appear during RAISE or LOWER operations are displayed although no operation is being carried out When RAISE or LOWER operation prohibition condition occurs, work equipment does not move	Working mode		EM-63
When error occurs, control is carried out for LOWER operation However, if RAISE operation is input, control is carried out for RAISE operation	×	×	×	○	×	×	Cautions and warnings which usually appear only during LOWER operations are displayed although no operation is being carried out When LOWER operation prohibition condition occurs, work equipment does not move	Working mode		EM-60
—	—	—	—	—	—	—	Cautions and warnings which usually appear during RAISE or LOWER operations are displayed although no operation is being carried out (When jib hoist lever is at neutral)	Working mode		EM-63
—	—	—	—	—	—	—	Impossible to detect right swing During swing operations, cautions and warnings are not given	Working mode		EM-138

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
96	ON/OFF input	OSS error EB3	1) Defective swing right PPC pressure switch or swing left PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (5) – CR7 (3) – R26 (female) (1) or between C13 (female) (13) – CR7 (2) – R25 (female) (1) 3) Defective contact or disconnection in wiring harness between R26 (female) (2), R25 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) – battery (-) – chassis 5) Defective slip ring 6) Defective moment limiter controller	Swing RIGHT and LEFT input detected simultaneously	Voltage (between C13 (5), (13) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Swing lever at neutral: Max. 1 V
97		—	1) Defective swing left PPC pressure switch 2) Wiring harness between C13 (female) (13) – CR7 (2) – R25 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C13 (13) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Swing operated to left: 15 – 30 V
98		—	1) Defective swing right PPC pressure switch or swing left PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (5) – CR7 (3) – R26 (female) (1) or between C13 (female) (13) – CR7 (2) – R25 (female) (1) 3) Defective contact or disconnection in wiring harness between R26 (female) (2), R25 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) – battery (-) – chassis 5) Defective slip ring 6) Defective moment limiter controller	Same as disconnection in swing right and swing left PPC pressure switch inputs	Voltage (between C13 (5), (13) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Swing lever at neutral: Max. 1 V
99		—	1) Defective main winch WIND IN PPC pressure switch 2) Wiring harness between C13 (female) (6) – CR9 (11) – R61 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C13 (6) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Main winch operated to WIND IN: 15 – 30 V
100		OSS error EB4	1) Defective main winch WIND IN PPC pressure switch or WIND OUT PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (6) – CR9 (11) – R61 (female) (1) or between C13 (female) (14) – CR9 (14) – R64 (female) (1) or short circuit with power source 3) Defective contact or disconnection in wiring harness between R61 (female) (2), R64 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) – battery (-) – chassis 5) Defective slip ring 6) Defective moment limiter controller	Main winch WIND IN and WIND OUT input detected simultaneously	Voltage (between C13 (6), (14) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Main winch lever at neutral: Max. 1 V
101		—	1) Defective main winch WIND OUT PPC pressure switch 2) Wiring harness between C13 (female) (14) – CR9 (14) – R64 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C13 (14) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Main winch operated to WIND OUT: 15 – 30 V

★ When operating the work equipment control lever or swing lever, it is possible to operate in small movements (enough to be able to detect the PPC pressure).

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
—	○	×	×	○	×	×	Cautions and warnings which usually appear only during swing operations are displayed although no operation is being carried out	Working mode		EM-64
—	—	—	—	—	—	—	Impossible to detect left swing (abnormality in swing warning) During swing operations, cautions and warnings are not given	Working mode		EM-137
—	—	—	—	—	—	—	Cautions and warnings which usually appear only during swing operations are displayed although no operation is being carried out (when swing control lever is at neutral)	Working mode		EM-64
—	—	—	—	—	—	—	Cautions and warnings which usually appear only during WIND IN operations are not displayed Impossible to detect main winch WIND IN	Working mode		EM-133
—	○	×	×	○	×	×	When main winch WIND IN operation prohibition condition occurs, work equipment does not move	Working mode		EM-65
—	—	—	—	—	—	—	Impossible to detect main winch WIND OUT	Working mode		EM-134

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
102	ON/OFF input	—	1) Defective main winch WIND IN PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (6) – CR9 (11) – R61 (female) (1) or between C13 (female) (14) – CR9 (14) – R64 (female) (1) or short circuit with power source 3) Defective contact or disconnection in wiring harness between R61 (female) (2), R64 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) – battery (-) chassis 5) Defective slip ring 6) Defective moment limiter controller	Same as disconnection in main winch WIND IN and WIND OUT PPC pressure switch inputs	Voltage (between C13 (14) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Main winch lever at neutral: Max. 1 V
103		—	1) Defective auxiliary winch WIND OUT PPC pressure switch 2) Wiring harness between C13 (female) (7) – CR9 (10) – R60 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C13 (7) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Auxiliary winch operated to WIND IN: 15 – 30 V
104		OSS error EB5	1) Defective auxiliary winch WIND IN PPC pressure switch or auxiliary winch WIND OUT PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (7) – CR9 (10) – R60 (female) (1) or between C13 (female) (15) – CR9 (13) – R63 (female) (1) or short circuit with power source 3) Defective contact or disconnection in wiring harness between R60 (female) (2), R63 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) battery (-) chassis 5) Defective slip ring 6) Defective moment limiter controller	Auxiliary winch WIND IN and WIND OUT input detected simultaneously	Voltage (between C13 (7), (15) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Auxiliary winch lever at neutral: Max. 1 V
105		—	1) Defective auxiliary winch WIND OUT PPC pressure switch 2) Wiring harness between C13 (female) (15) – CR9 (13) – R63 (female) (1) short circuiting with chassis ground 3) Defective moment limiter controller	—	Voltage (between C13 (15) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Auxiliary winch operated to WIND OUT: 15 – 30 V
106		OSS error EB5	1) Defective auxiliary winch WIND IN PPC pressure switch or auxiliary winch WIND OUT PPC pressure switch 2) Defective contact or disconnection in wiring harness between C13 (female) (7) – CR9 (10) – R60 (female) (1) or between C13 (female) (15) – CR9 (13) – R63 (female) (1) 3) Defective contact or disconnection in wiring harness between R60 (female) (2), R63 (female) (2) – CR1 (5), CR3 (13), (14) – R04 (female) (1), R03 (female) (1), (2) 4) Defective contact or disconnection in wiring harness between L04 (female) (1), L03 (female) (1), (2) – battery (-) – chassis 5) Defective slip ring 6) Defective moment limiter controller	Same as disconnection in auxiliary winch WIND IN and WIND OUT PPC pressure switch inputs	Voltage (between C13 (7), (15) and chassis) • When engine is started and PTO switch is at Operation 1 or Operation 2: Auxiliary winch lever at neutral: Max. 1 V

★ When operating the work equipment control lever or swing lever, it is possible to operate in small movements (enough to be able to detect the PPC pressure).

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
—	—	—	—	—	—	—	(when main winch lever is at N)	Working mode		EM-65
—	—	—	—	—	—	—	Cautions and warnings which usually appear only during WIND IN operations are not displayed Impossible to detect auxiliary winch WIND IN	Working mode		EM-135
—	○	×	×	○	×	×	When auxiliary winch WIND IN operation prohibition condition occurs, work equipment does not move	Working mode		EM-66
—	—	—	—	—	—	—	Impossible to detect auxiliary winch WIND OUT	Working mode		EM-136
—	—	—	—	—	—	—	(when auxiliary winch lever is at N)	Working mode		EM-66

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
107	Sensor input	OSS error E45	1) Defective hoist cylinder head pressure sensor 2) Defective contact or disconnection in wiring harness between C16 (female) (20) - CR6 (8) - R37 (female) (1) 3) Defective contact or disconnection in wiring harness between C16 (female) (2) - CR6 (10) - R37 (female) (3) 4) Defective contact or disconnection in wiring harness between C16 (female) (18) - CR6 (9) - R37 (female) (2) 5) Defective contact or disconnection in wiring harness between C12 (8),(18) and chassis 6) Wiring harness between C16 (female) (2) - CR6 (10) - R37 (female) (3) short circuiting with chassis ground 7) Wiring harness between C16 (female) (2) - CR6 (10) - R37 (female) (3) short circuiting with power source 8) Defective moment limiter controller	Sensor 15V power source not short circuited with ground and input voltage within error detection range	Voltage (between C16 (2) and (20)) • When engine is started and boom hoist cylinder head pressure is detected: 0.7 - 5.3 V Starting switch at ON: Max. 1 V
108		OSS error E44	1) Defective hoist cylinder bottom pressure sensor 2) Defective contact or disconnection in wiring harness between C16 (female) (20) - CR6 (5) - R36 (female) (1) 3) Defective contact or disconnection in wiring harness between C16 (female) (12) - CR6 (7) - R36 (female) (3) 4) Defective contact or disconnection in wiring harness between C16 (female) (8) - CR6 (6) - R36 (female) (2) 5) Defective contact or disconnection in wiring harness between C12 (8),(18) and chassis 6) Wiring harness between C16 (female) (12) - CR6 (7) - R36 (female) (3) short circuiting with chassis ground 7) Wiring harness between C16 (female) (12) - CR6 (7) - R36 (female) (3) short circuiting with power source 8) Defective moment limiter controller	Sensor 15V power source not short circuited with ground and input voltage within error detection range	Voltage (between C16 (12) and (20)) • When engine is started and boom hoist cylinder bottom pressure is detected: 0.7 - 5.3 V Starting switch at ON: Max. 1 V
109		OSS error E48	1) Mistake in connection of R36 and R37 2) Defective moment limiter controller	Sensor 15V power source not short circuited with ground and no sensor error and result of calculation of axial force is negative	Sensor resistance value See STANDARD VALUE TABLE on page 20-47. Voltage (between C16 (3) and (20)) 0 - 10.5 V (see graph on page 20-52)
110		OSS error E46	1) Defective swing angle sensor 1 2) Defective contact or disconnection in wiring harness between C16 (female) (13) - CR6 (4) - CR5 (female) (4) or between C16 (female) (3) - CR6 (2) - CR5 (female) (2) 3) Wiring harness between C16 (female) (13) - CR6 (4) - CR5 (female) (4) or between C16 (female) (3) - CR6 (2) - CR5 (female) (2) short circuiting with chassis ground 4) Wiring harness between C16 (female) (13) - CR6 (4) - CR5 (female) (4) or between C16 (female) (3) - CR6 (2) - CR5 (female) (2) short circuiting with power source 5) Defective contact or disconnection in wiring harness between CR5 (female) (3) - CR6 (3) - C16 (female) (10)	Sensor 15V power source not short circuited with ground and abnormality in voltage related system	
111					
112		OSS error E43	1) Defective boom length sensor 2) Defective contact or disconnection in wiring harness between C16 (female) (1) - CR10 (6) - BR2 (3) - B14 (female) (1) 3) Defective contact or disconnection in wiring harness between C12 (8),(18) and chassis 4) Defective contact or disconnection in wiring harness between C16 (female) (10) - CR10 (8) - BR2 (5) - B14 (female) (3) 5) Defective contact or disconnection in wiring harness between C16 (female) (4) - CR10 (7) - BR2 (4) - B14 (female) (2) 6) Wiring harness between C16 (female) (4) - CR10 (7) - BR2 (4) - B14 (female) (2) short circuiting with chassis ground 7) Wiring harness between C16 (female) (4) - CR10 (7) - BR2 (4) - B14 (female) (2) short circuiting with power source 8) Defective moment limiter controller	Sensor 10V power source not short circuited with ground and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-46. Voltage (between C16 (4) and (20)) See STANDARD VALUE TABLE on page 20-39

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
—	○	○	○	×	×	×	Abnormality in hook load calculation, motion cut	Working mode		EM-15
—	○	○	○	×	×	×	Abnormality in hook load calculation, motion cut	Working mode		EM-14
—	○	○	○	×	×	×	Abnormality in hook load calculation, motion cut	Working mode		EM-17
—	○	○	○	×	×	×	Abnormality in swing angle calculation	Working mode		EM-16
—	○	○	○	×	×	×	Abnormality in hook load calculation, motion cut	Working mode		EM-13

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
113	Sensor input	OSS error E41 OSS error E00	1) Defective boom angle sensor 2) Defective contact or disconnection in wiring harness between C16 (female) (1) – CR10 (1) – R65 (female) (1) 3) Defective contact or disconnection in wiring harness between C12 (8),(18) and chassis 4) Defective contact or disconnection in wiring harness between C16 (female) (10) – CR10 (3) – R65 (female) (3) 5) Defective contact or disconnection in wiring harness between C16 (female) (14) – CR10 (2) – R65 (female) (2) 6) Wiring harness between C16 (female) (14) – CR10 (2) – R65 (female) (2) short circuiting with chassis ground 7) Wiring harness between C16 (female) (14) – CR10 (2) – R65 (female) (2) short circuiting with power source 8) Defective moment limiter controller	Sensor 10V power source not short circuited with ground and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-46. Voltage (between C16 (4) and (20)) Boom angle 0° : Approx. 8.5 V Boom angle 83°: Approx. 1.6 V
114	Communication between controllers		1) Defective contact or disconnection in wiring harness between C12 (female) (21) and C93 (female) (11) 2) Defective contact or disconnection in wiring harness between C12 (female) (11) and C93 (female) (10) 3) Wiring harness between C12 (female) (11) and C93 (female) (10) short circuiting with chassis ground 4) Wiring harness between C12 (female) (21) and C93 (female) (11) short circuiting with chassis ground 5) Defective moment limiter controller or moment limiter monitor	Abnormality in communication	Voltage (between C12 (11),(21) and (8),(18)) When starting switch is at ON: 4 – 8 V
115		OSS error E20 OSS error E30	1) Defective contact or disconnection in wiring harness between C15 (female) (11) and C05 (female) (12) and between C15 (female) (3) and C05 (female) (4) 2) Wiring harness between C05 (female) (4) and C15 (female) (3) short circuiting with chassis ground 3) Wiring harness between C05 (female) (12) and C15 (female) (11) short circuiting with chassis ground 4) Defective upper MDT or moment limiter controller	Abnormality in communication	Voltage (between C15 (4),(12) and (10)) When starting switch is at ON: 4 – 8 V
116			1) Wiring harness between C15 (female) (5),(13 and J1 (female) (4) short circuiting with chassis ground 2) Defective jib communication module 3) Defective contact or disconnection in wiring harness between J1 (female) (11) and chassis 4) Defective contact or disconnection in wiring harness between C15 (female) (5),(13) and J1 (female) (4) 5) Defective moment limiter controller	Abnormality in communication	Voltage (between C15 (5),(13) and (1),(9)) When starting switch is at ON and PTO switch is at Operation 1 or Operation 2: 9 – 13 V
118	Others	OSS error E02	1) Defective moment limiter monitor rotary switch	Switch input data are abnormal (input data are not 1 position)	—
119		OSS error E10	1) Defective moment limiter controller		—

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
—	○	○	○	×	×	×	Abnormality in hook load calculation, motion cut	Working mode		EM-12
Display, graphic back-up lamp are output independently	○	○	×	○	○	×	When moment limiter panel is operated nothing is received			EM-1
—	—	—	—	—	—	—				
Outrigger setting reset Graphic back-up lamp ON	○	○	○	×	○	×	Communication data from MDT dos not come, motion cut	Working mode		EM-5
	○	○	○	○	×	×	Communication data from transmission module do not come, impossible to operate jib	Working mode		EM-10
	○	○	○	○	○	×	Motion cut, impossible to set moment limiter working mode	Working mode		EM-3
	○	○	○	○	○	×	Motion cut	Working mode		EM-4

023S02

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
120	Other errors	OSS error E21	1) Defective outrigger length sensor FL 2) Defective contact or disconnection in wiring harness between M06 (female) (2) – LM10 (15) – L42 (female) (1) 3) Defective contact or disconnection in wiring harness between M02 (11),(21) and chassis 4) Defective contact or disconnection in wiring harness between M06 (female) (9) – LM09 (1) – L42 (female) (3) 5) Defective contact or disconnection in wiring harness between M05 (female) (6) – LM09 (14) – L42 (female) (2) 6) Wiring harness between M05 (female) (6) – LM09 (14) – L42 (female) (2) short circuiting with chassis ground 7) Wiring harness between M05 (female) (6) – LM09 (14) – L42 (female) (2) short circuiting with power source 8) Defective lower MDT	Communication normal between moment limiter and MDT and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-42. Voltage (between M05 (6) and M06 (9)) See STANDARD VALUE TABLE on page 20-27
121		OSS error E22	1) Defective outrigger length sensor FR 2) Defective contact or disconnection in wiring harness between M06 (female) (2) – LM10 (15) – L39 (female) (1) 3) Defective contact or disconnection in wiring harness between M02 (11),(21) and chassis 4) Defective contact or disconnection in wiring harness between M06 (female) (9) – LM09 (1) – L39 (female) (3) 5) Defective contact or disconnection in wiring harness between M05 (female) (7) – LM09 (16) – L39 (female) (2) 6) Wiring harness between M05 (female) (7) – LM09 (16) – L39 (female) (2) short circuiting with chassis ground 7) Wiring harness between M05 (female) (7) – LM09 (16) – L39 (female) (2) short circuiting with power source 8) Defective lower MDT	Communication normal between moment limiter and MDT and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-42. Voltage (between M05 (7) and M06 (9)) See STANDARD VALUE TABLE on page 20-27
122		OSS error E23	1) Defective outrigger length sensor RL 2) Defective contact or disconnection in wiring harness between M06 (female) (2) – LM10 (15) – L33 (female) (1) 3) Defective contact or disconnection in wiring harness between M02 (11),(21) and chassis 4) Defective contact or disconnection in wiring harness between M06 (female) (9) – LM09 (1) – L33 (female) (3) 5) Defective contact or disconnection in wiring harness between M05 (female) (16) – LM09 (12) – L33 (female) (2) 6) Wiring harness between M05 (female) (16) – LM09 (12) – L33 (female) (2) short circuiting with chassis ground 7) Wiring harness between M05 (female) (16) – LM09 (12) – L33 (female) (2) short circuiting with power source 8) Defective lower MDT	Communication normal between moment limiter and MDT and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-42. Voltage (between M05 (16) and M06 (9)) See STANDARD VALUE TABLE on page 20-27
123		OSS error E24	1) Defective outrigger length sensor RR 2) Defective contact or disconnection in wiring harness between M06 (female) (2) – LM10 (15) – L36 (female) (1) 3) Defective contact or disconnection in wiring harness between M02 (11),(21) and chassis 4) Defective contact or disconnection in wiring harness between M06 (female) (9) – LM09 (1) – L36 (female) (3) 5) Defective contact or disconnection in wiring harness between M05 (female) (17) – LM09 (10) – L36 (female) (2) 6) Wiring harness between M05 (female) (17) LM09 (10) L36 (female) (2) short circuiting with chassis ground 7) Wiring harness between M05 (female) (17) – LM09 (10) – L36 (female) (2) short circuiting with power source 8) Defective lower MDT	Communication normal between moment limiter and MDT and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-42. Voltage (between M05 (17) and M06 (9)) See STANDARD VALUE TABLE on page 20-27

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
	○	○	○	×	×	×	Motion cut, impossible to set outrigger operation, possible to set outrigger extension width with emergency setting mode	Working mode		EM-6
	○	○	○	×	×	×	Motion cut, impossible to set outrigger operation, possible to set outrigger extension width with emergency setting mode	Working mode		EM-7
	○	○	○	×	×	×	Motion cut, impossible to set outrigger operation, possible to set outrigger extension width with emergency setting mode	Working mode		EM-8
	○	○	○	×	×	×	Motion cut, impossible to set outrigger operation, possible to set outrigger extension width with emergency setting mode	Working mode		EM-9

No.	Abnormal system	Error code	Nature of abnormality	Condition when abnormal	Condition when normal
124	Other errors	OSS error E31	1) Defective jib tilt angle sensor 2) Defective jib communication module 3) Defective contact or disconnection in wiring harness between J01 (female) (5) and J03 (female) (1) 4) Defective contact or disconnection in wiring harness between J01 (10) and chassis 5) Defective contact or disconnection in wiring harness between J01 (female) (15) and J03 (female) (3) 6) Defective contact or disconnection in wiring harness between J01 (female) (6) and J03 (female) (2) 7) Wiring harness between J01 (female) (6) and J03 (female) (2) short circuiting with chassis ground 8) Wiring harness between J01 (female) (6) and J03 (female) (2) short circuiting with power source	Communication normal between moment limiter and MDT and input voltage within error detection range	Sensor resistance value See STANDARD VALUE TABLE on page 20-47. Voltage (between J01 (6) and (15)) When starting switch is ON and PTO switch is at Operation 1: 1 – 3.8 V
125		OSS error E01	1) Defective moment limiter monitor		—
126		OSS error EA6	1) Defective setting of moment limiter controller rotary switch 2) Defective setting in lower MDT 3) Defective moment limiter controller	X/H selection detected in MDT does not match specification selection made with rotary switch of moment limiter	—
127		OSS error E68	1) Defective boom angle sensor 2) Defective boom length sensor 3) Defective swing angle sensor 4) Wiring harness between C16 (female) (1) and CR10 (male) (1),(6) or between C16 (female) (11) and CR6 (female) (1) short circuiting with chassis ground 5) Wiring harness between CR6 (male) (1) and CR5 (female) (1) short circuiting with chassis ground 6) Wiring harness between CR10 (female) (1) and R65 (female) (1) or between CR10 (female) (6) – BR2 (3) – B14 (female) (1) short circuiting with chassis ground 7) Defective moment limiter controller	Output voltage of sensor 10 V power source is less than 0.7 V (output voltage input inside controller)	Voltage (between C16 (1),(11) and (10)) When starting switch is ON and PTO switch is at Operation 1: 9.5 – 10.5V
128		OSS error E6A	1) Defective bottom pressure sensor or head pressure sensor 2) Wiring harness between C16 (female) (8) – CR6 (6) – R36 (female) (2) short circuiting with chassis ground 3) Wiring harness between C16 (female) (18) – CR6 (9) – R37 (female) (2) short circuiting with chassis ground 4) Defective moment limiter controller	Output voltage of sensor 15 V power source is less than 0.4 V (output voltage input inside controller)	Voltage (between C16 (8),(18) and (20)) When starting switch is ON and PTO switch is at Operation 1: 13.5 – 17 V
129		OSS error EA7	1) Defective setting of rotary switch 2) Defective moment limiter controller	Setting of specification selection rotary switch is not for specified data	

023S02

Action by controller when abnormality is detected							Problem that appears on machine when there is abnormality	PTO code	Working mode	Trouble-shooting code
Content	Buzzer	Red lamp	Motion cut	Error re-corded	Emergency stop display	Latch				
	○	○	○	×	×	×	Motion cut, impossible to operate jib	Working mode		EM-11
	○	○	○	○	○	×	Motion cut	Working mode		EM-2
	○	○	○	○	○	×	Motion cut	Working mode		EM-59
Output OFF Error code E68 displayed, buzzer sounds, red warning lamp lights up, motion cut	○	○	○	×	×	○	Calculation of boom angle, boom length, swing angle is not carried out normally, motion cut	Working mode		EM-32
Error code E6A displayed, buzzer sounds, red warning lamp lights up, motion cut	○	○	○	×	×	○	Calculation of pressure is not carried out normally, motion cut	Working mode		EM-33
Error code EA7 displayed, buzzer sounds, red warning lamp lights up, motion cut	○	○	○	×	○	×	Motion cut	Working mode		EM-54

023S02

JUDGEMENT TABLE FOR MOMENT LIMITER CONTROLLER,
AND HYDRAULIC AND MECHANICAL SYSTEMS (1/1)

Location of failure Failure mode			Self-diagnostic display(abnormality display)																											
			OSS errors																											
			E 00	E 01	E 02	E 10	E 20	E 21	E 22	E 23	E 24	E 30	E 31	E 41	E 43	E 44	E 45	E 46	E 48	E 50	E 51	E 52	E 53	E 58						
			Abnormality in panel communication	Panel system error	Abnormality in panel rotary switch	OSS system error	Abnormality in S-NET (communication between MDTs)	Abnormality in outrigger length sensor FL system	Abnormality in outrigger length sensor FR system	Abnormality in outrigger length sensor RL system	Abnormality in outrigger length sensor RR system	Abnormality in jib transmission module communication	Abnormality in jib tilt angle sensor system	Abnormality in boom angle sensor system	Abnormality in boom length sensor system	Abnormality in bottom pressure sensor system	Abnormality in head pressure sensor system	Abnormality in swing angle sensor	Reverse rotation of hoist cylinder axis	Main unload solenoid short circuited with ground	PPC unload solenoid short circuited with ground	Boom telescope selector solenoid short circuited with ground	Automatic stop cancel prohibition relay short circuited with ground	Jib EXTEND/STOW relay short circuited with ground						
Work equipment system	1	Boom and winch do not move (including cases where PTO clutch does not engage)																												
	2	Boom cannot be raised or lowered or speed is slow	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○											
	3	Boom cannot be extended or retracted, or speed is slow	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○		○									
	4	Winch cannot be wound in or wound out, or speed is slow	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○											
	5	Winch moves intermittently (there is hunting)																												
	6	Jib cannot be raised, lowered, or extended, stowed, or rotated	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○						○				
	7	Upper structure cannot be swung or swing speed is slow																												
	8	Outriggers cannot be extended or stowed													○															
	9	Excessive hydraulic drift																												
Travel system	11	Machine does not move off																												
	12	Machine does not accelerate or does not decelerate																												
	13	Travel speed is slow or lacks power																												
	14	Torque converter lock-up does not engage or cannot be disengaged (engine stalls when machine is stopped or moves off)																												
	15	Excessive time lag when moving off (shifting gear), or shift up is slow																												
	16	Torque converter oil temperature becomes high																												
	17	Brake cannot be applied (braking effect is poor) or cannot be released (drags), pulls to one side																												
	18	Exhaust brake cannot be applied or cannot be released																												
	19	Air pressure does not rise or is too low																												
	20	Cannot switch between 2-wheel drive and 4-wheel drive																												
	21	Steering mode cannot be switched																												
	22	Wheels do not move when steering wheel is turned (steering does not turn or is difficult to turn)																												
	23	Rear steering is not locked or is not released																												
	24	Suspension cannot be locked or cannot be set free																												
	25	Suspension lift cannot be used																												
	Buzzer, lamp, gauge does not work, etc.																													
Troubleshooting code when error code is displayed			EM -1	EM -2	EM -3	EM -4	EM -5	EM -6	EM -7	EM -8	EM -9	EM -10	EM -11	EM -12	EM -13	EM -14	EM -15	EM -16	EM -17	EM -18	EM -19	EM -20	EM -21	EM -26						

Outrigger operation impossible
(Note: Outrigger operation possible in emergency setting mode)

For details of the failure mode or the problem that appears on the machine, see pages 20-735, 741-1, 741-2.

Impossible to telescope top boom

TROUBLESHOOTING

JUDGEMENT TABLE FOR MOMENT LIMITER CONTROLLER, AND HYDRAULIC AND MECHANICAL SYSTEMS

- ★ Troubleshooting codes EM-107 and 108 are for the free- fall system (does not switch to free-fall or remains in free-fall condition).
- ★ Troubleshooting codes E-2 – 4 are for the engine starting system.

Self-diagnostic display(abnormality display)																																		Troubleshooting code when there is no abnormality display	
Jib rotation permission relay short circuited with ground	10 V power source short circuited with ground	15 V power source short circuited with ground	Main unload solenoid short circuited with power source	PPC unload solenoid short circuited with power source	Boom telescope selector solenoid short circuited with power source	Automatic stop cancel prohibition relay short circuited with power source	Jib EXTEND/STOW relay short circuited with power source	Moment limiter buzzer short circuited with ground	Emergency alarm buzzer short circuited with ground	Jib rotation permission relay short circuited with power source	Disconnection in main unload solenoid	Disconnection in PPC unload solenoid	Disconnection in boom telescope selector solenoid	Disconnection in automatic stop cancel prohibition relay	Over-front limit switch short circuited with ground	Top boom stow limit switch output short circuited with ground	Boom selector switch (top) short circuited with ground	Abnormality in left lock pin completion limit switch input	Abnormality in PTO switch (travel mode switch)	H/X selection doesn't match (outrigger)	Specification selection rotary switch setting not available	Boom RAISE PPC pressure switch short circuited with ground	Boom LOWER PPC pressure switch short circuited with ground	Boom EXTEND PPC pressure switch short circuited with ground	Boom RETRACT PPC pressure switch short circuited with ground	Jib RAISE PPC pressure switch short circuited with ground	Jib LOWER PPC pressure switch short circuited with ground	Boom RAISE + LOWER PPC pressure switch input simultaneously	Boom EXTEND + RETRACT PPC pressure switch input simultaneously	Jib RAISE + LOWER PPC pressure switch input simultaneously	Swing left + right PPC pressure switch input simultaneously	Main winch WIND IN + WIND OUT PPC pressure switch input simultaneously	Auxiliary winch WIND IN + WIND OUT PPC pressure switch input simultaneously		
OSS errors																																			
F59	F68	F6A	F70	F71	F72	F73	F78	F5C	F5D	F79	F88	F89	F8A	F8B	F80	F81	F82	F83	F85	F86	F87	F88	F89	F8A	F8B	F8C	F8D	F8E	F8F	F8G	F8H	F8I	F8J		
															</																				

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MACHINE
(FAILURE MODE) WHEN MDTU ERROR
E28 OR MDTL ERROR E28 OCCUR****1. Upper MDT (MDTU)**

- 1) The rear steering LOCK/FREE/CENTER condition is held at the condition in operation before the failure occurred.
- 2) The steering mode is held at the condition in operation before the error occurred.
- 3) The outrigger power source is switched ON to make it possible to operate with the bottom outrigger control panel.
- 4) The machine model, top, and bottom selection are held in the condition in operation before the error occurred.
- 5) The winch rotation buzzer signal (pulse) is output.

2. Lower MDT (MDTL)

- 1) The output to the outrigger related solenoids is stopped.
- 2) The steering mode is held at the condition in operation before the error occurred.
- 3) The side lamp, head lamp, and hazard lamp functions are turned ON (when the engine is started).
- 4) The machine model, top, and bottom selection are held in the condition in operation before the error occurred.
- 5) The other outputs sent by the lower MDT to the solenoids for suspension lift, service (auxiliary) brake, and exhaust brake are stopped.

3. Moment limiter

- 1) Emergency stop mode (▲) display (graphic display) + emergency alarm buzzer
- 2) All other displays go out.
- 3) Possible to clear outrigger setting and operate motion cut (automatic stop) or over-rear stability stop

4. Transmission controller

- 1) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).

- 2) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MACHINE
(FAILURE MODE) WHEN MDTU ERROR
E29 OR OSS ERROR E20 OCCUR****1. Upper MDT (MDTU), lower MDT (MDTL)**

- 1) Impossible to switch normal steering to reverse steering
- 2) Swing flasher does not function.

2. Moment limiter

- 1) Emergency stop mode (▲) display (graphic display) + emergency alarm buzzer
- 2) Turns the moment limiter panel lamp (night lighting) ON.
- 3) Possible to clear outrigger setting and operate motion cut (automatic stop) or over-rear stability stop

3. Transmission controller

- 1) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).
- 2) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)

**ACTION TAKEN BY CONTROLLER AND
PROBLEM THAT APPEARS ON MACHINE
(FAILURE MODE) WHEN MDTL ERROR
E29 OCCURS****1. Upper MDT (MDTU), lower MDT (MDTL)**

- 1) The steering mode is held at the condition in operation before the error occurred.

2. Moment limiter

- 1) If the PTO mode switch is at Travel Operation 1, emergency stop mode (▲) display + emergency alarm buzzer

3. Transmission controller

- 1) The gear shift lever signal is held at the condition in operation before the error occurred.
Gear shifting is carried out by the input signal sent by the interlock signal (2 seconds after the lever position is changed)
- 2) The travel mode (2WD Hi, 4WD Hi, 4WD Lo) is held at the condition in operation before the error occurred.
- 3) When carrying out the operation for the moment limiter controller to send the N command signal to the transmission controller, it is impossible to give the command signal (impossible to send the signal).
- 4) The neutral safety control is carried out (for example, if the gear shift lever is set to any position other than N by mistake during on-tire operations, the transmission is set to neutral to prevent the machine from moving if the PTO switch is moved from Operation 2 to Travel or Operation 1.)
- 5) The steering mode relay is held at the condition in operation before the error occurred.
- 6) After the starting switch is turned OFF, the PTO mode is set to Travel and the travel mode is set to 2WD Hi.

ACTION TAKEN BY CONTROLLER AND PROBLEM THAT APPEARS ON MACHINE (FAILURE MODE) WHEN OSS ERROR E30 OCCURS

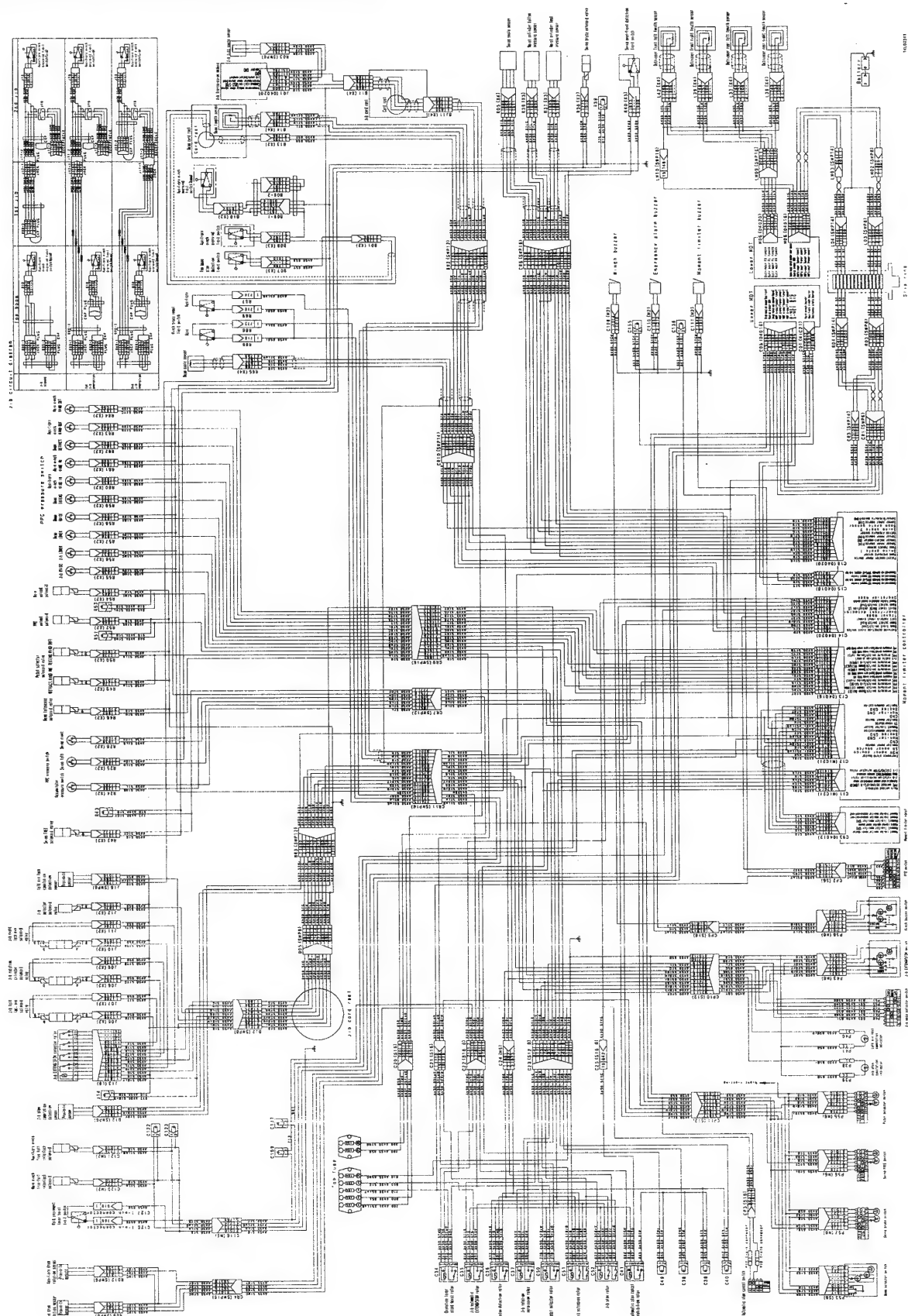
1. Upper MDT (MDTU), lower MDT (MDTL), transmission controller
 - No response (ignores condition)
2. Moment limiter
 - 1) If the problem occurs during jib operations, the following are carried out: motion cut, error code display + emergency alarm buzzer

ACTION TAKEN BY CONTROLLER AND PROBLEM THAT APPEARS ON MACHINE (FAILURE MODE) WHEN OSS ERROR E00 OCCURS

1. Upper MDT (MDTU), lower MDT (MDTL), transmission controller
 - No response (ignores condition)
2. Moment limiter
 - 1) The condition in operation before the error occurred is held until the starting switch is turned OFF (the overload automatic stop also functions), but after the starting switch is turned OFF, it cannot be reset.
 - 2) The moment limiter panel lamp (night lighting) is lighted up.
 - 3) Emergency stop mode (▲) display + emergency alarm buzzer

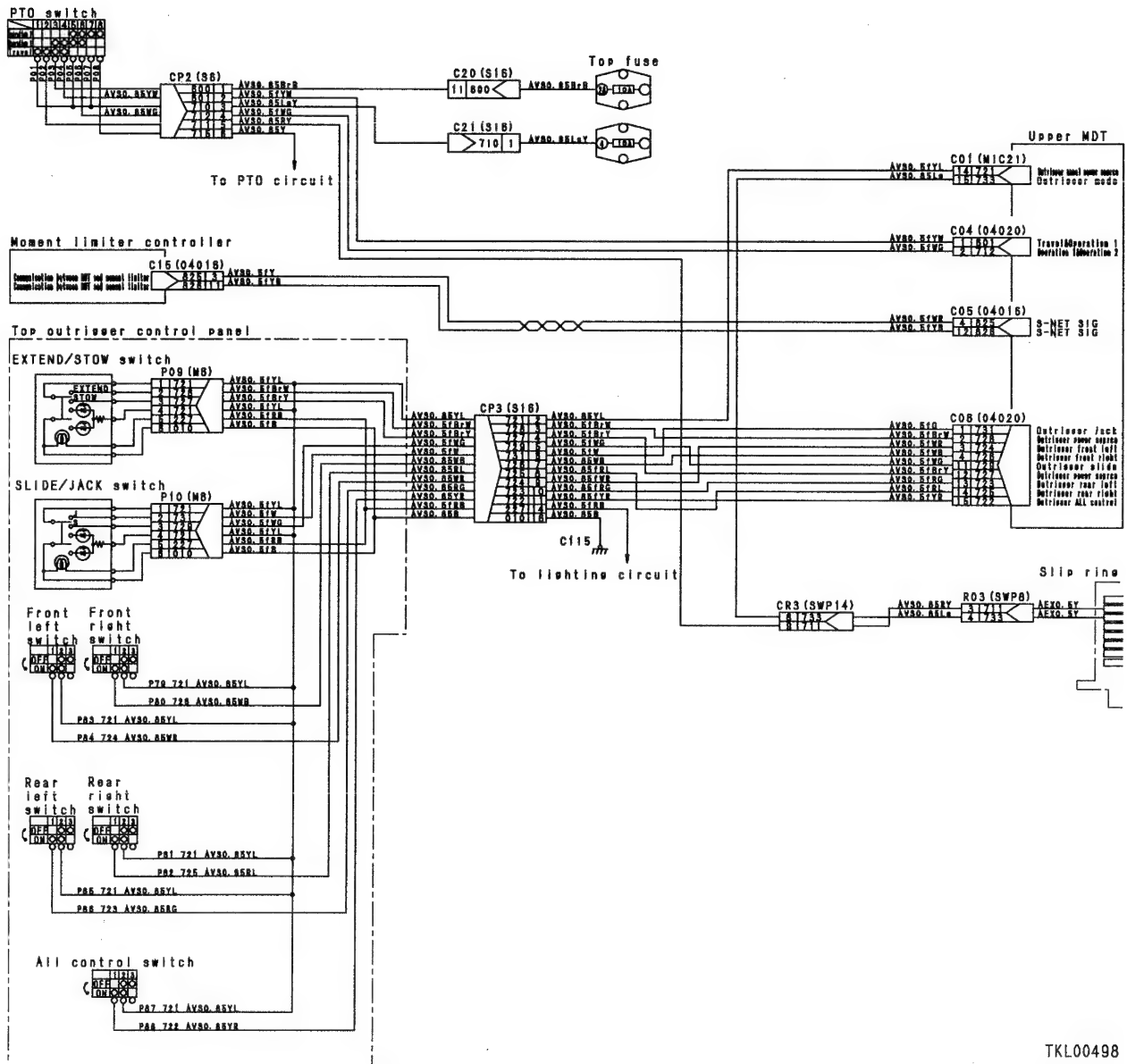
ELECTRICAL CIRCUIT DIAGRAM OF MOMENT LIMITER SYSTEM

★ For details of this page, see page 90-207.



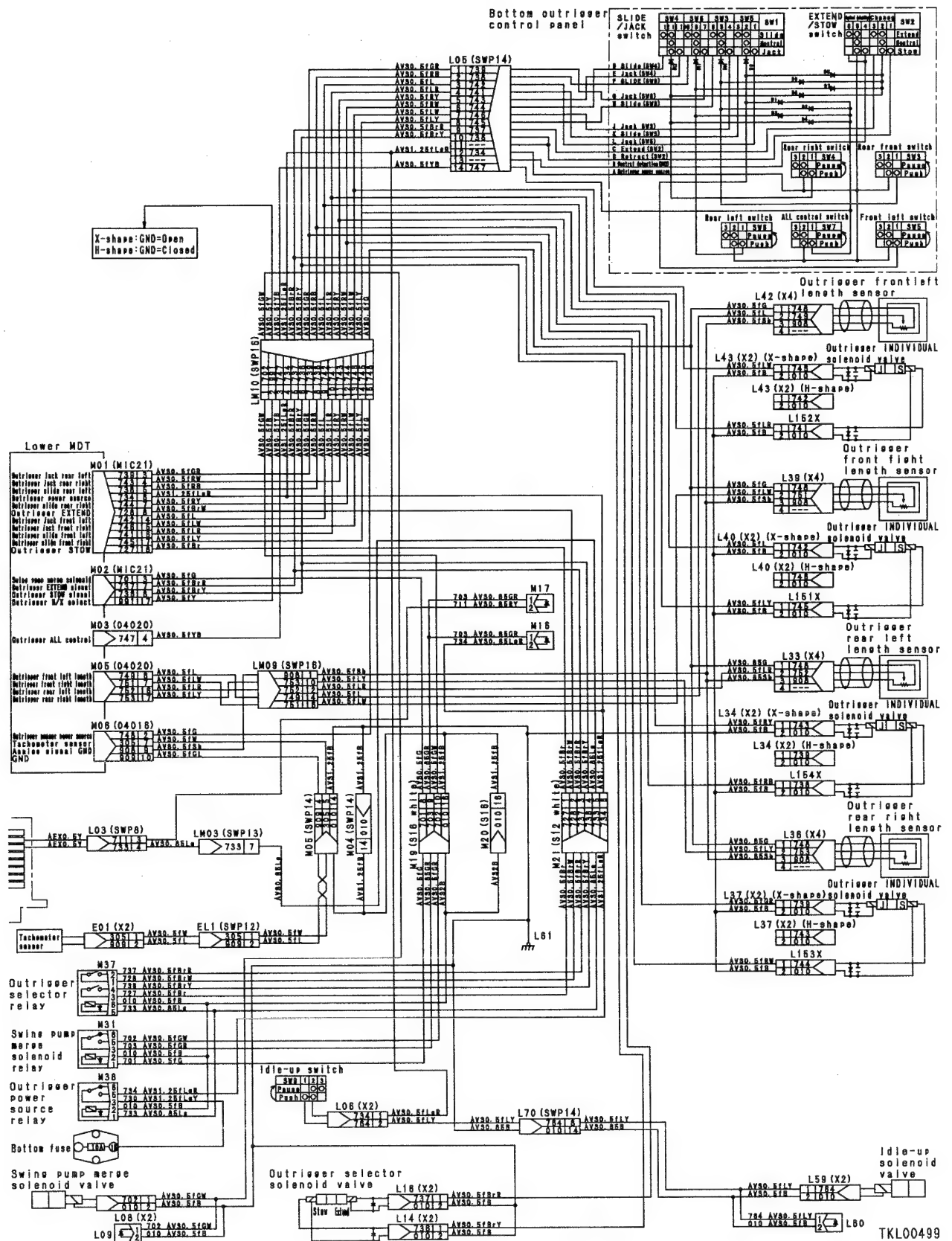
023S02

ELECTRICAL CIRCUIT DIAGRAM OF OUTRIGGER SYSTEM



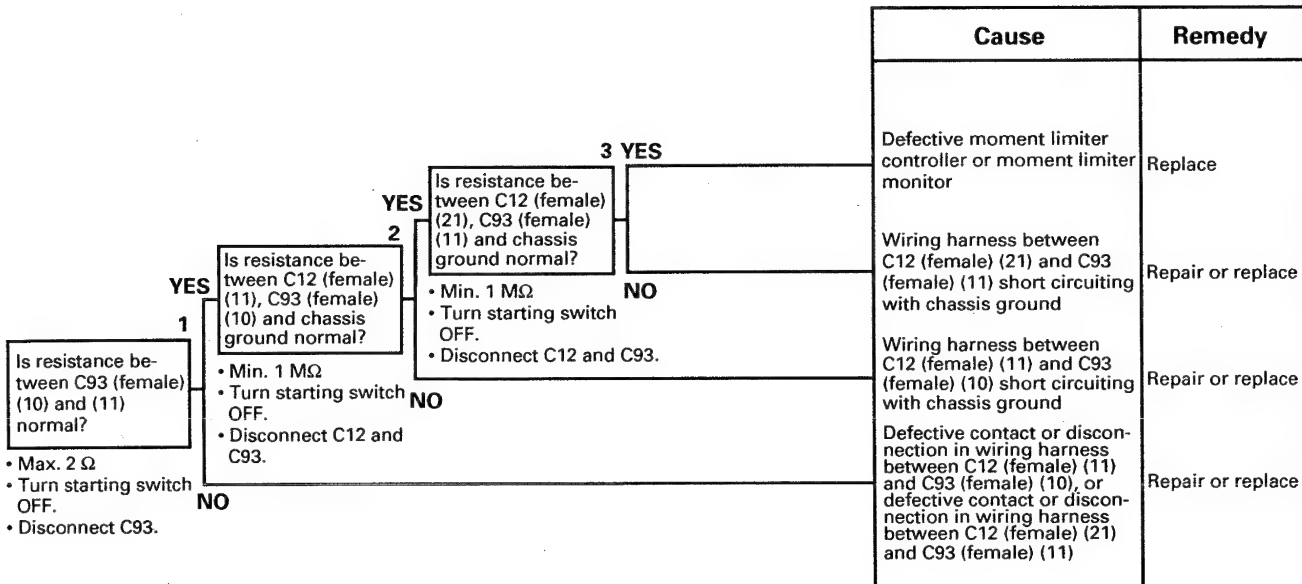
TKL00498

023S02



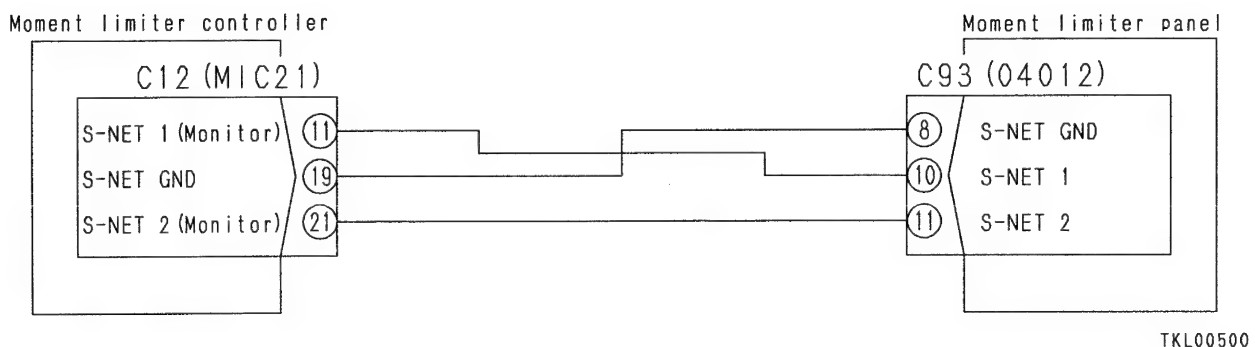
EM-1 OSS error E00 (Abnormality in communication (cut off) between moment limiter controller and monitor) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EM-1 Related electric circuit diagram



EM-2 OSS error E01 (Panel system error) is displayed

	Cause	Remedy
	Defective moment limiter panel	Replace

EM-3 OSS error E02 (Abnormality in panel rotary switch) is displayed

	Cause	Remedy
	Defective moment limiter panel	Replace

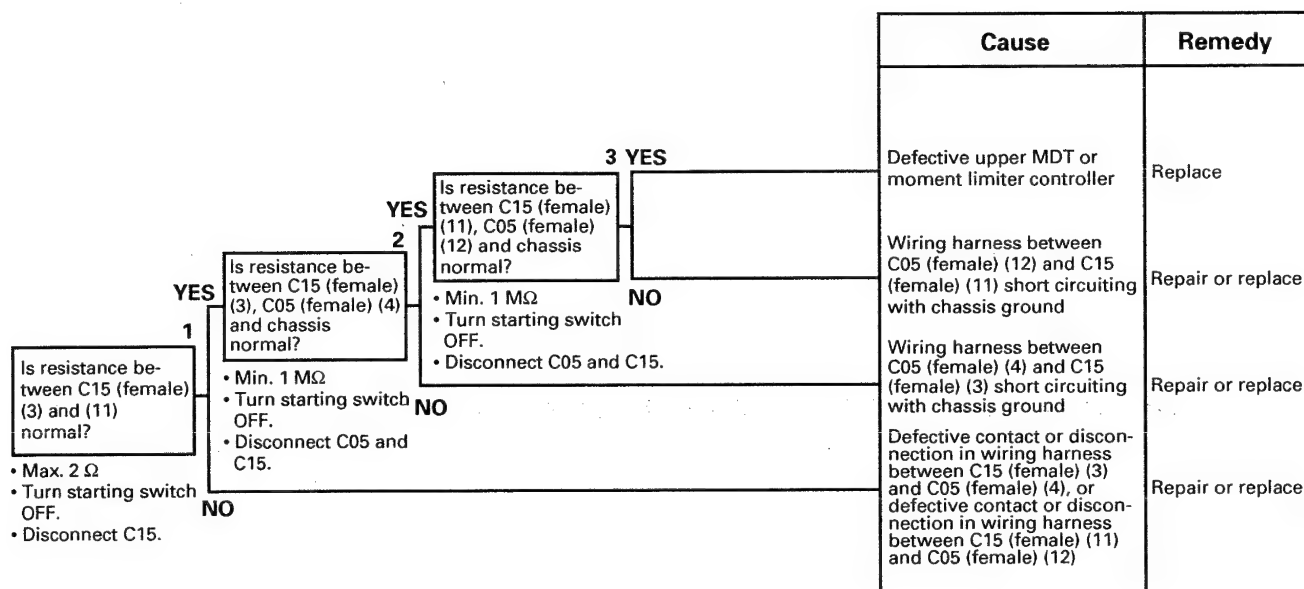
EM-4 OSS error E10 (Moment limiter system error) is displayed

	Cause	Remedy
	Defective moment limiter controller	Replace

023S02

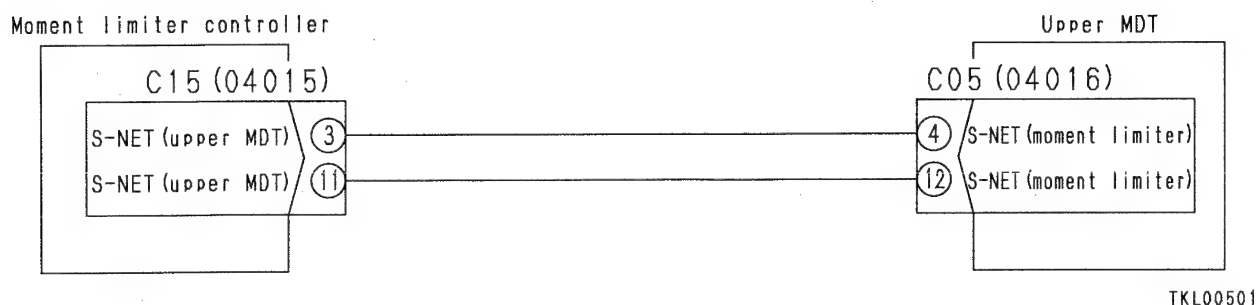
EM-5 OSS error E20 (Abnormality in S-NET communication between moment limiter controller and MDT) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



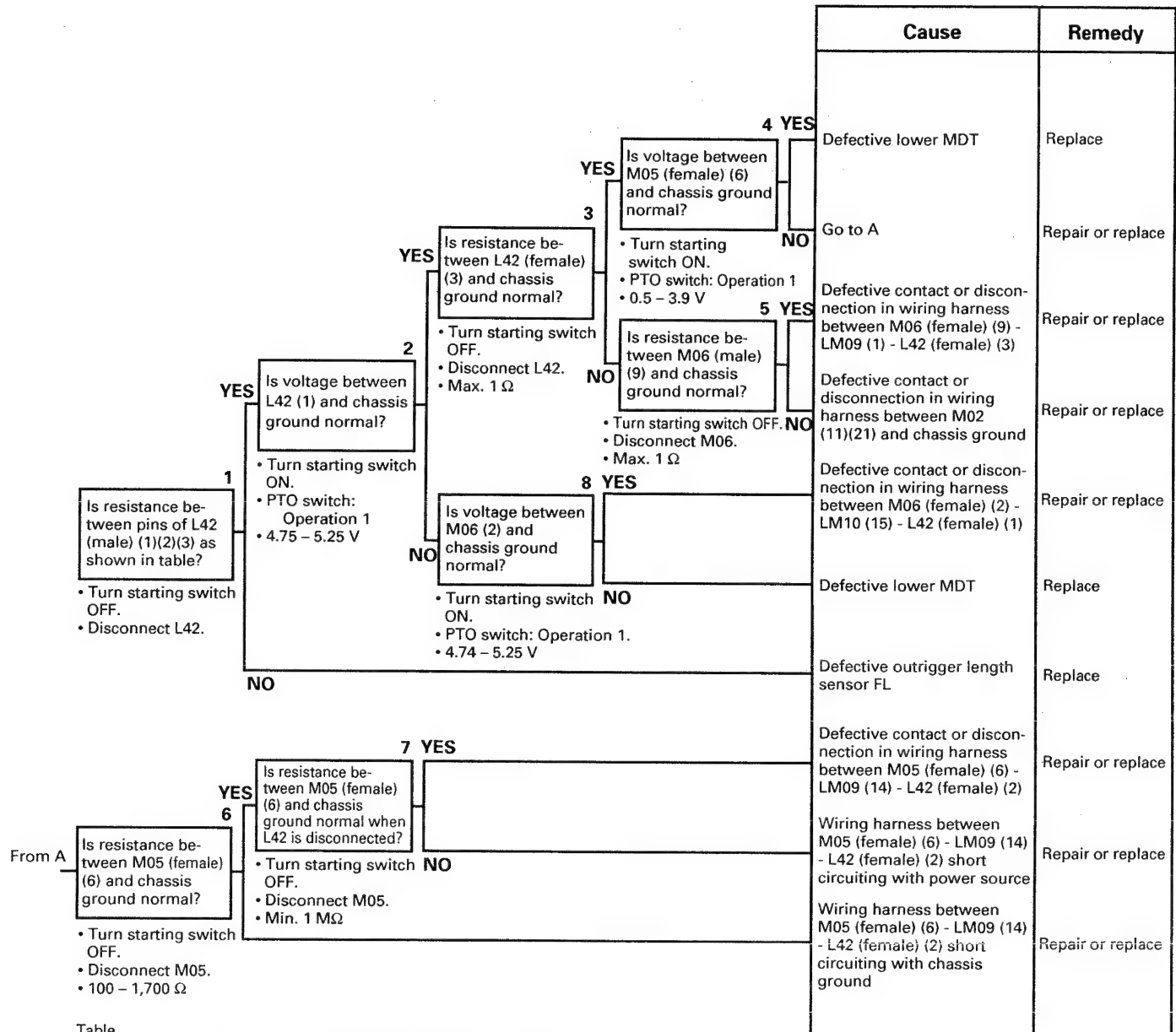
023S02

EM-5 Related electric circuit diagram



EM-6 OSS error E21 (Abnormality in outrigger length sensor FL) is displayed

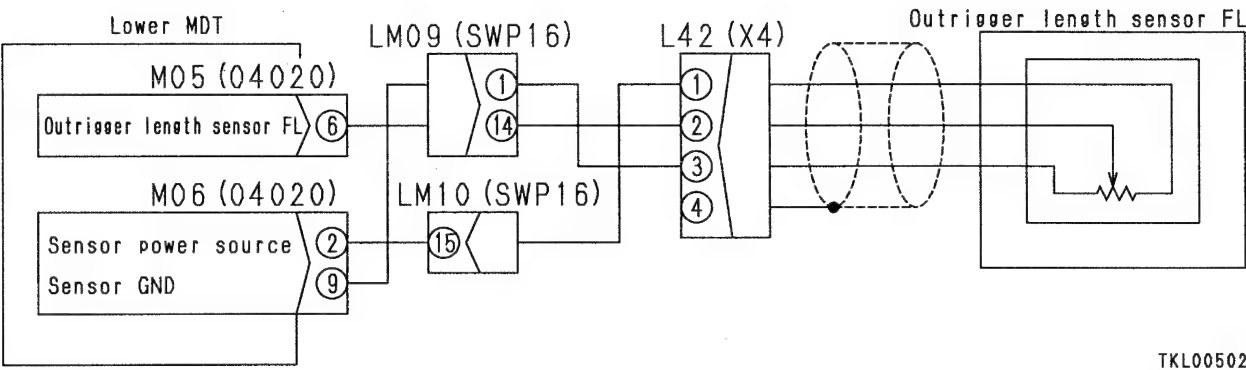
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Table

L42 (male)	Outrigger FL	Resistance
Between (1) – (3)	Throughout whole stroke	1,900 – 2,100 Ω
Between (2) – (3)	Fully retracted	100 – 300 Ω
Between (2) – (3)	Fully extended	1,400 – 1,700 Ω

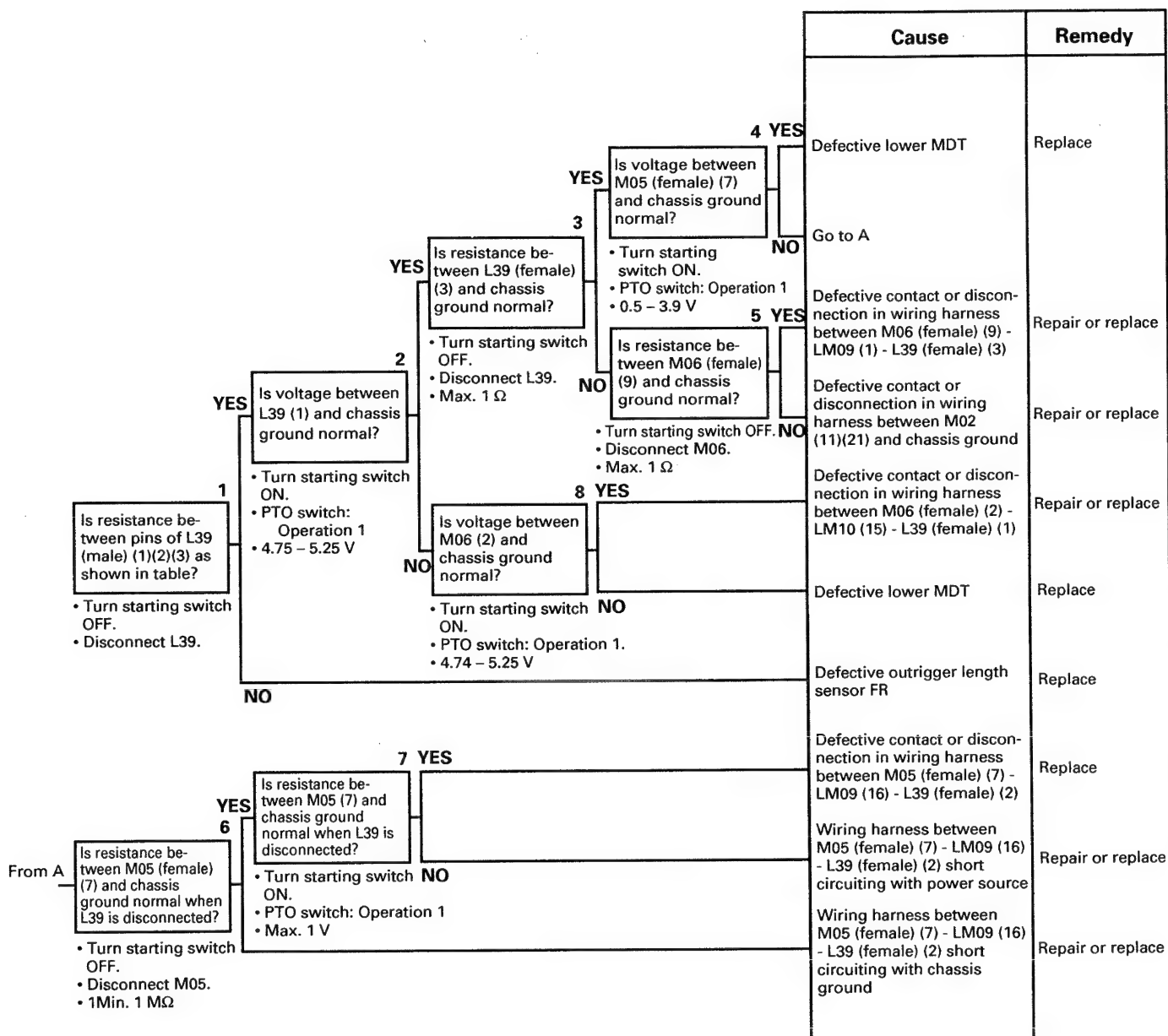
EM-6 Related electric circuit diagram



023S02

EM-7 OSS error E22 (Abnormality in outrigger length sensor FR) is displayed

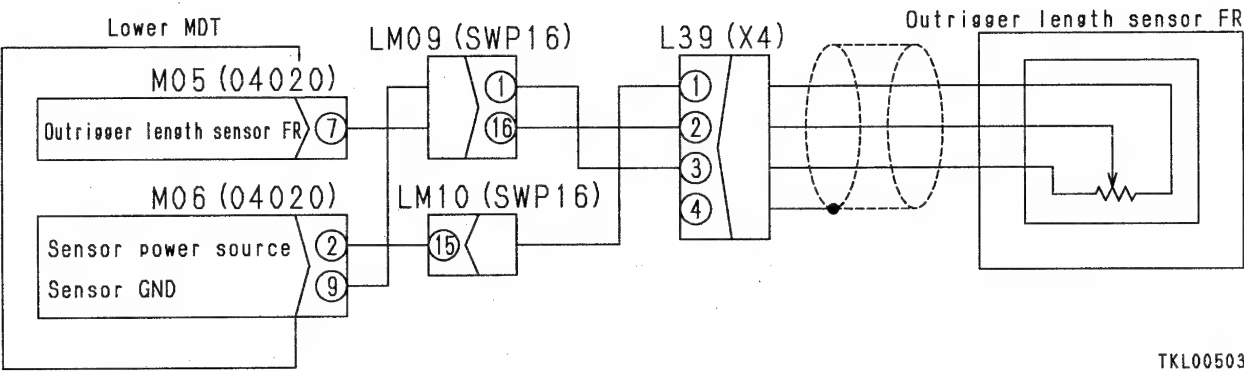
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Table

L39 (male)	Outrigger FR	Resistance
Between (1) – (3)	Throughout whole stroke	1,900 – 2,100 Ω
Between (2) – (3)	Fully retracted	100 – 300 Ω
Between (2) – (3)	Fully extended	1,400 – 1,700 Ω

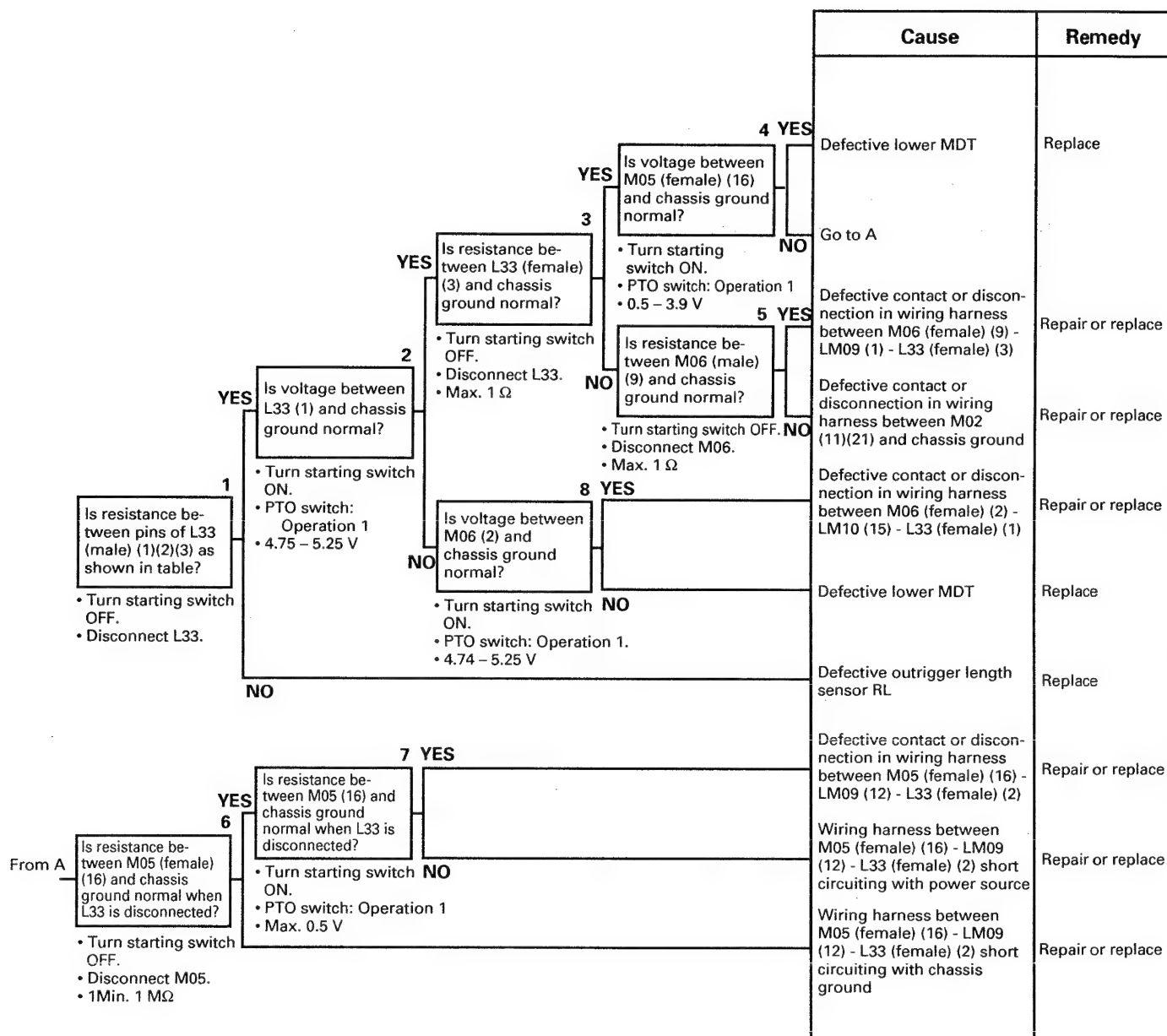
EL-M Related electric circuit diagram



023S02

EM-8 OSS error E23 (Abnormality in outrigger length sensor RL) is displayed

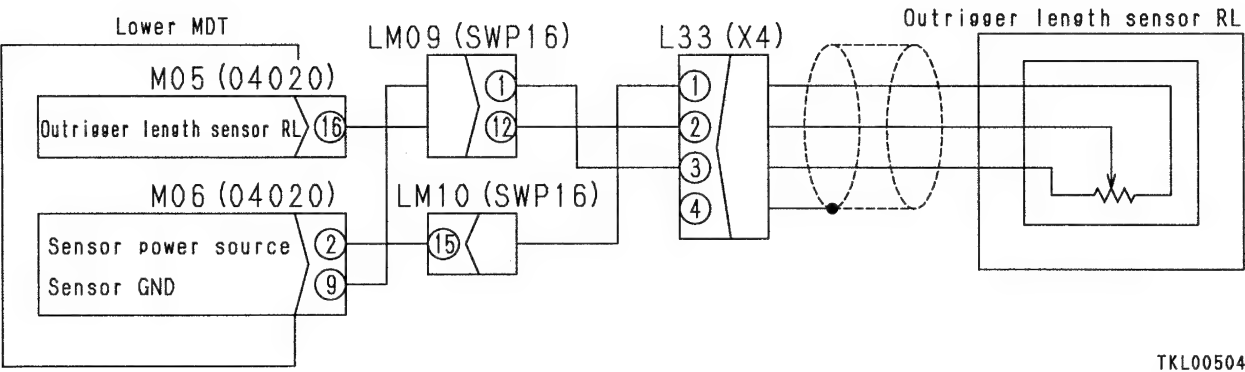
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Table

L33 (male)	Outrigger RL	Resistance
Between (1) – (3)	Throughout whole stroke	1,900 – 2,100 Ω
Between (2) – (3)	Fully retracted	100 – 300 Ω
Between (2) – (3)	Fully extended	1,400 – 1,700 Ω

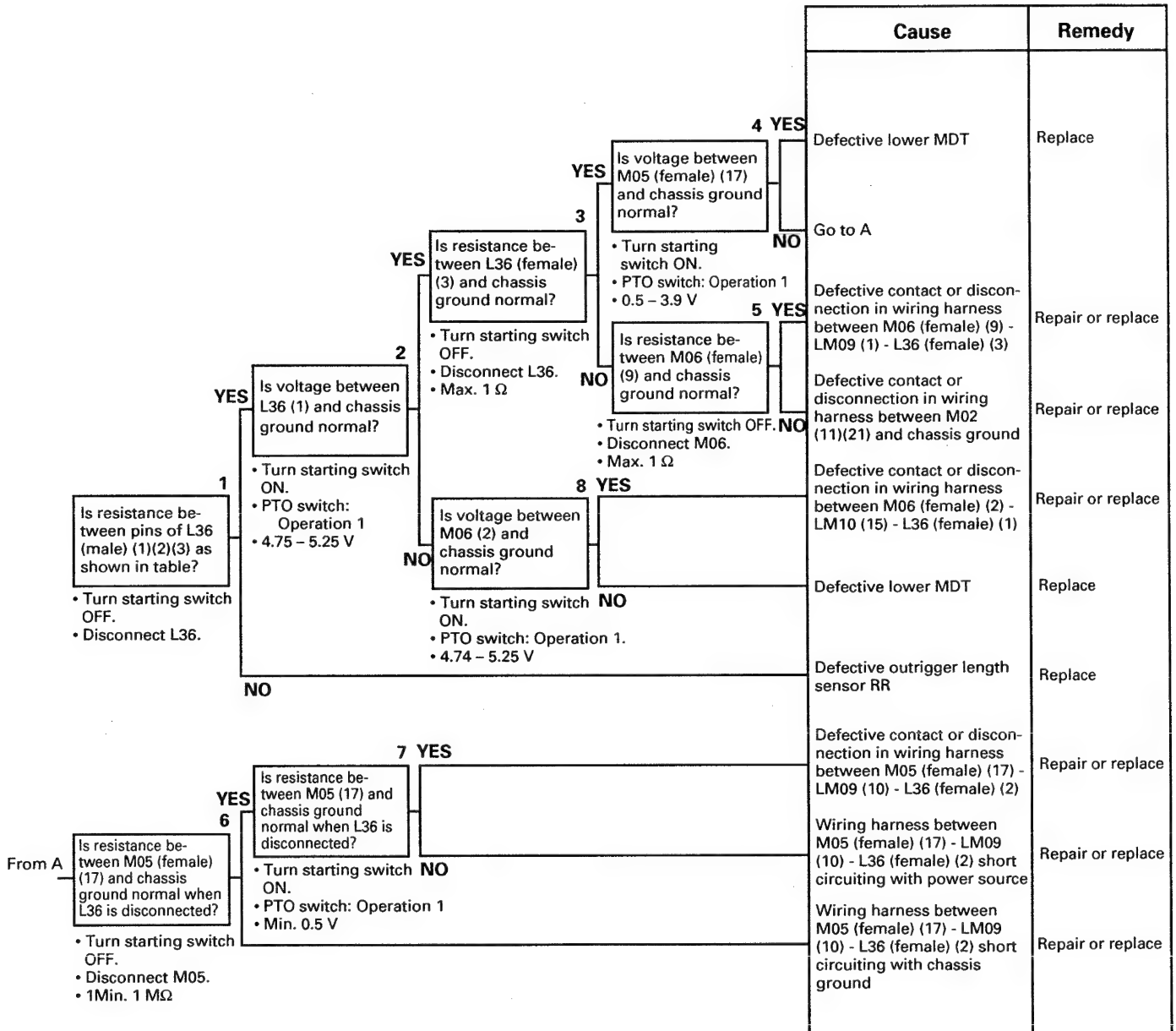
EM-8 Related electric circuit diagram



023S02

EM-9 OSS error E24 (Abnormality in outrigger length sensor RR) is displayed

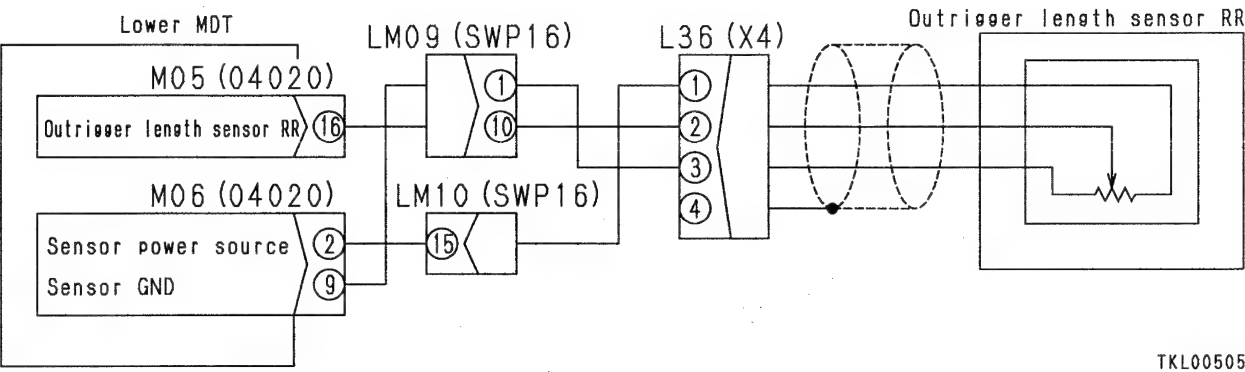
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Table

L36 (male)	Outrigger RR	Resistance
Between (1) – (3)	Throughout whole stroke	1,900 – 2,100 Ω
Between (2) – (3)	Fully retracted	100 – 300 Ω
Between (2) – (3)	Fully extended	1,400 – 1,700 Ω

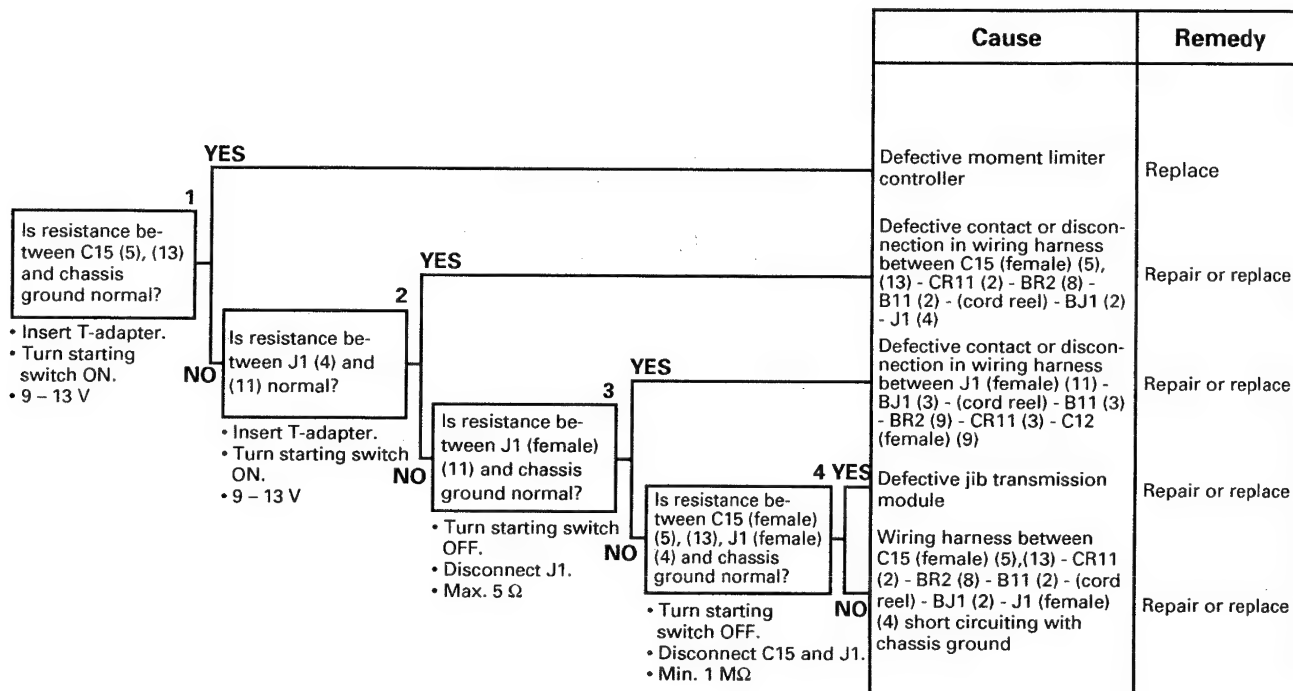
EM-9 Related electric circuit diagram



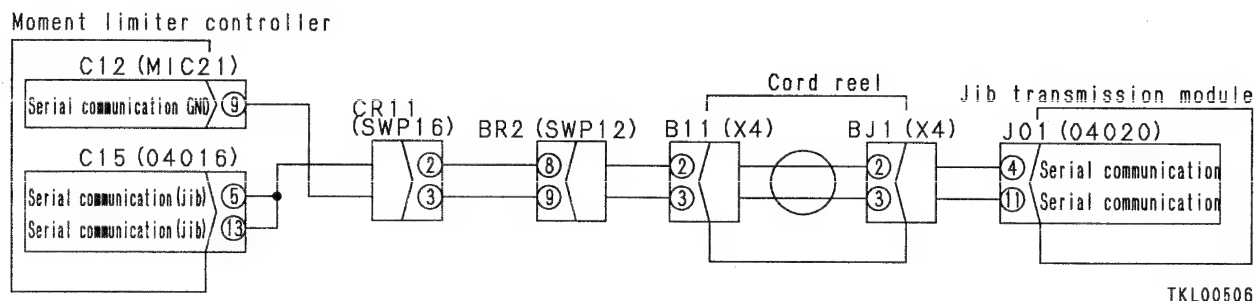
023S02

EM-10 OSS error E30 (Abnormality in communication (cut off) between moment limiter controller and jib transmission module) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

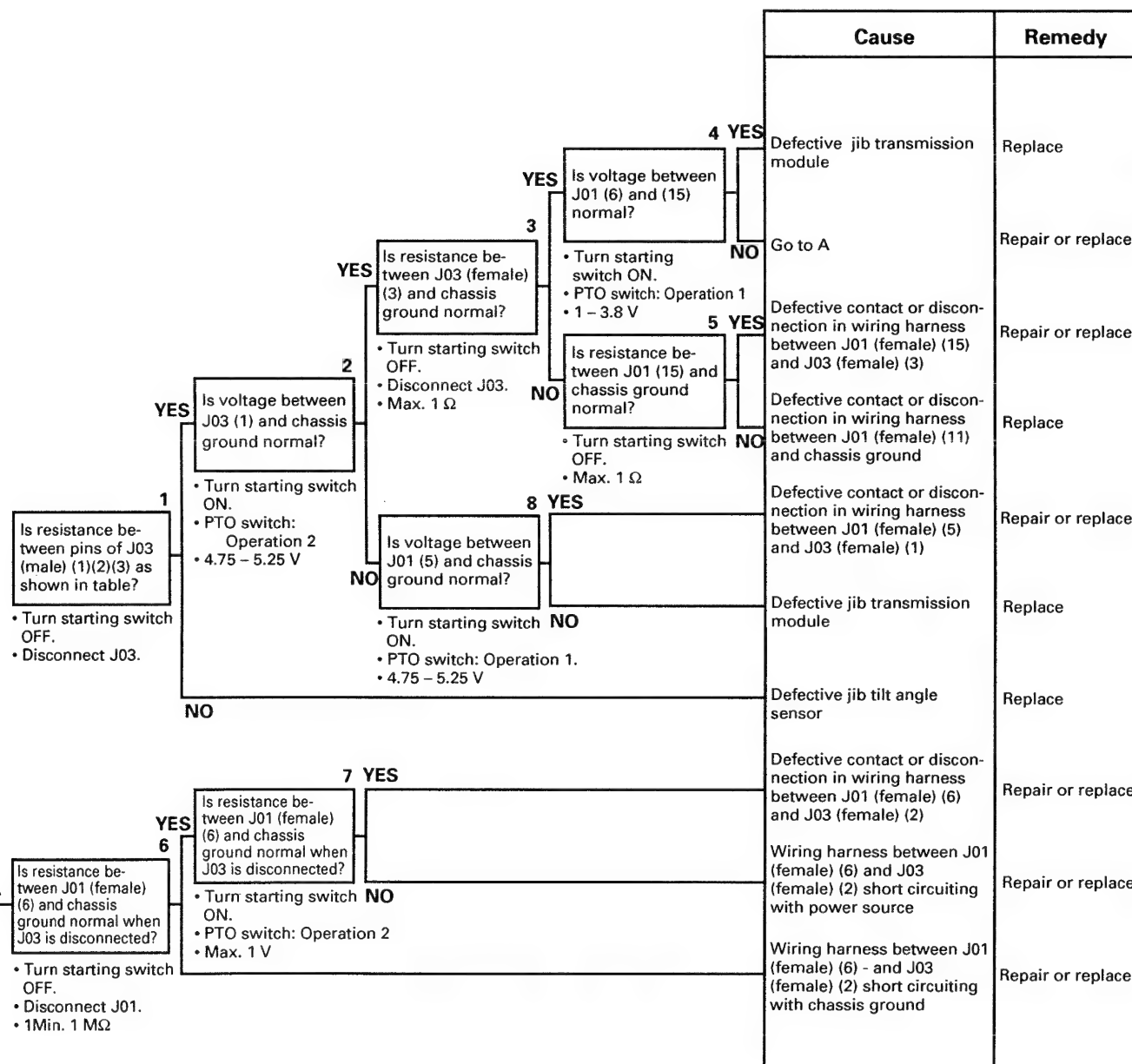


EM-10 Related electric circuit diagram



EM-11 OSS error E31 (Abnormality in jib tilt angle sensor system) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

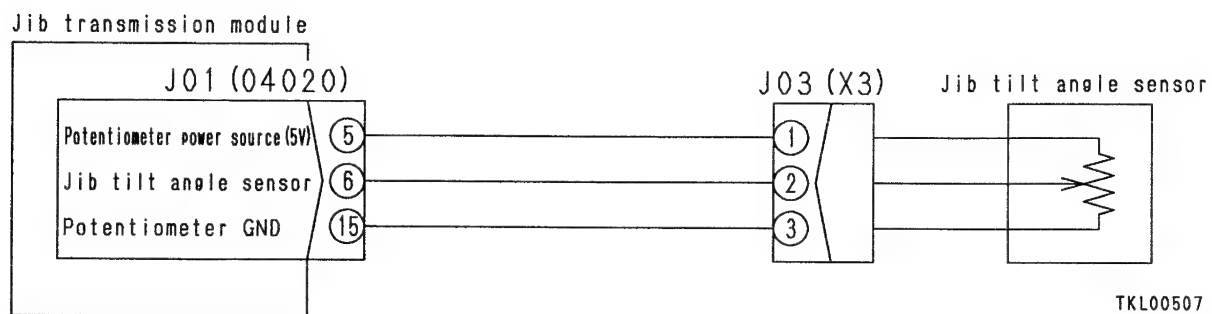


023502

Table

J03 (male)	Jib	Resistance
Between (1) - (3)	Throughout whole stroke	4 - 6 kΩ
Between (2) - (3)	Fully raised and tilted	2.5 - 4.5 kΩ
Between (2) - (3)	Fully lowered and tilted	1.5 - 2.6 kΩ

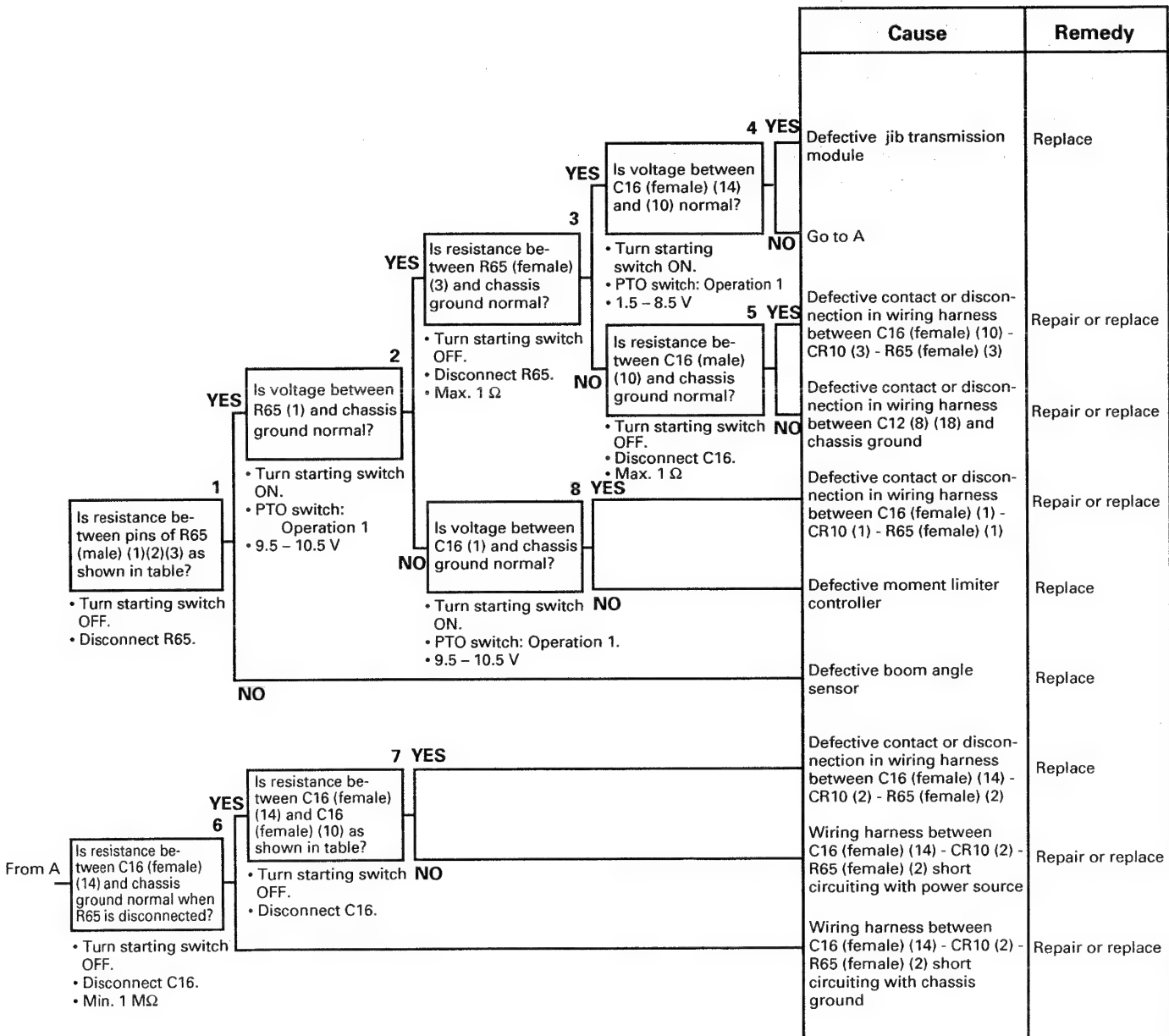
EM-11 Related electric circuit diagram



023S02

EM-12 OSS error E41 (Abnormality in boom angle sensor system) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

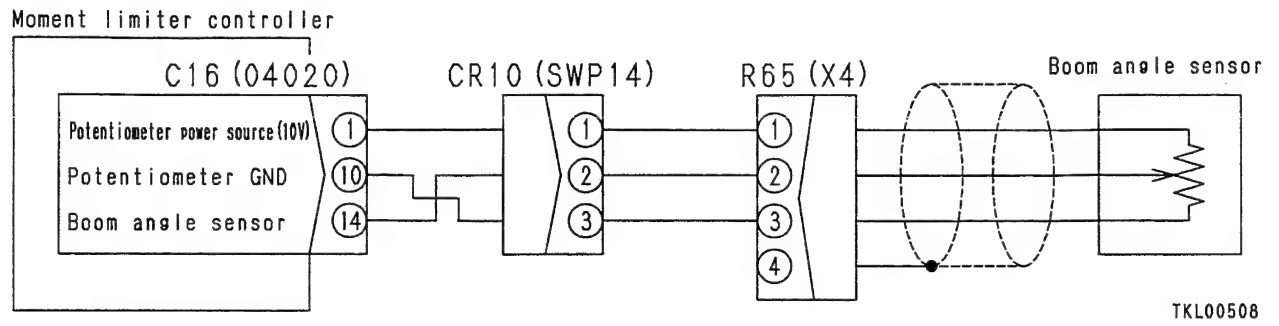


023S02

Table

C16 (female)	R65 (male)	Boom	Resistance
Between (1) – (10)	Between (1) – (3)	Throughout whole stroke	400 – 600 Ω

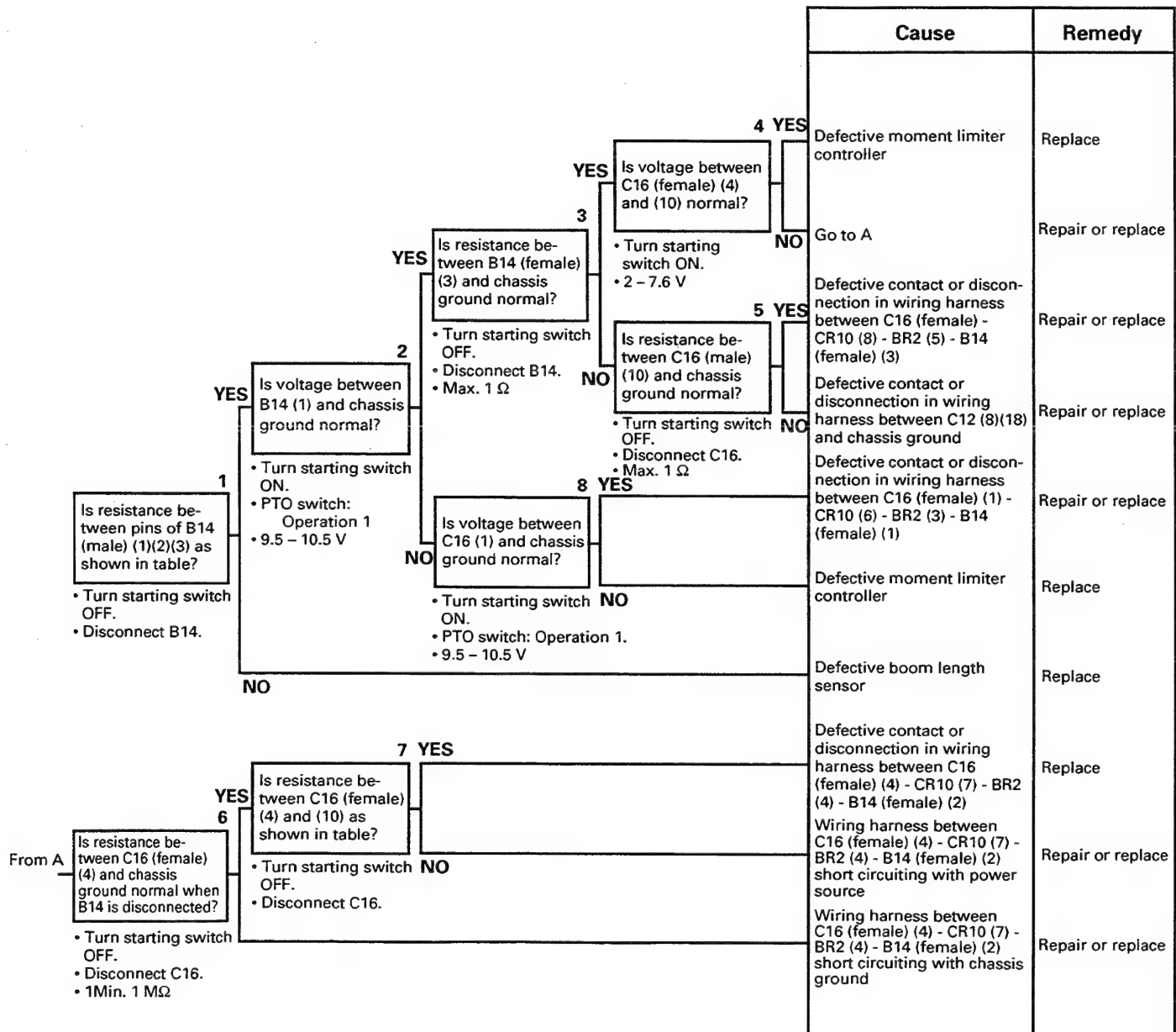
EM-12 Related electric circuit diagram



023S02

EM-13 OSS error E43 (Abnormality in boom length sensor system) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

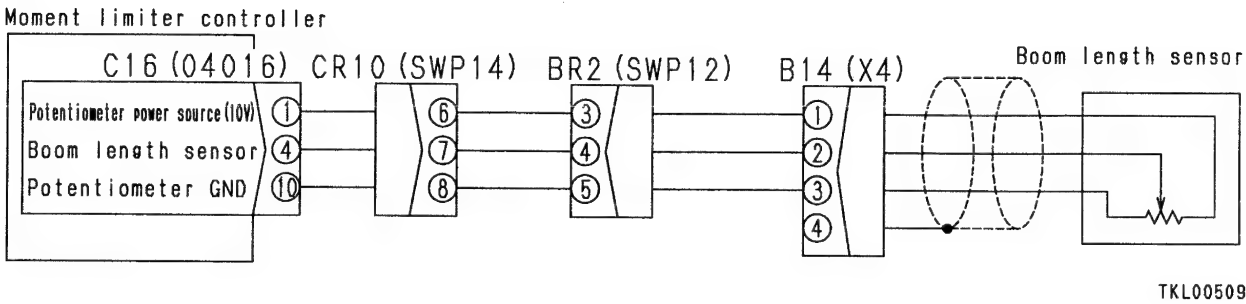


Table

C16 (female)	B14 (male)	Boom	Resistance
Between (1) – (10)	Between (1) – (3)	Throughout whole stroke	4,750 – 5,250 Ω
Between (4) – (10)	Between (2) – (3)	Fully retracted	950 – 2,050 Ω
Between (4) – (10)	Between (2) – (3)	2-stage boom fully extended★	3,600 – 4,000 Ω

★Keep the boom selector switch pressed to 2nd stage and extend the boom fully.

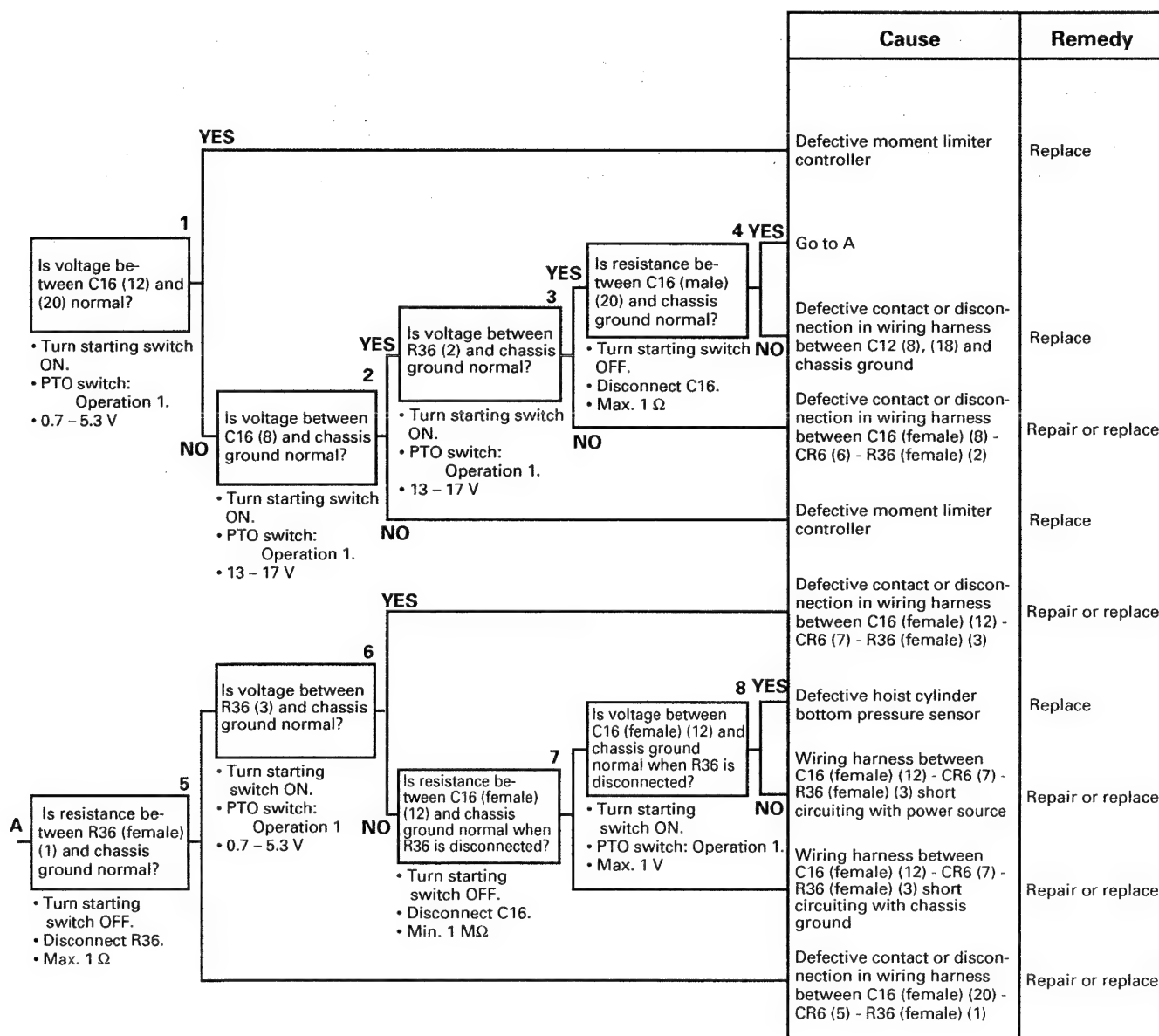
EM-13 Related electric circuit diagram



023S02

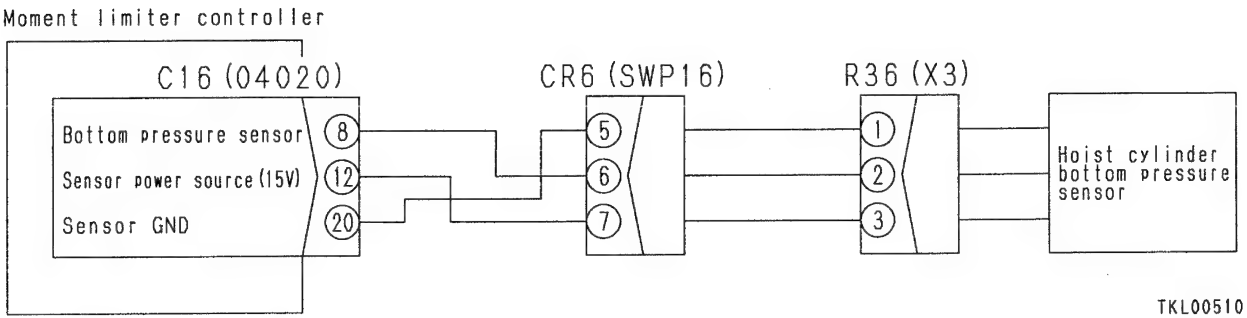
EM-14 OSS error E44 (Abnormality in hoist cylinder bottom pressure sensor system) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

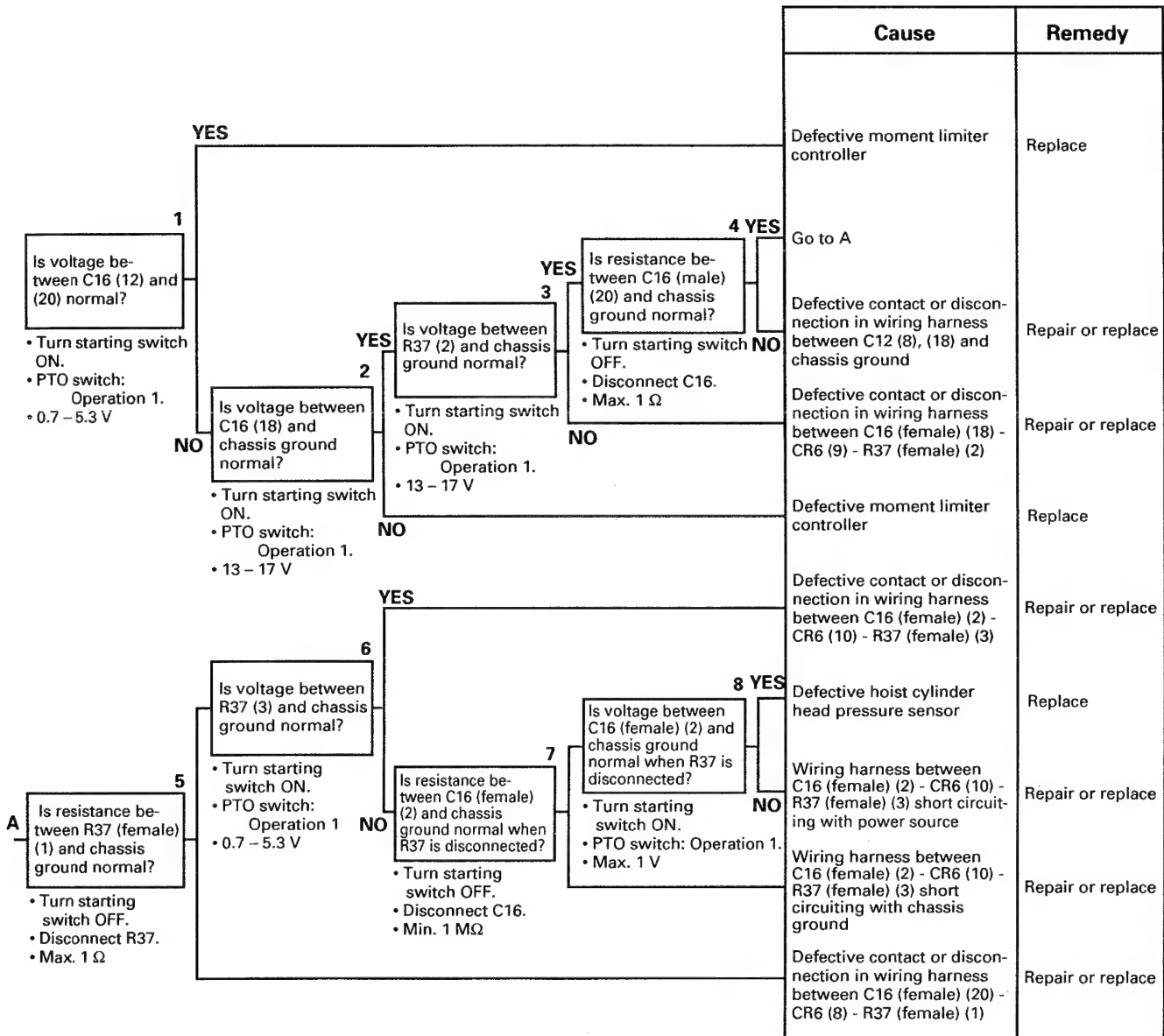
EM-14 Related electric circuit diagram



023S02

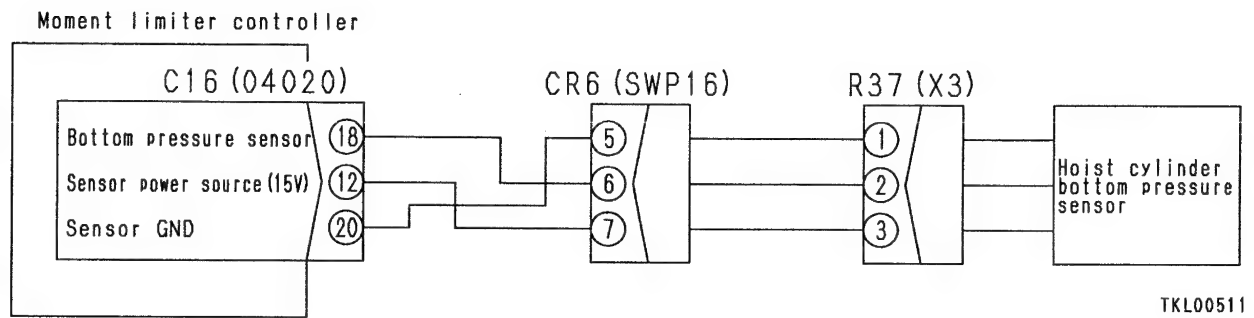
EM-15 OSS error E45 (Abnormality in hoist cylinder head pressure sensor system) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

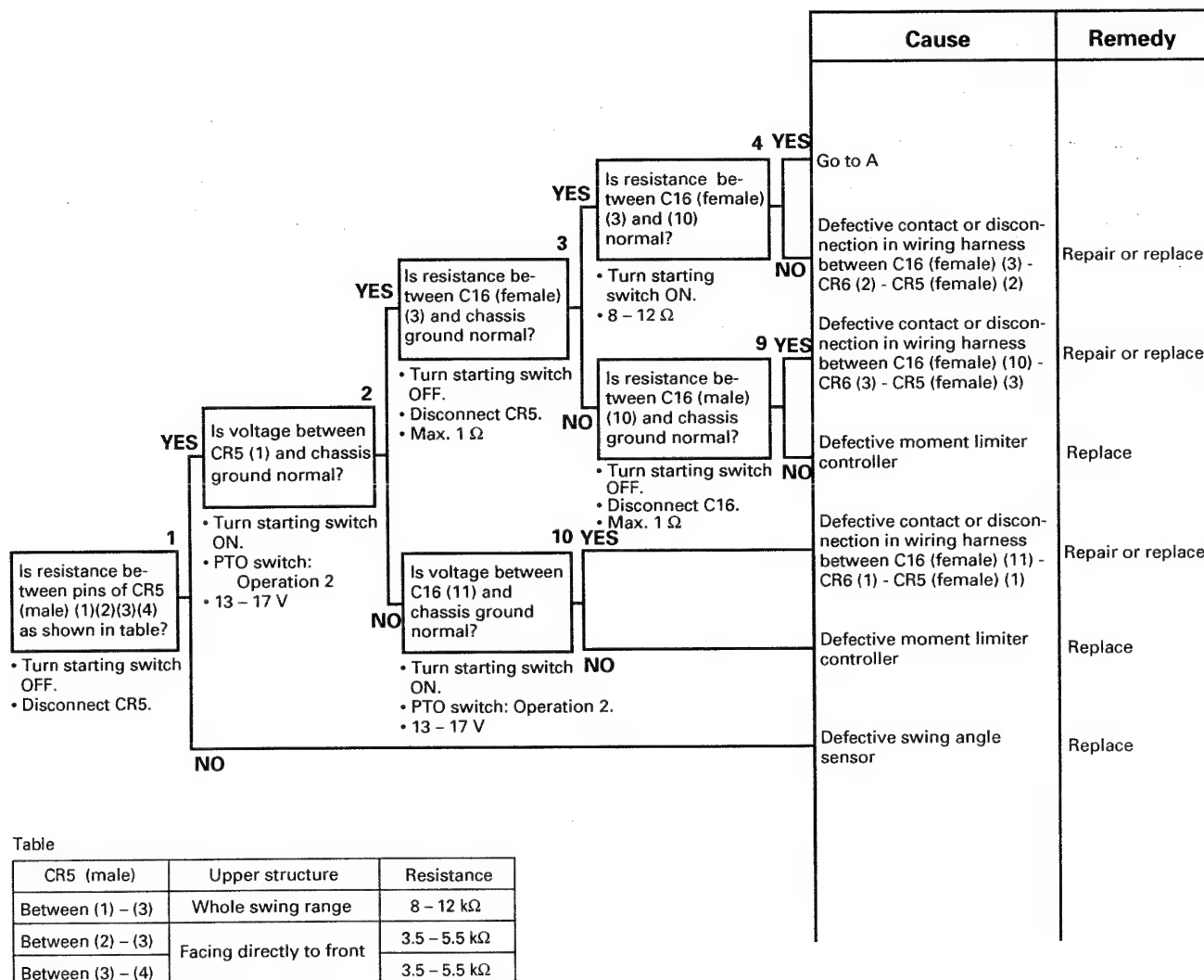
EM-15 Related electric circuit diagram



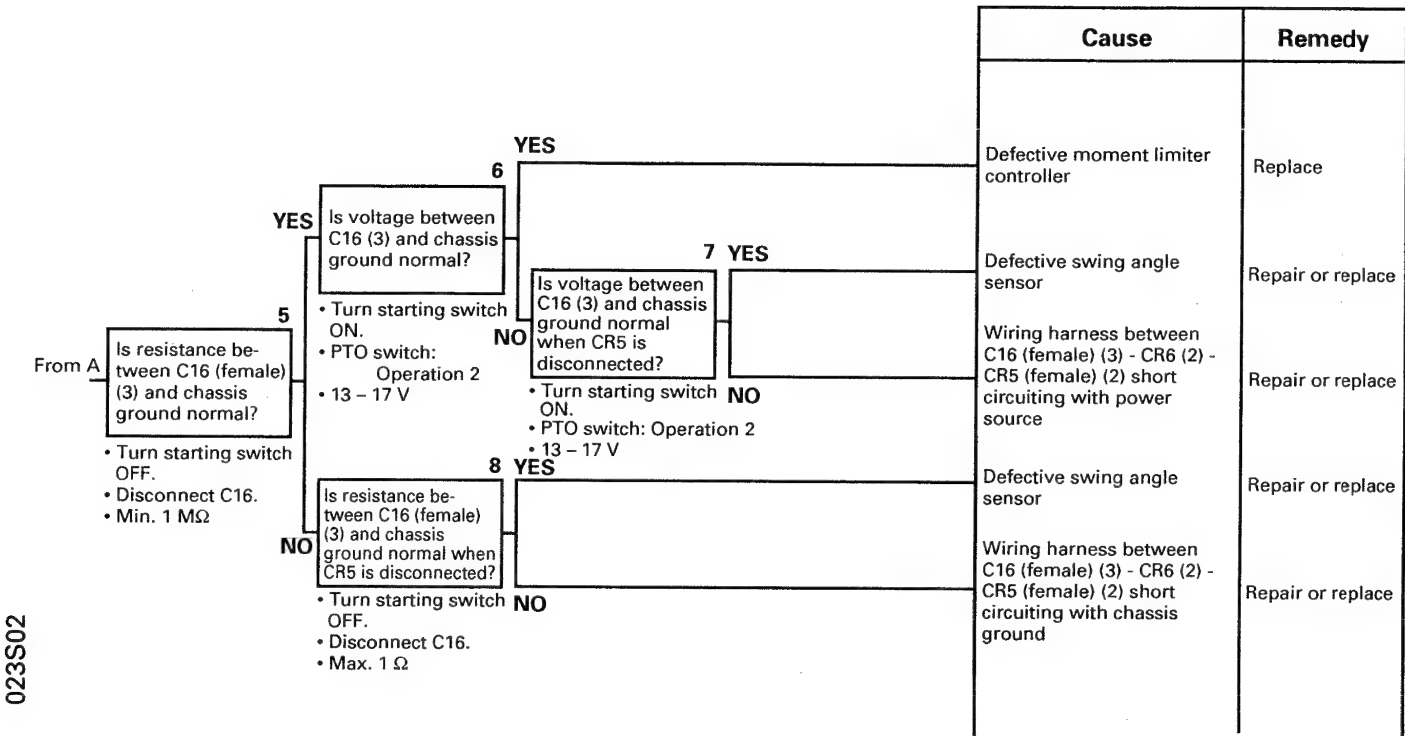
023S02

EM-16 OSS error E46 (Abnormality in swing angle sensor) is displayed

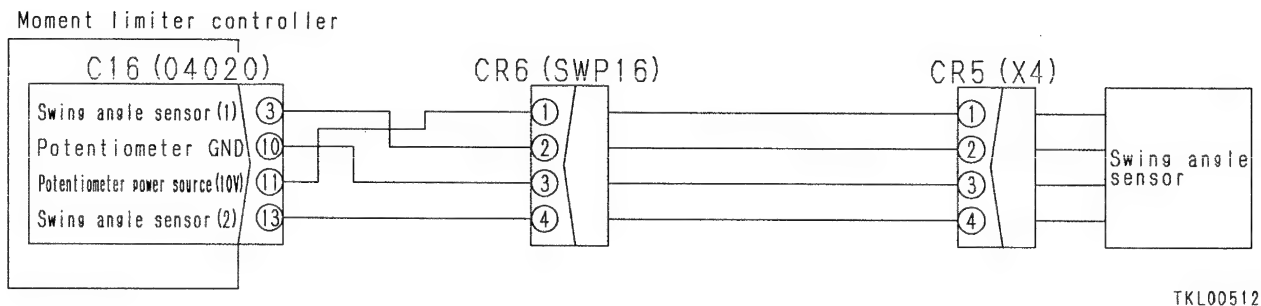
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

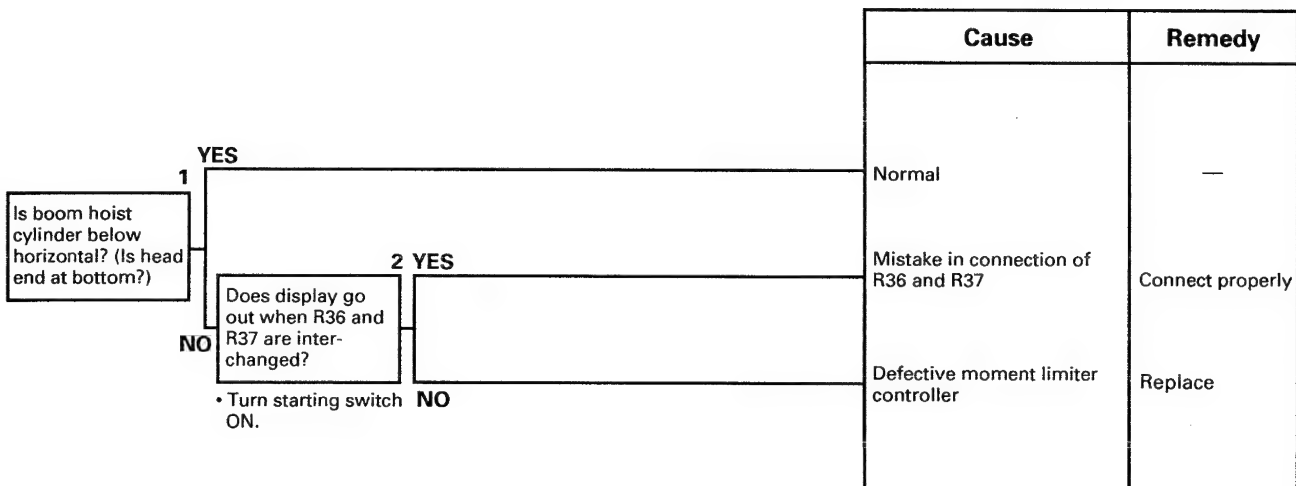


EM-16 Related electric circuit diagram

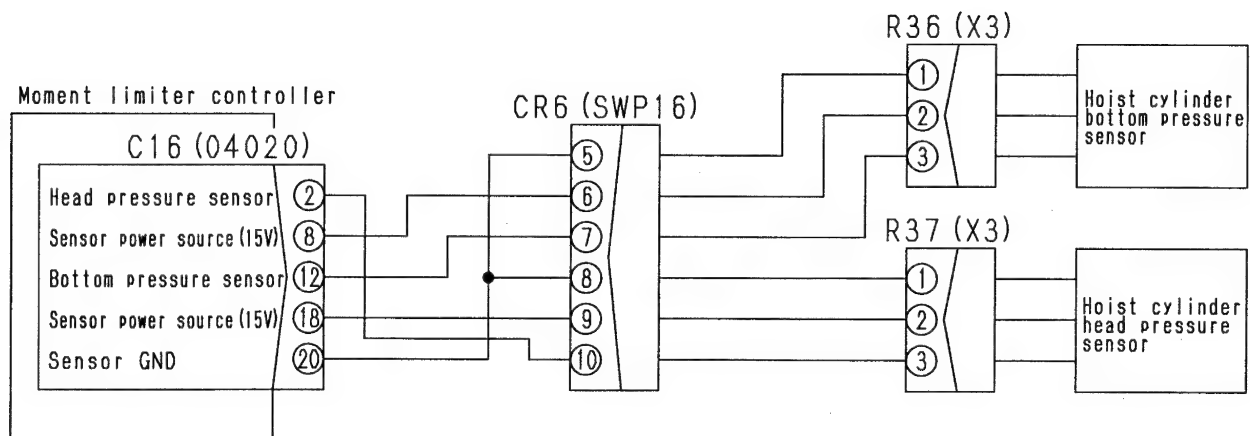


EM-17 OSS error E48 (Reverse rotation of hoist cylinder axis power) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



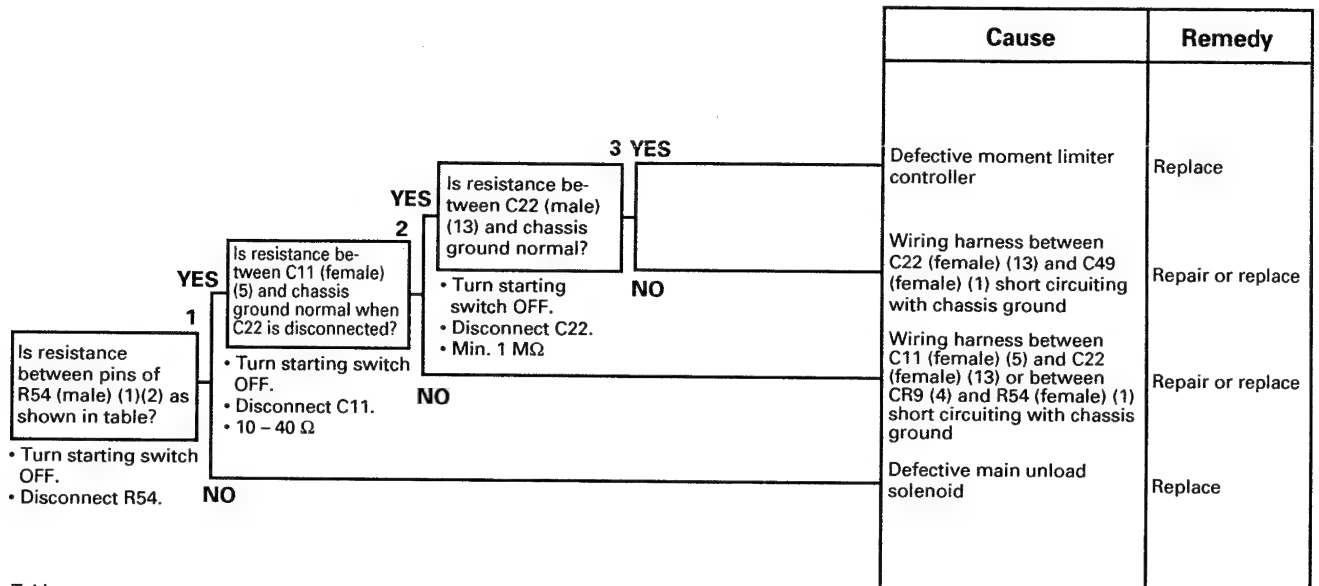
EM-17 Related electric circuit diagram



TKL00513

EM-18 OSS error E50 (Main unload solenoid short circuited with ground) is displayed

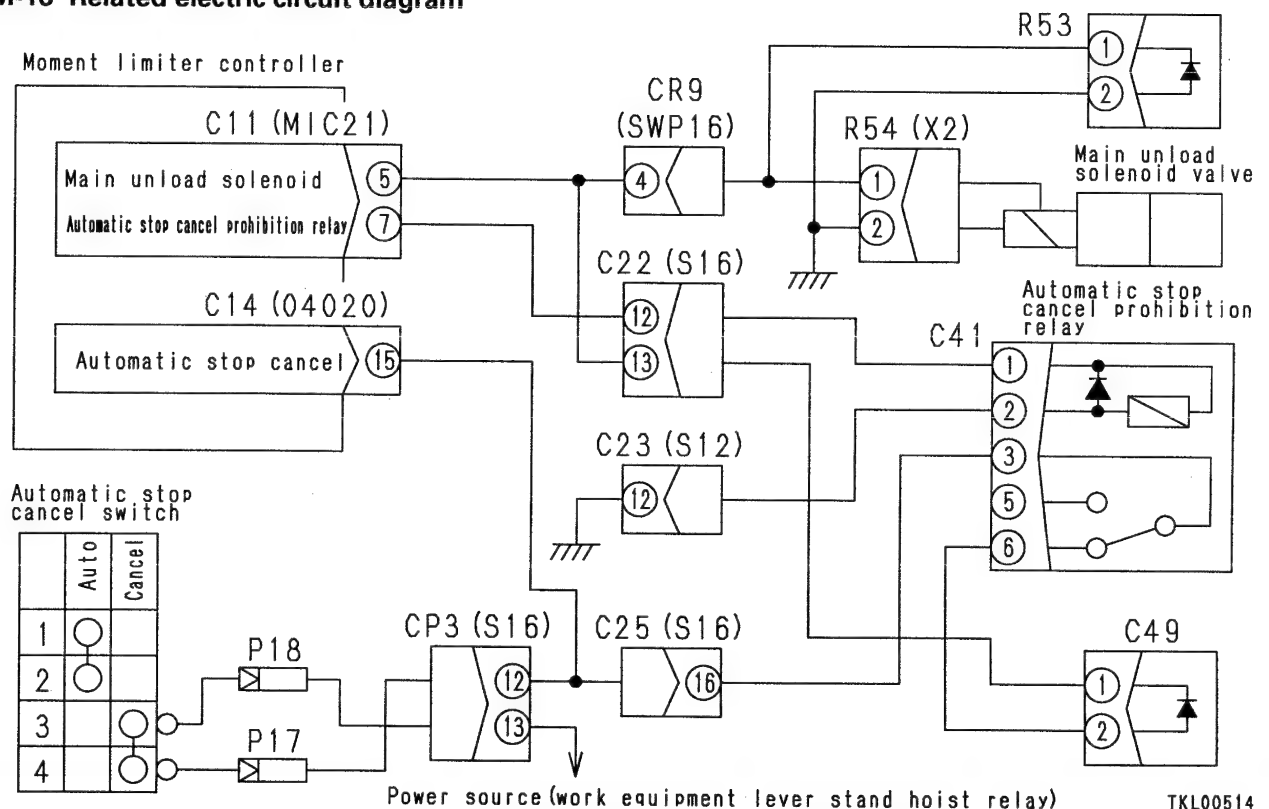
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Table

R54 (female)	Resistance
Between (1) – (2)	10 – 40 Ω
Between (1) - chassis ground	Min. 1 MΩ

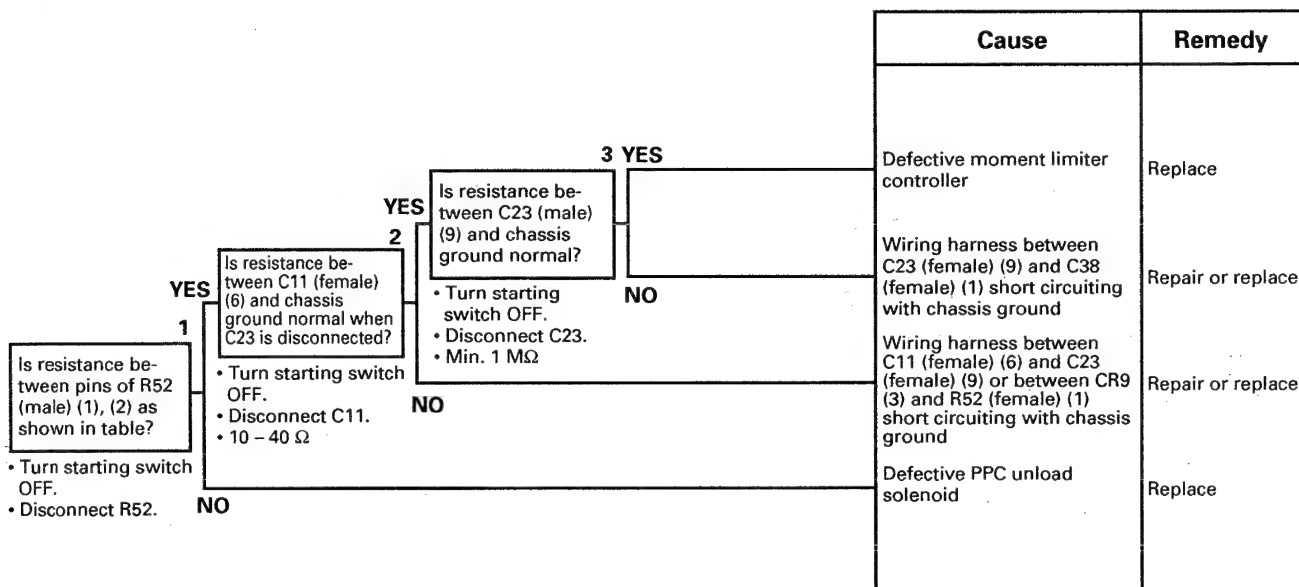
EM-16 Related electric circuit diagram



TKL00514

EM-19 OSS error E51 (PPC unload solenoid short circuited with ground) is displayed

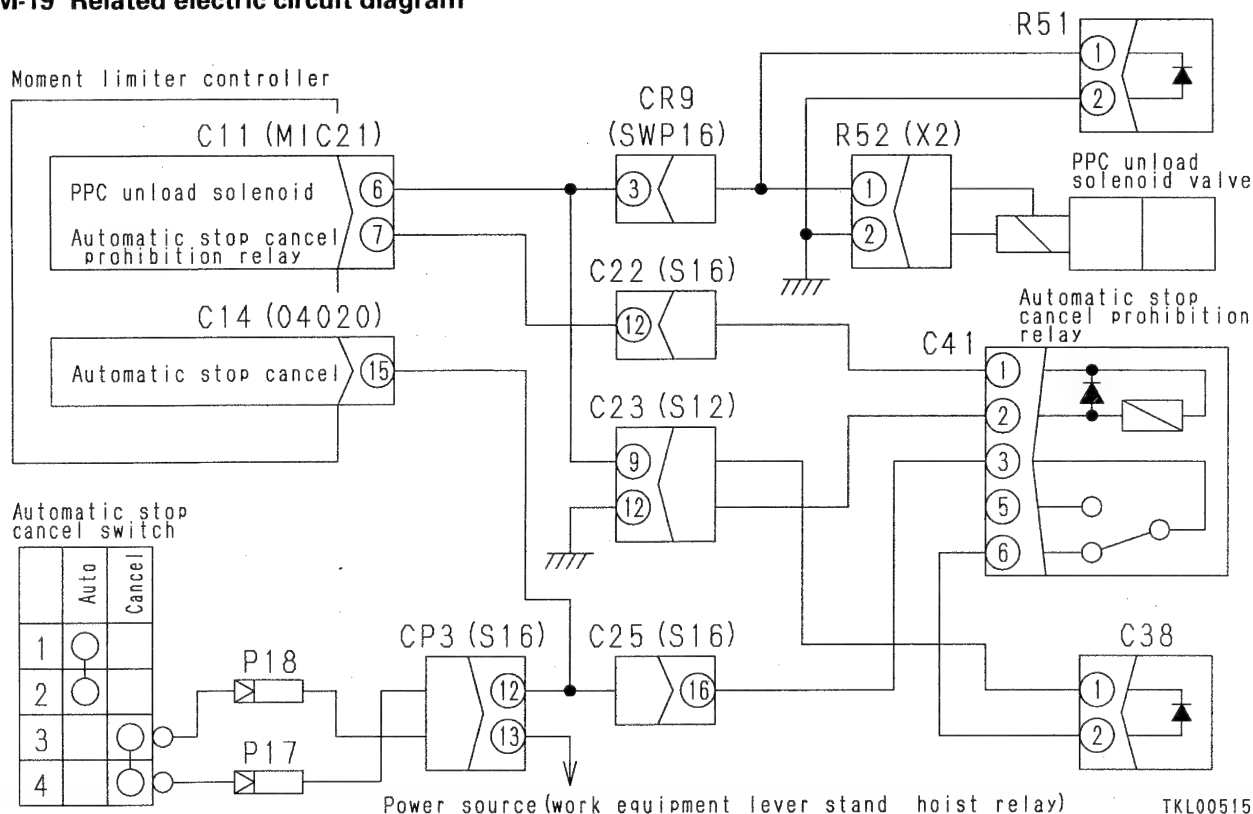
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Table

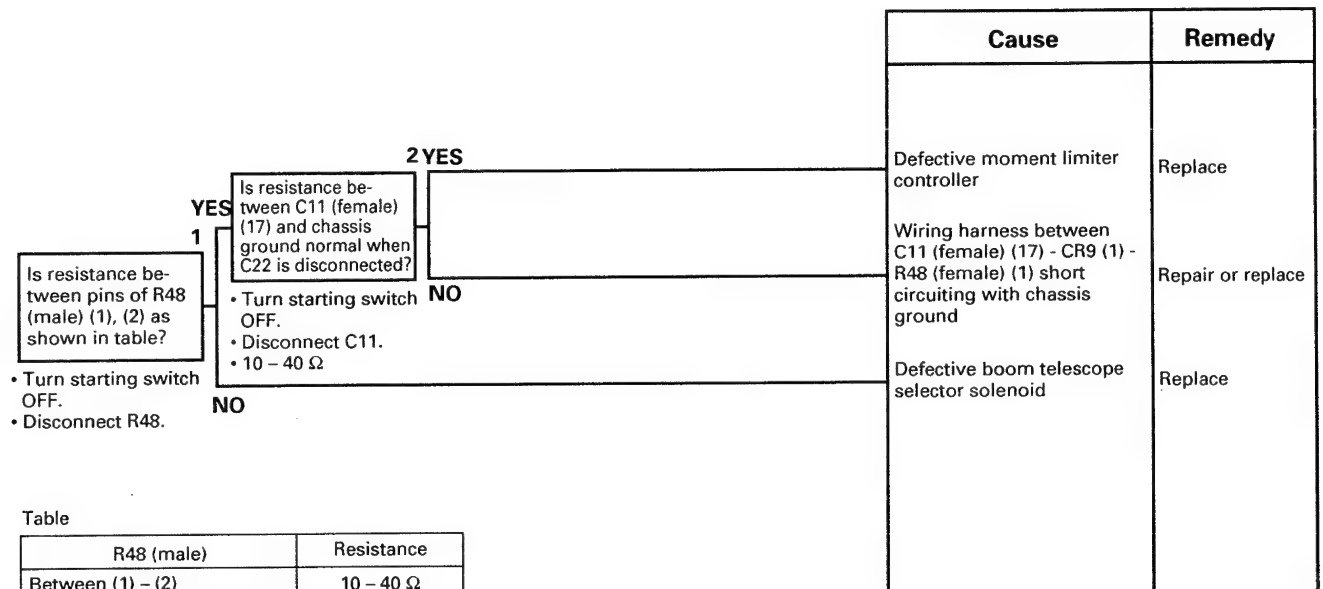
R52 (female)	Resistance
Between (1) – (2)	30 – 80 Ω
Between (1) - chassis ground	Min. 1 M Ω

EM-19 Related electric circuit diagram



EM-20 OSS error E52 (Boom telescope selector solenoid short circuited with ground) is displayed

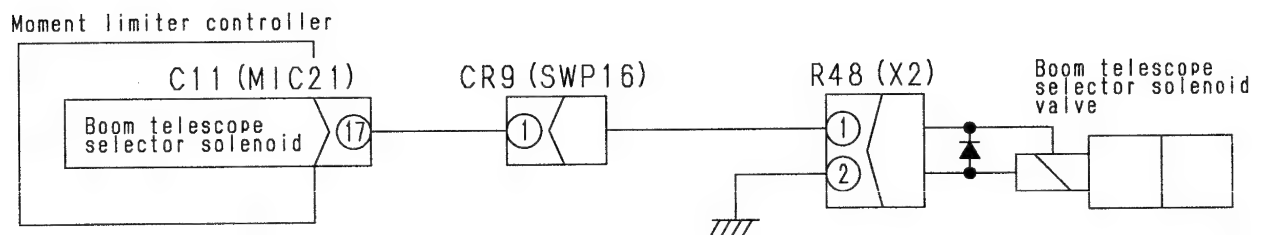
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Table

R48 (male)	Resistance
Between (1) – (2)	10 – 40 Ω
Between (1) - chassis ground	Min. 1 M Ω

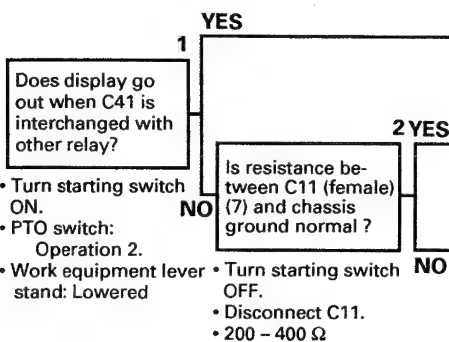
EM-20 Related electric circuit diagram



TKL00516

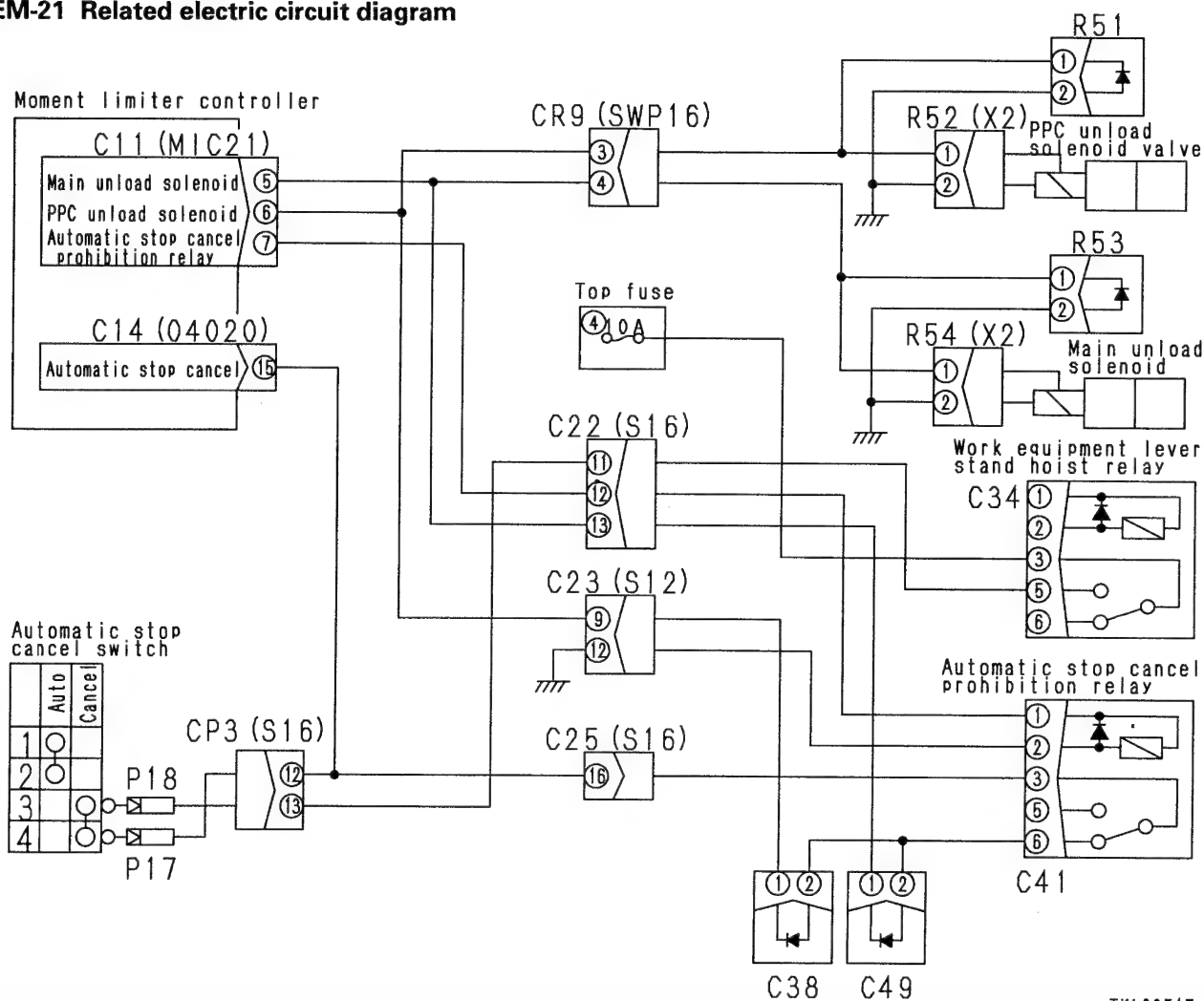
EM-21 OSS error E53 (Automatic stop cancel prohibition relay short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Cause	Remedy
Defective automatic stop cancel prohibition relay	Replace
Defective moment limiter controller	Replace
Wiring harness between C11 (female) (7) - C22 (12) - C41 (female) (1) short circuiting with chassis ground	Repair or replace

EM-21 Related electric circuit diagram



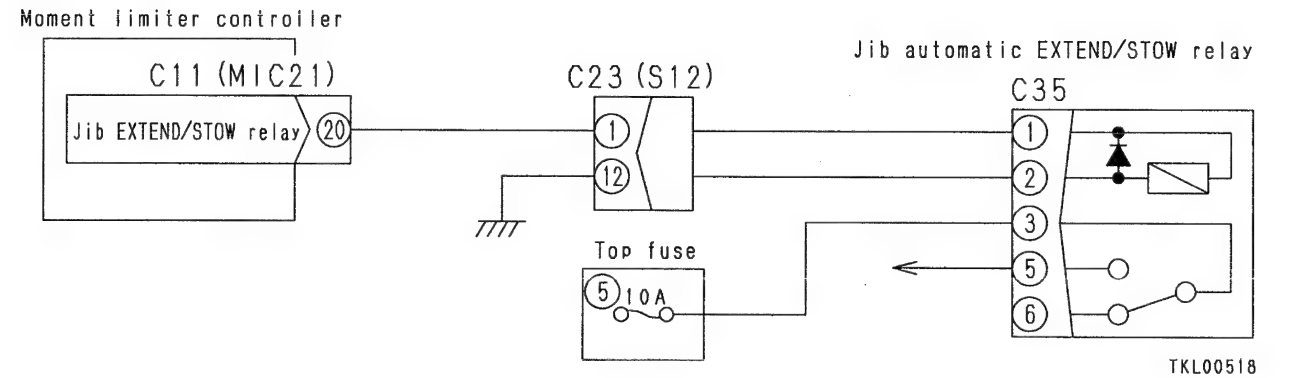
TKL00517

EM-26 OSS error E58 (Jib automatic EXTEND/STOW relay short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

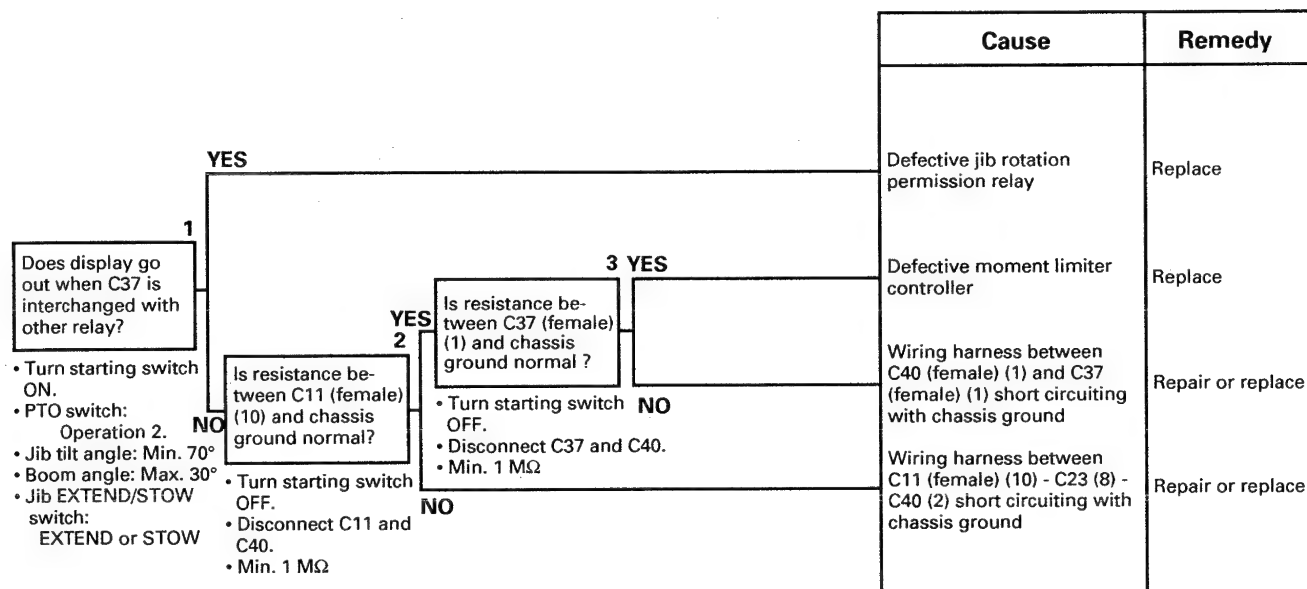
		Cause	Remedy							
<div><div>1</div><div>Does display go out when C35 is interchanged with other relay?</div><div><div>Turn starting switch ON. PTO switch: Operation 2. Jib EXTEND/STOW switch: EXTEND or STOW</div><div><div>NO</div><div><div>2</div><div>Is resistance between C11 (female) (20) and chassis ground normal ?</div><div><div>• Turn starting switch OFF. • Disconnect C11. • 200 – 400 Ω</div></div></div></div></div><tr><td>YES</td><td>Defective jib automatic EXTEND/STOW relay</td><td>Replace</td></tr><tr><td>NO</td><td>Defective moment limiter controller</td><td>Replace</td></tr><tr><td></td><td>NO</td><td>Wiring harness between C11 (female) (20) - C23 (1) - C35 (female) (1) short circuiting with chassis ground</td><td>Repair or replace</td></tr></div>	YES	Defective jib automatic EXTEND/STOW relay	Replace	NO	Defective moment limiter controller	Replace		NO	Wiring harness between C11 (female) (20) - C23 (1) - C35 (female) (1) short circuiting with chassis ground	Repair or replace
	YES	Defective jib automatic EXTEND/STOW relay	Replace							
	NO	Defective moment limiter controller	Replace							
	NO	Wiring harness between C11 (female) (20) - C23 (1) - C35 (female) (1) short circuiting with chassis ground	Repair or replace							

EM-26 Related electric circuit diagram

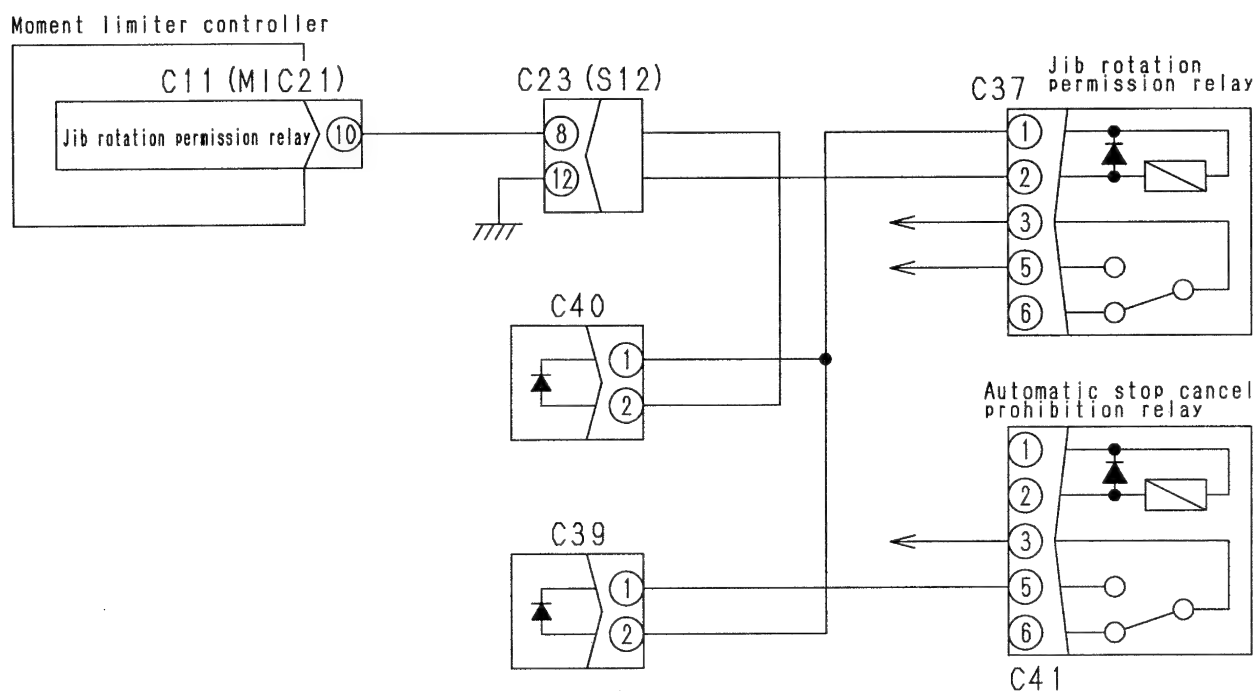


EM-27 OSS error E59 (Jib rotation permission relay short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



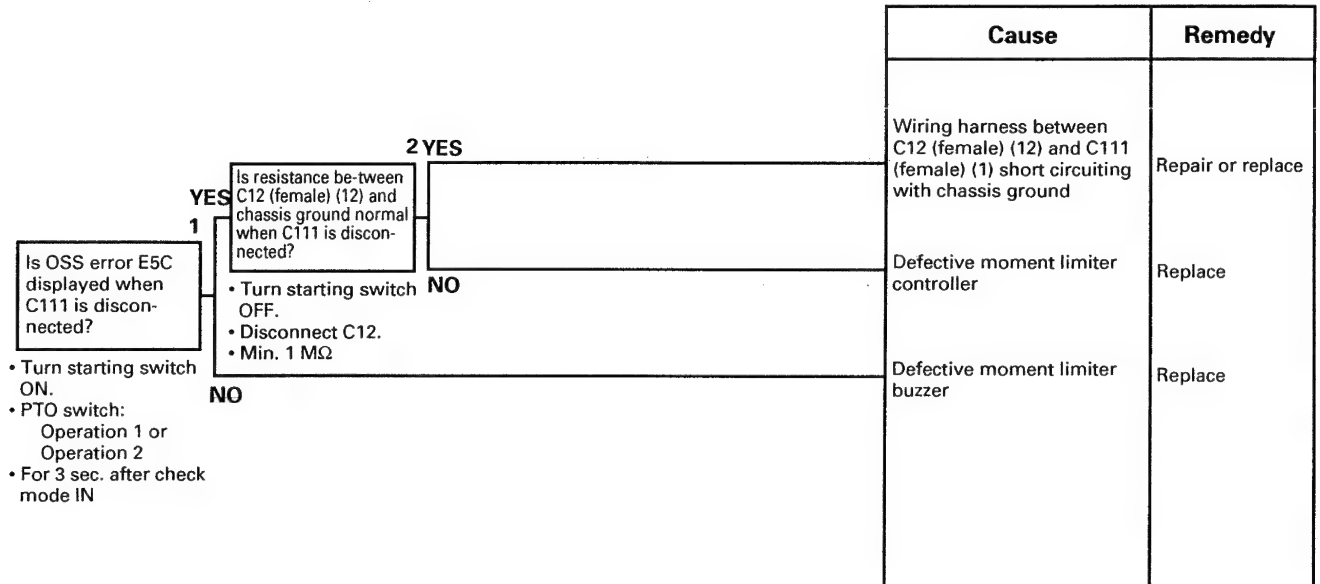
EM-27 Related electric circuit diagram



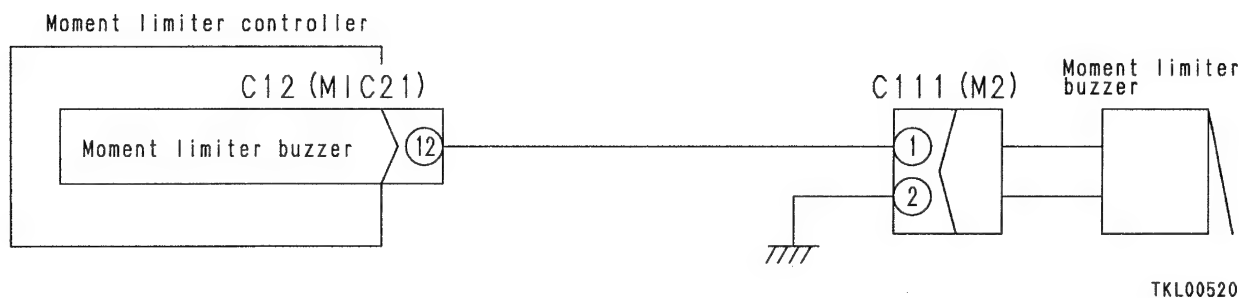
TKL00519

EM-30 OSS error E5C (Moment limiter buzzer short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

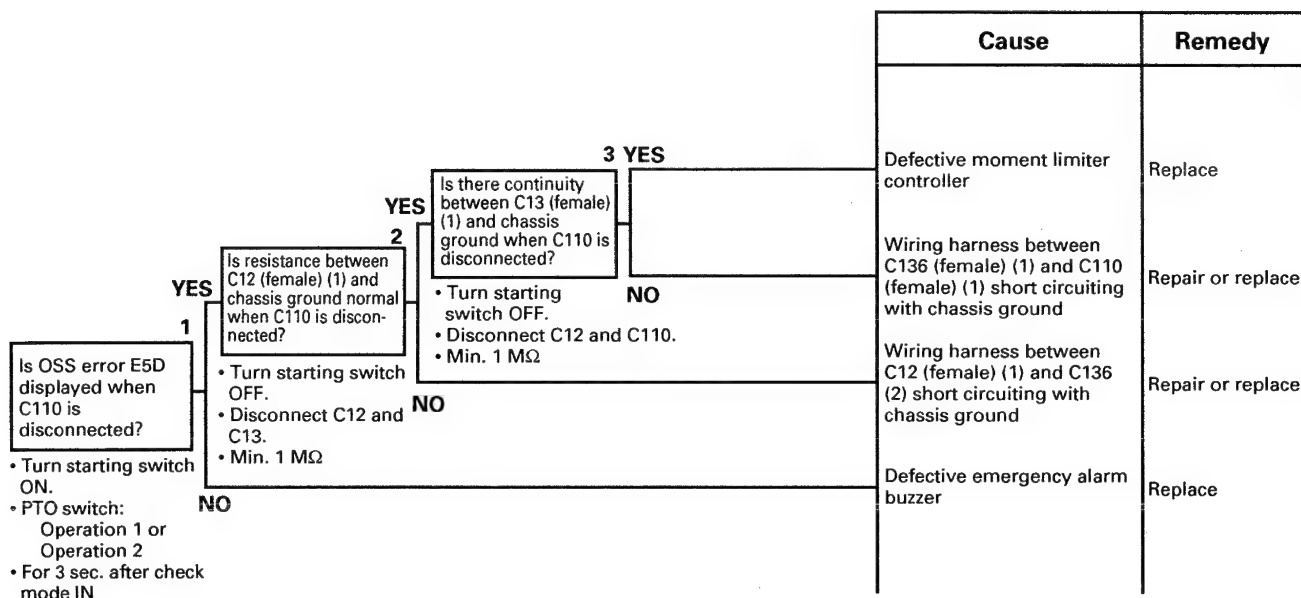


EM-30 Related electric circuit diagram



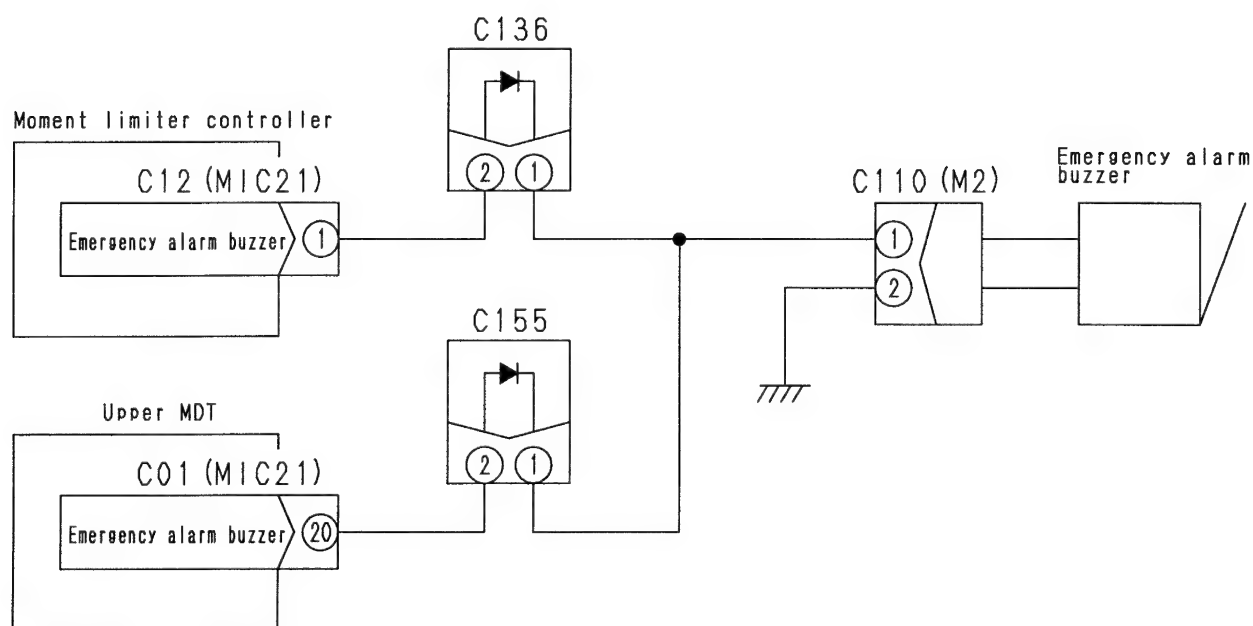
EM-31 OSS error E5D (Emergency alarm buzzer short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

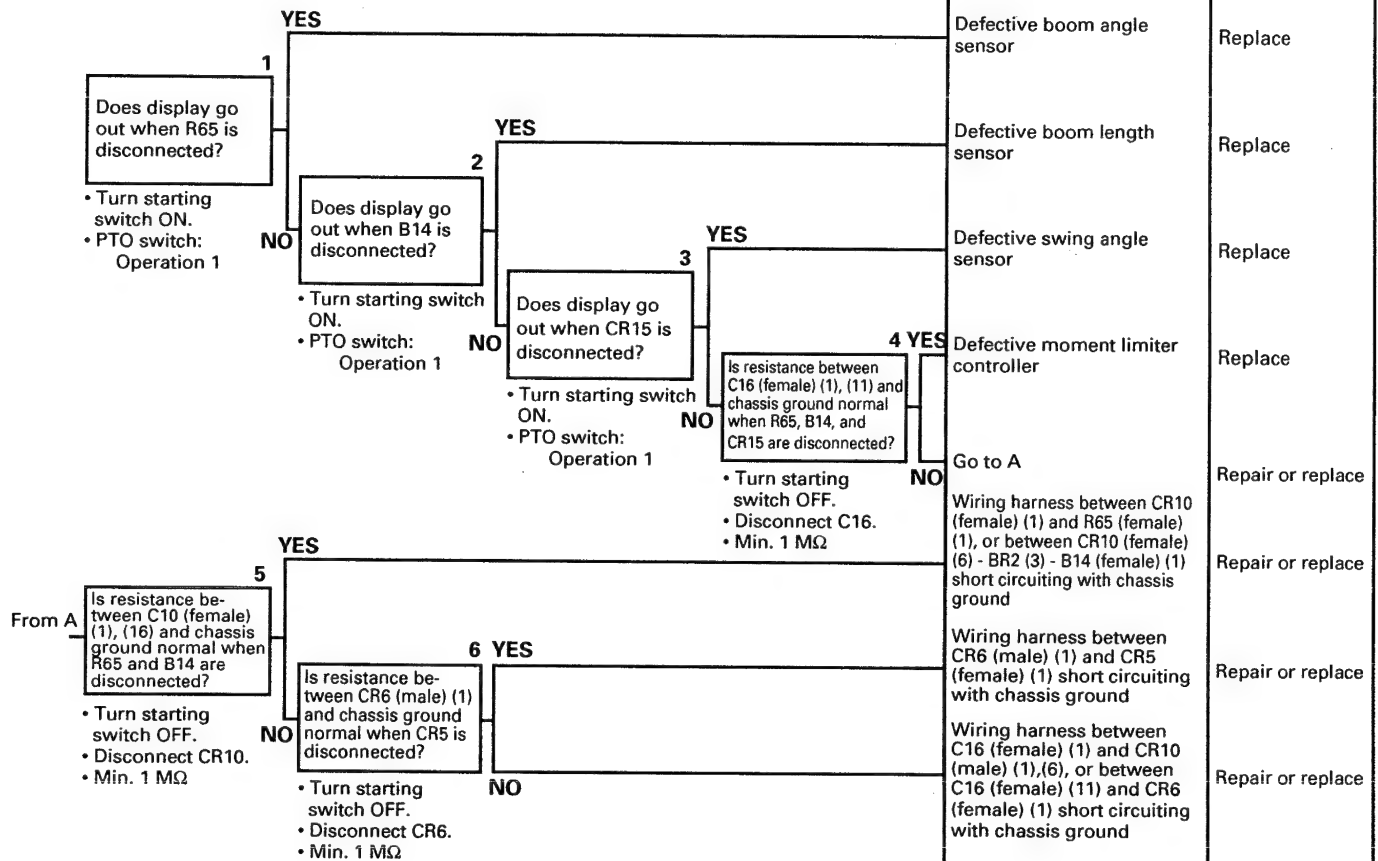
EM-31 Related electric circuit diagram



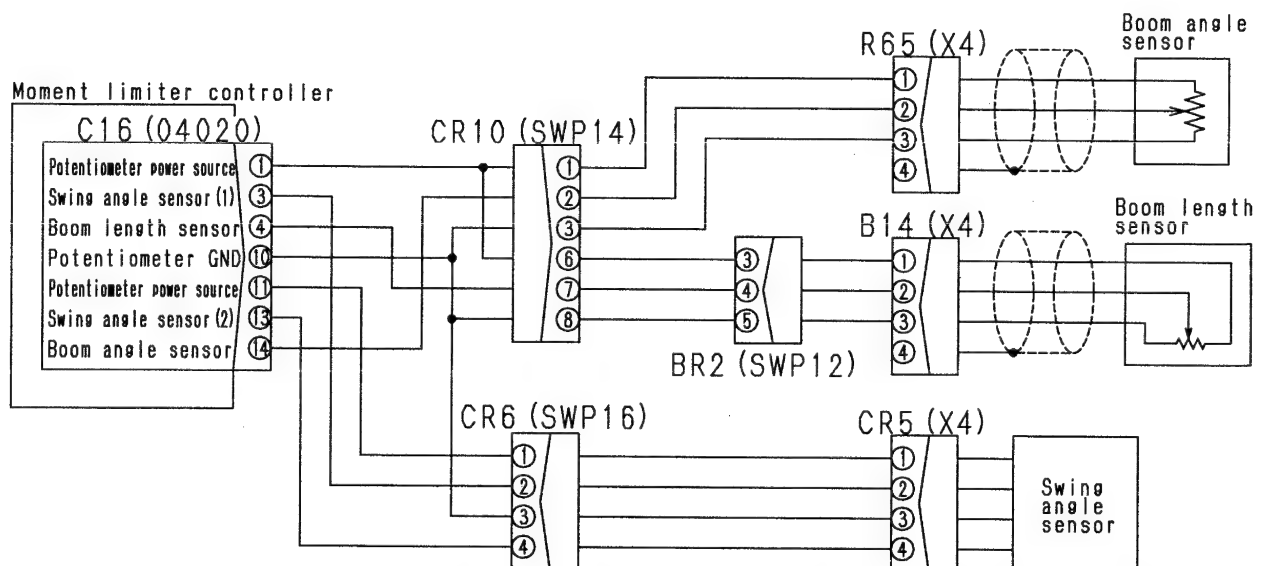
TKL00521

EM-32 OSS error E68 (Sensor 10 V power source short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



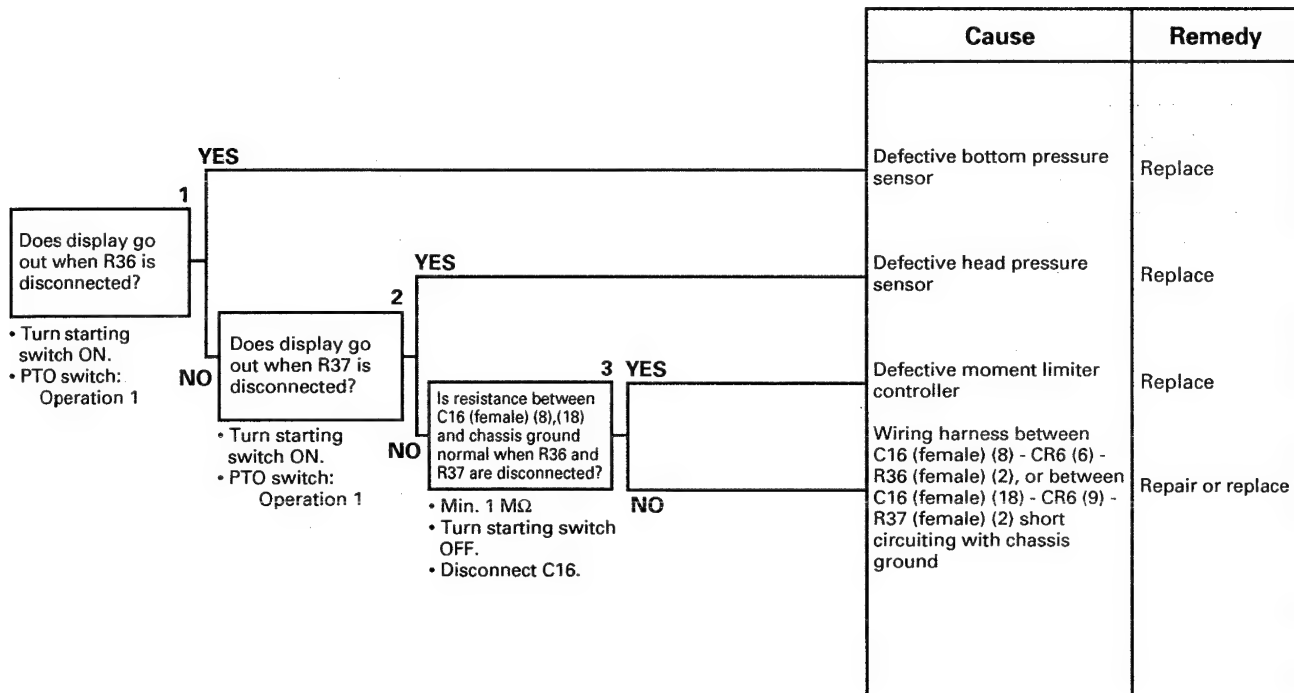
EM-32 Related electric circuit diagram



TKL00522

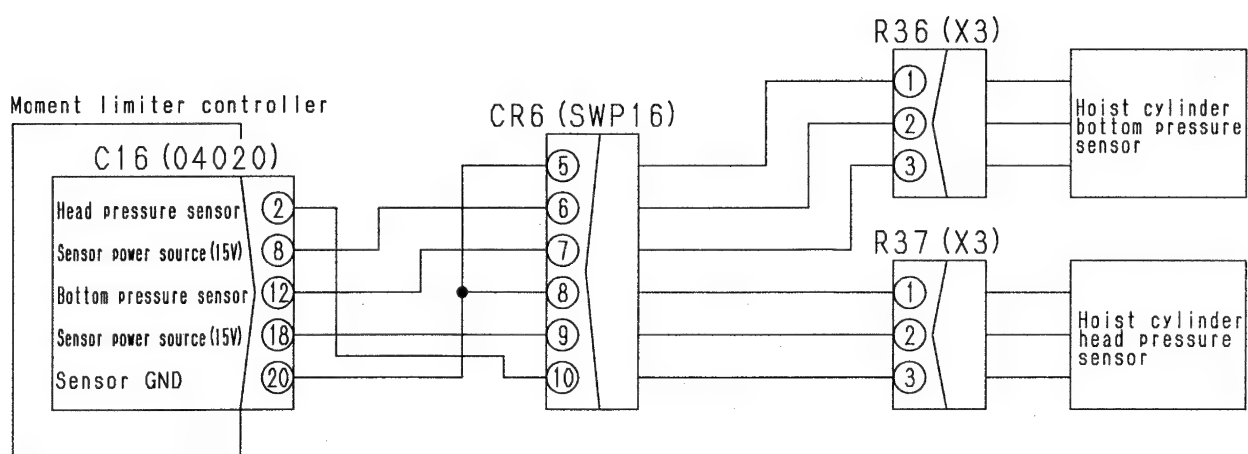
EM-33 OSS error E6A (Sensor 15 V power source short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EM-33 Related electric circuit diagram



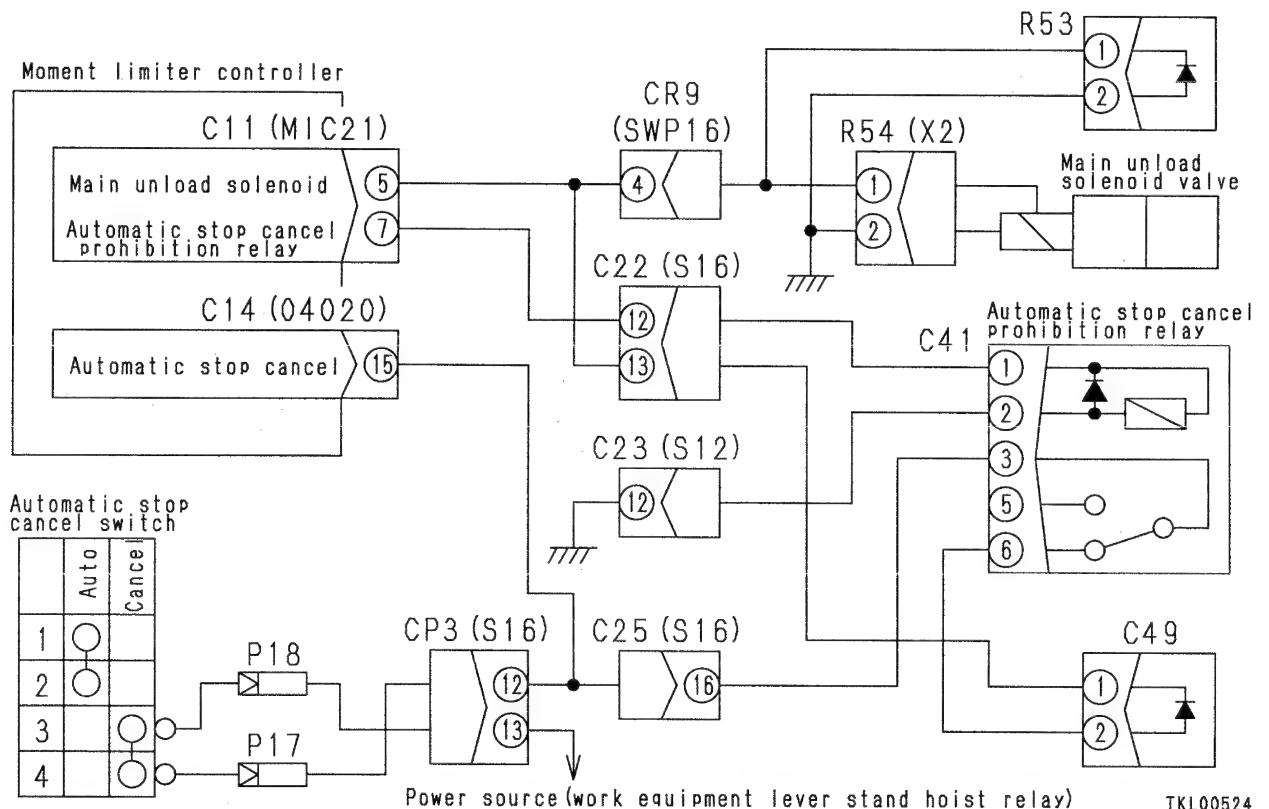
TKL00523

EM-34 OSS error E70 (Main unload solenoid short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Use the check mode to check that the automatic stop cancel signal is normal before starting troubleshooting

	Cause	Remedy
<p>1</p> <p>Is voltage between C11 (female) (5) and chassis ground normal?</p> <p>YES</p> <p>NO</p> <ul style="list-style-type: none"> • Disconnect C11. • Turn starting switch ON. • PTO switch: Operation 1. • Work equipment lever stand: Lowered • Max. 1 V 	Defective moment limiter controller	Replace
<p>2 YES</p> <p>Is voltage between C11 (female) (5) and chassis ground normal when C22 is disconnected?</p> <p>YES</p> <p>NO</p> <ul style="list-style-type: none"> • Disconnect C11. • Turn starting switch ON. • PTO switch: Operation 1 • Work equipment lever stand: Lowered • Max. 1 V 	Wiring harness between C11 (female) (5) and C22 (female) (13) or between CR9 (4) and R54 (female) (1) short circuiting with power source	Repair or replace
	Wiring harness between C22 (female) (13) - C49 (1), (2) - C41 (female) (6) short circuiting with power source	Repair or replace

EM-34 Related electric circuit diagram

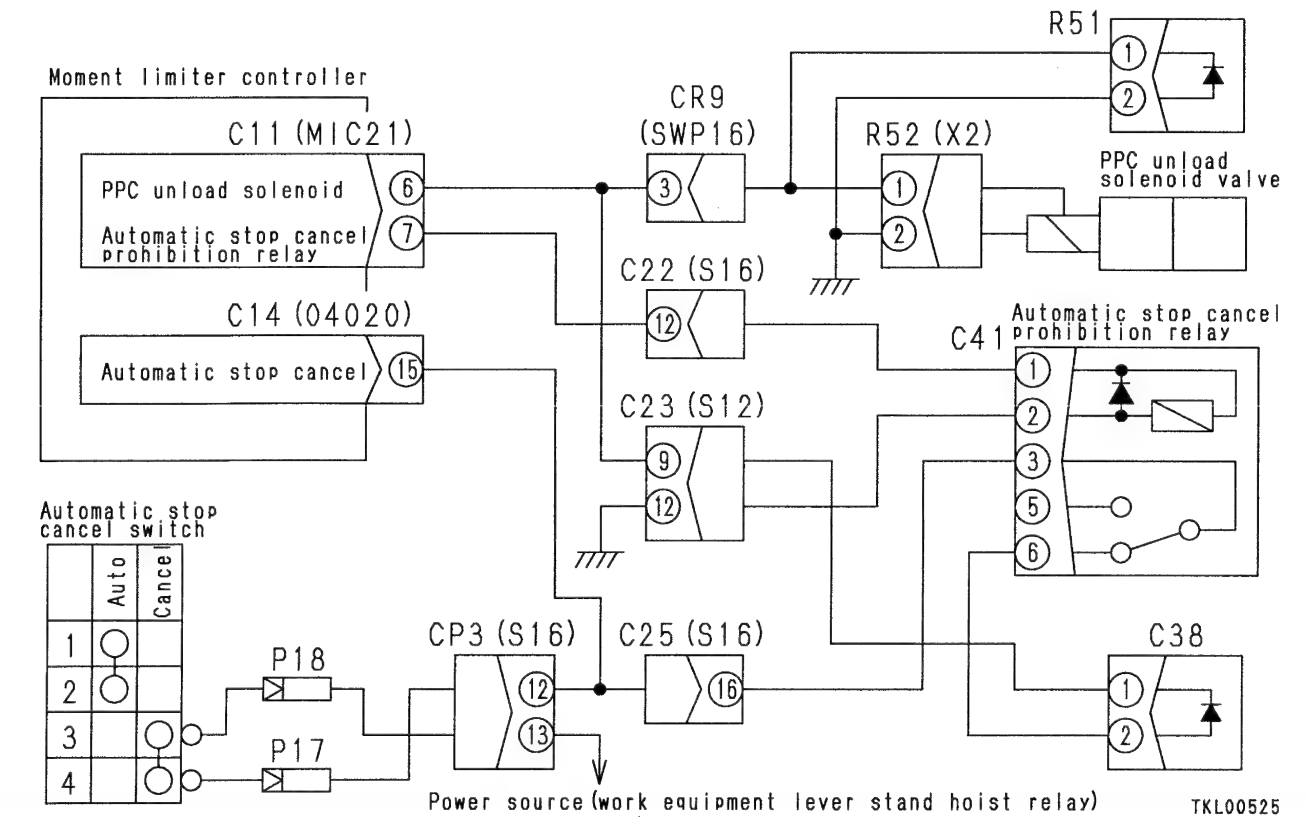


EM-35 OSS error E71 (PPC unload solenoid short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Use the check mode to check that the automatic stop cancel signal is normal before starting troubleshooting.

	Cause	Remedy
<div> <div> <div>1</div> <div> YES </div> </div> <div> <div> Is voltage between C11 (female) (6) and chassis ground normal? </div> <div> YES </div> </div> </div>	Defective moment limiter controller	Replace
<div> <div> <div>2</div> <div>YES</div> </div> <div> <div> Is voltage between C11 (female) (6) and chassis ground normal when C23 is disconnected? </div> <div> YES </div> </div> </div>	Wiring harness between C23 (male) (9) - C38 (1),(2) - C41 (female) (6) short circuiting with power source	Repair or replace
<div> <div> <div>NO</div> <div> NO </div> </div> <div> <div> Disconnect C11. Turn starting switch ON. PTO switch: Operation 1. Working mode: Boom Max. 1V </div> <div> Disconnect C11. Turn starting switch ON. PTO switch: Operation 1 Working mode: Boom Max. 1V </div> </div> </div>	Wiring harness between C11 (female) (6) - CR9 (3), C23 (female) (9) - R52 (female) (1) short circuiting with power source	Repair or replace

EM-35 Related electric circuit diagram



EM-36 OSS error E72 (Boom telescope selector solenoid short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

Is voltage between C11 (female) (11) and chassis normal?

• Max. 1 V

• Disconnect C11 and C48.

• Turn starting switch ON.

• PTO switch: Operation 1

NO

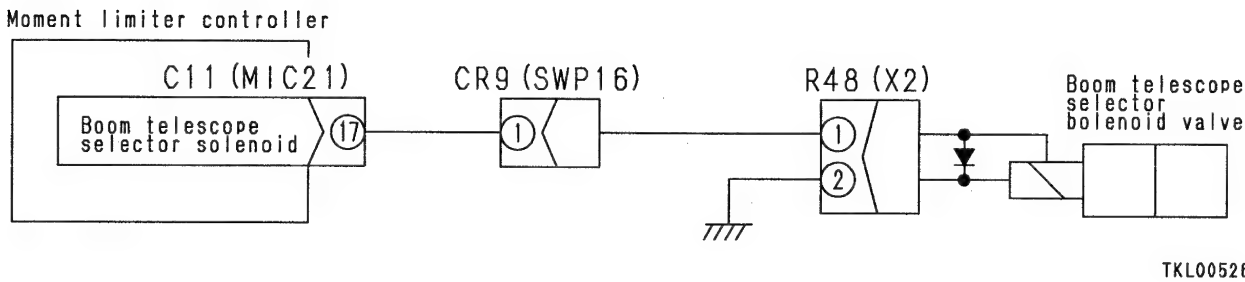
Defective moment limiter controller

Wiring harness between C11 (female) (17) - CR9 (1) - R48 (female) (1) short circuiting with power source

Replace

Repair or replace

EM-36 Related electric circuit diagram

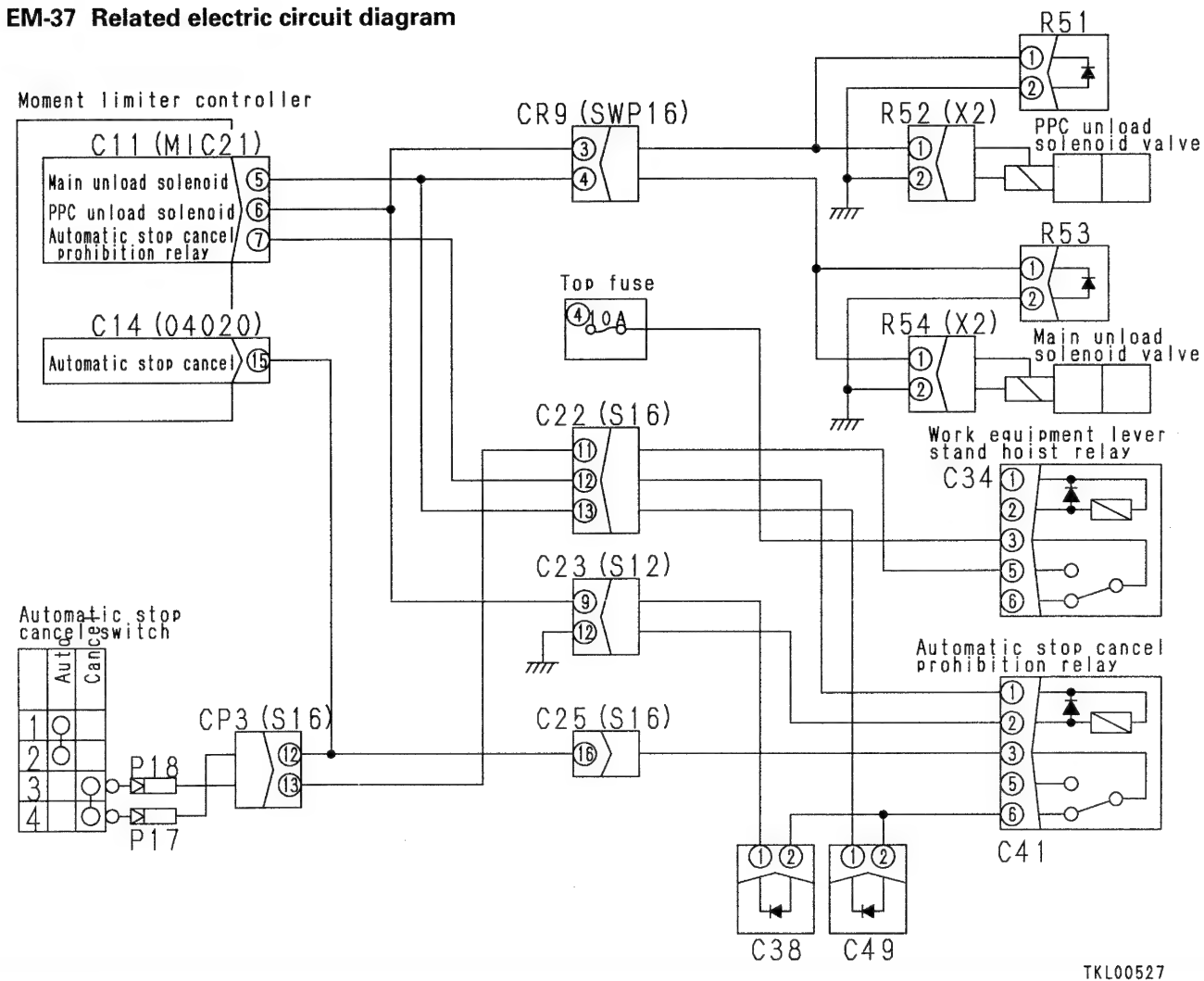


EM-37 OSS error E73 (Automatic stop cancel prohibition relay short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is voltage between C11 (female) (7) and chassis normal?</div> <div> <div>• Max. 1 V</div> <div>• Disconnect C11 and C41.</div> <div>• Turn starting switch ON.</div> <div>• PTO switch: Operation 1</div> </div> </div>	YES	Defective moment limiter controller	Replace
	NO	Wiring harness between C11 (female) (7) - C22 (12) - C41 (female) (1) short circuiting with power source	Repair or replace

EM-37 Related electric circuit diagram

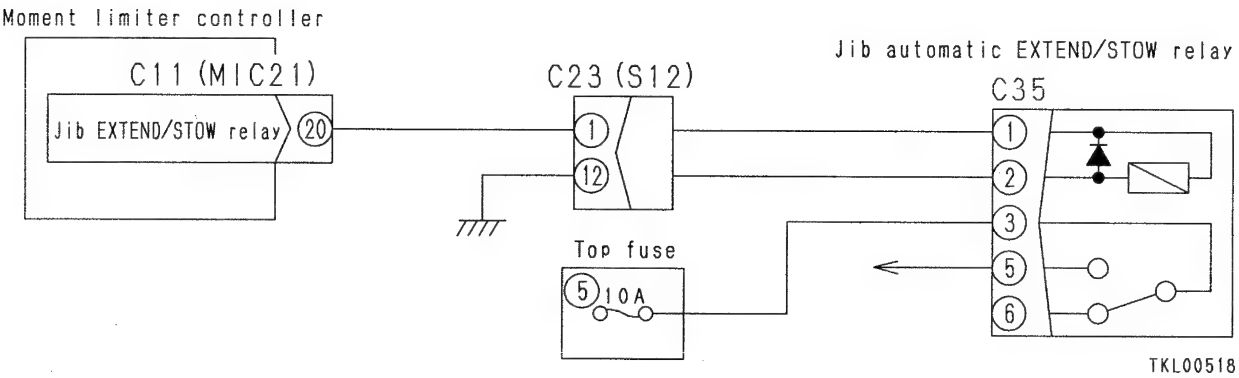


EM-41 OSS error E78 (Jib automatic EXTEND/STOW relay short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is voltage between C11 (female) (20) and chassis normal?</div> <div> <div>• Max. 1 V</div> <div>• Disconnect C11 and C35.</div> <div>• Turn starting switch ON.</div> <div>• PTO switch: Operation 1</div> </div> </div>	YES	Defective moment limiter controller	Repair or replace
	NO	Wiring harness between C11 (female) (20) - C23 (1) - C35 (female) (1) short circuiting with power source	Repair or replace

EM-41 Related electric circuit diagram



023S02

EM-42 OSS error E79 (Jib rotation permission relay short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

Is voltage between C11 (female) (10) and chassis ground normal?

• Max. 1 V

• Disconnect C11 and C37.

• Turn starting switch ON.

• PTO switch: Operation 1

• Working mode: Except preparation mode

NO

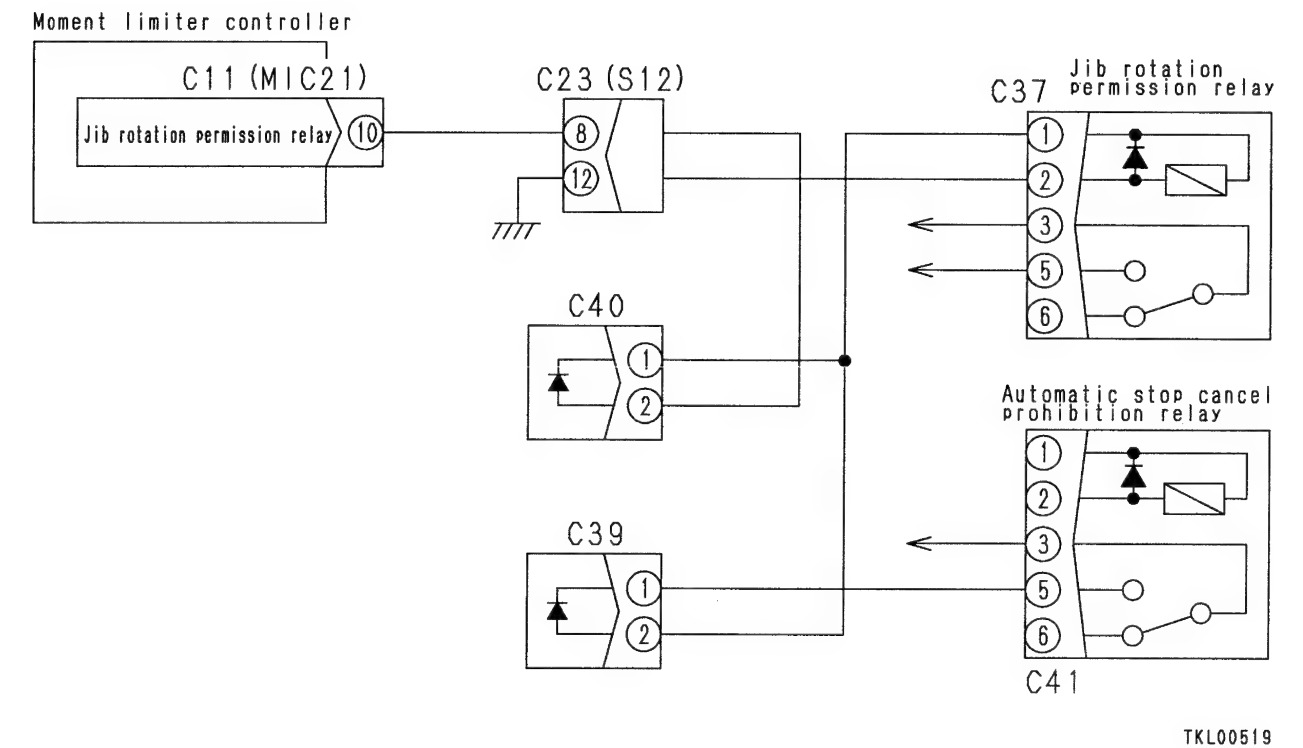
Defective moment limiter controller

Replace

Wiring harness between C11 (female) (10) - C23 (8) - C40 (2), (1) - C37 (female) (1) short circuiting with power source

Repair or replace

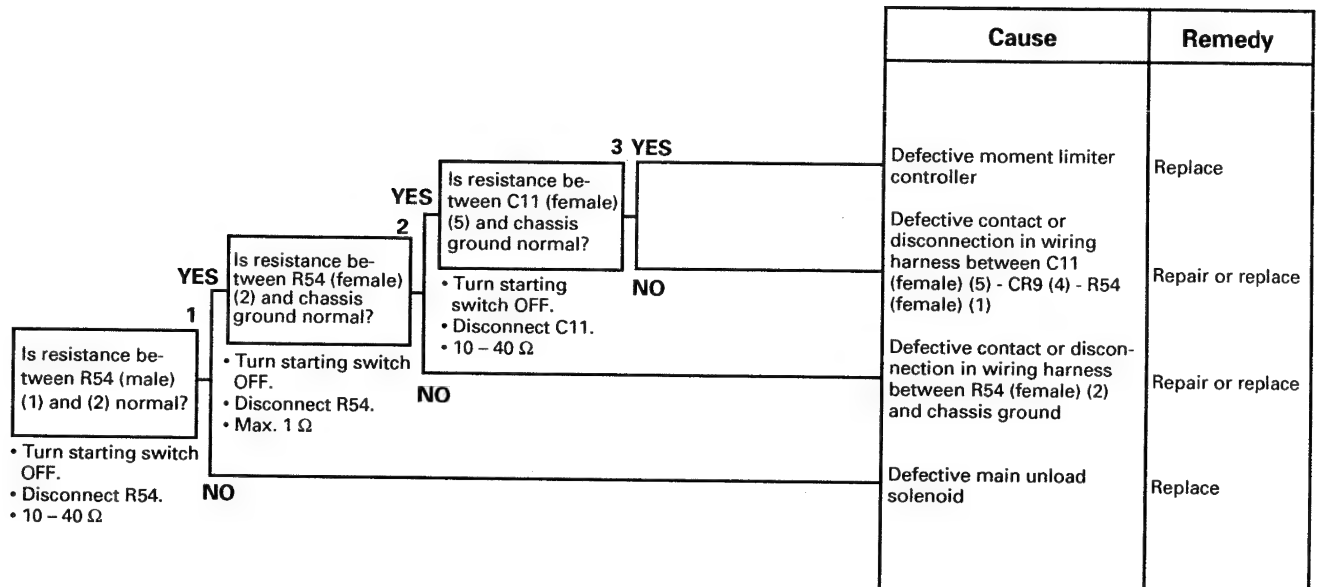
EM-42 Related electric circuit diagram



023S02

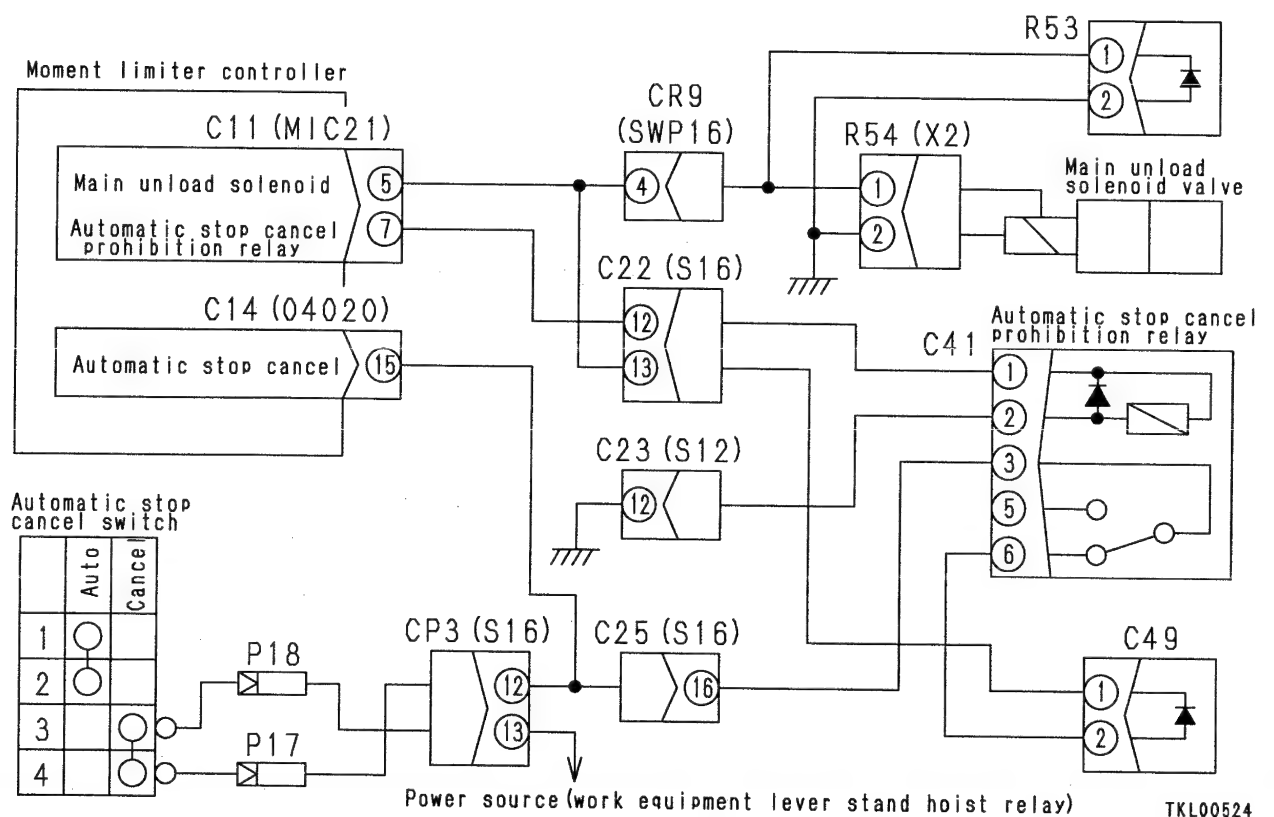
EM-43 OSS error E88 (Disconnection in main unload solenoid) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

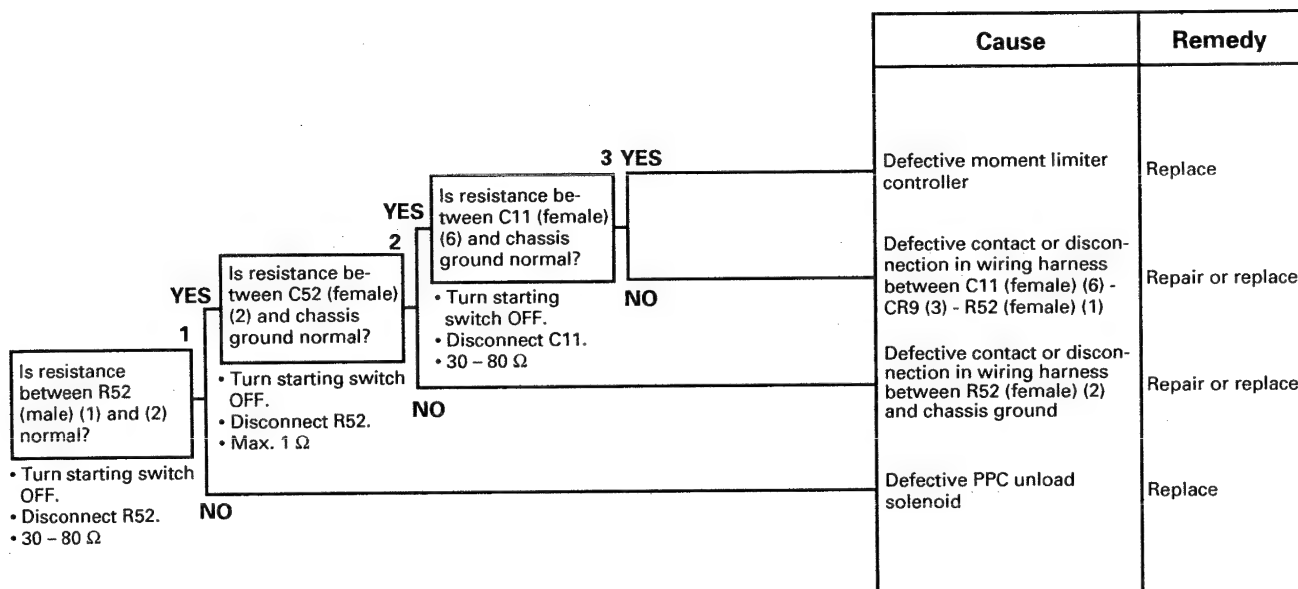
EM-43 Related electric circuit diagram



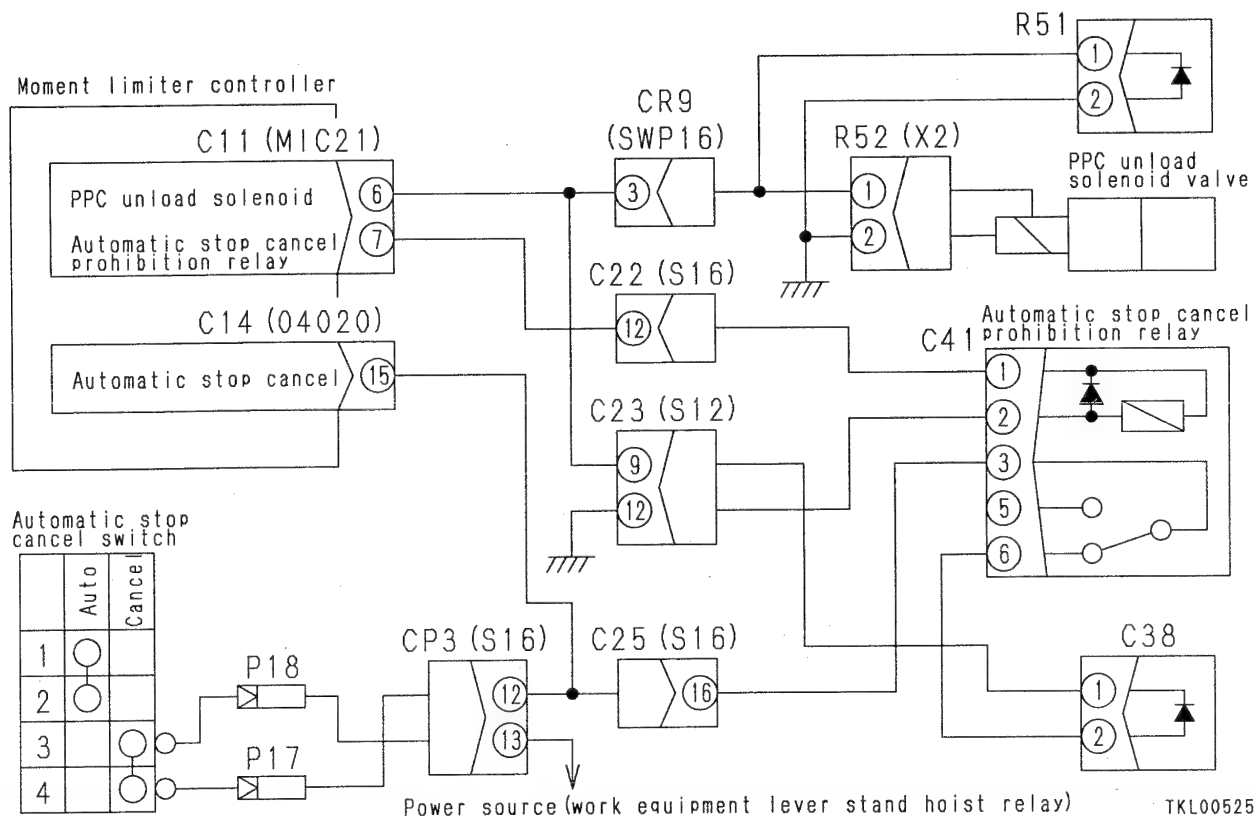
TKL00524

EM-44 OSS error E89 (Disconnection in PPC unload solenoid) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



EM-44 Related electric circuit diagram



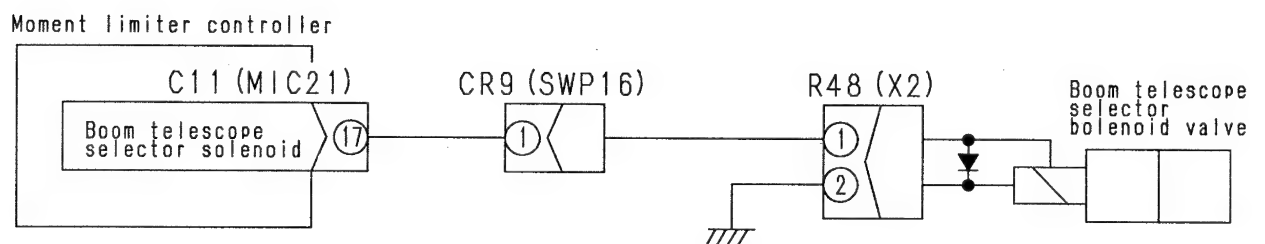
EM-45 OSS error E8A (Disconnection in boom telescope selector solenoid) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1</p> <p>Is resistance between C14 (female) (11) and chassis ground normal?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C14. • Upper structure: Any position except facing directly to front • Min. 1 MΩ 	YES	Defective moment limiter controller	Replace
	NO	Defective swing over-front limit switch	Replace
	<p>2 YES</p> <p>Is resistance between C14 (female) (11) and chassis ground normal when R40 is disconnected?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C14. • Min. 1 MΩ <p>NO</p>	Wiring harness between C14 (female) (11) - CR6 (12) - R40 (female) (1) short circuiting with chassis ground	

023S02

EM-45 Related electric circuit diagram



TKL00526

EM-46 OSS error E8B (Disconnection in automatic stop cancel prohibition relay) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Does display go out when C41 is interchanged with other relay?

• Turn starting switch ON.

YES

Defective automatic stop cancel prohibition relay

Replace

NO

2

Is resistance between C41 (female) (2) and chassis ground normal?

• Turn starting switch OFF.
 • Disconnect C41.
 • Max. 1 Ω

YES

Defective moment limiter controller

Replace

NO

3

Is resistance between C11 (female) (7) and chassis ground normal?

• Turn starting switch OFF.
 • Disconnect C11.
 • 200 – 400 Ω

YES

Defective contact or disconnection in wiring harness between C11 (female) (7) - C22 (12) - C41 (female) (1)

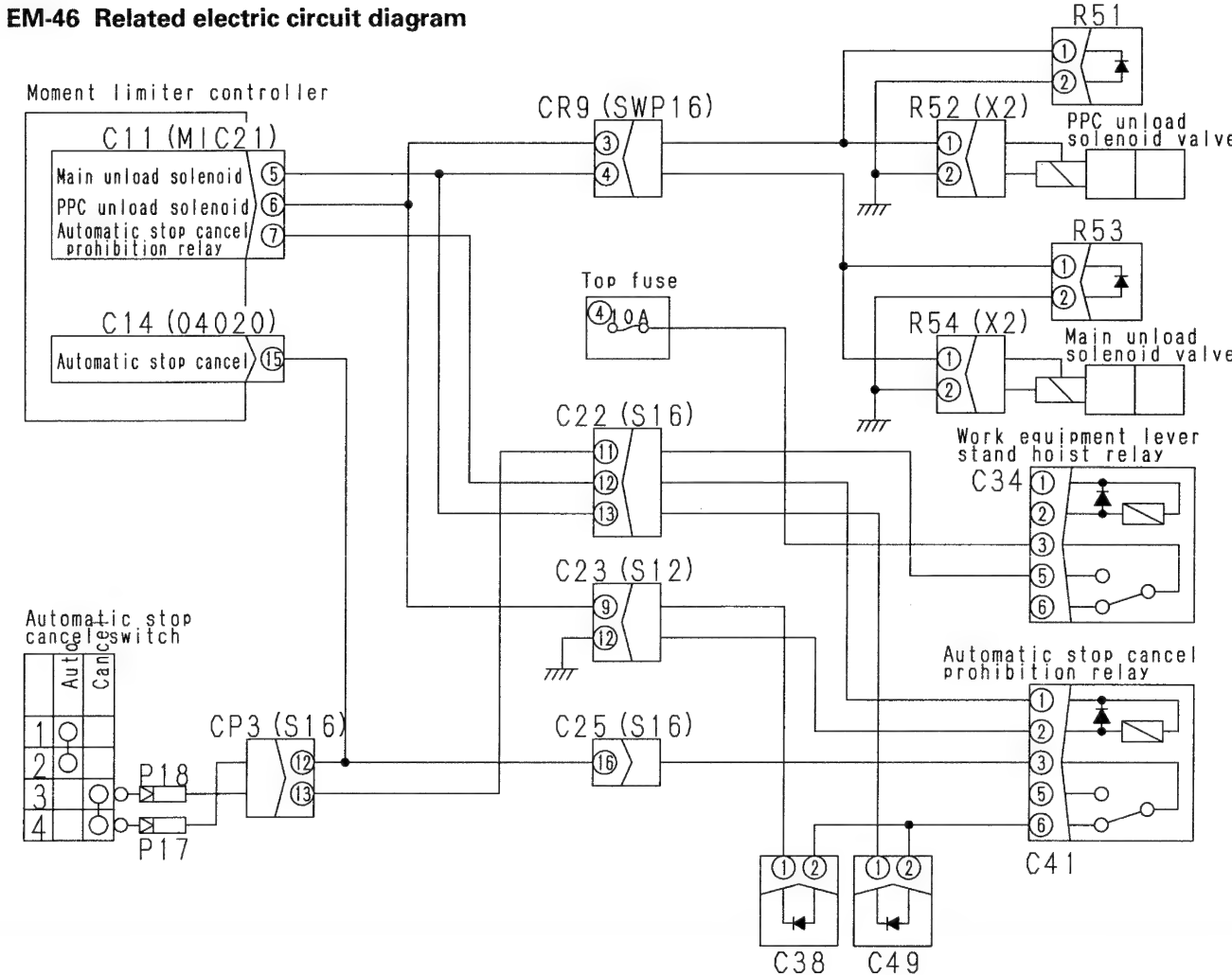
Repair or replace

NO

Defective contact or disconnection in wiring harness between C41 (female) (2) - C23 (12) - chassis ground

Repair or replace

EM-46 Related electric circuit diagram



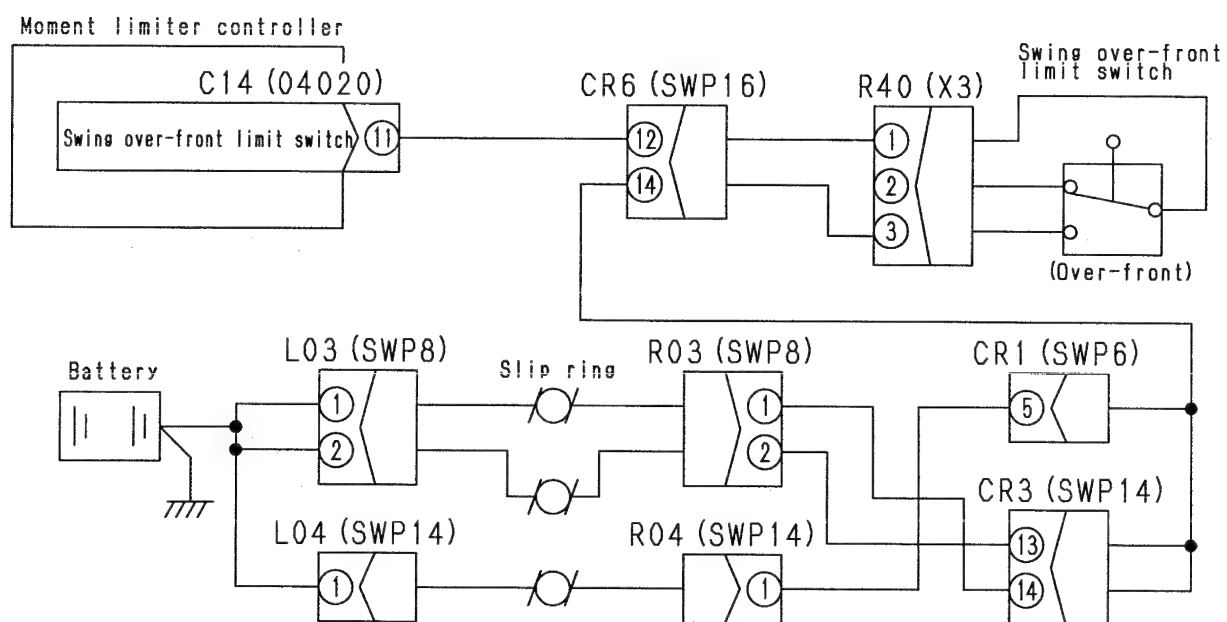
EM-47 OSS error EA0 (Abnormality in swing over-front limit switch) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div>1</div> <div>Is resistance between C14 (female) (11) and chassis ground normal?</div> <div><div>YES</div><div>2 YES</div><div>NO</div></div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect C14.</div><div>• Upper structure: Any position except facing directly to front</div><div>• Min. 1 MΩ</div></div>		Defective moment limiter controller	Replace
	<div>Is resistance between C14 (female) (11) and chassis ground normal when R40 is disconnected?</div> <div><div>YES</div><div>NO</div></div>	Defective swing over-front limit switch	Replace
	<div><div>• Turn starting switch OFF.</div><div>• Disconnect C14.</div><div>• Min. 1 MΩ</div></div>	Wiring harness between C14 (female) (11) - CR6 (12) - R40 (female) (1) short circuiting with chassis ground	

023S02

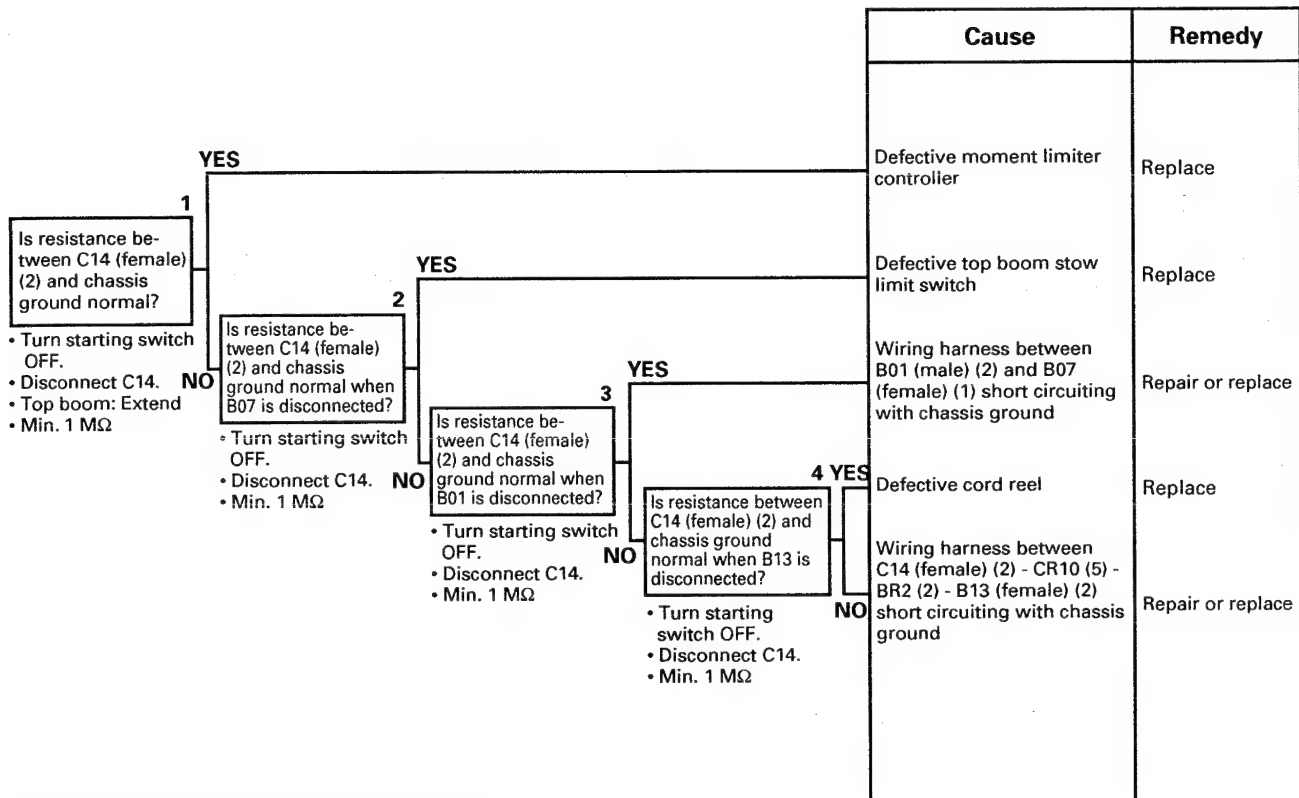
EM-47 Related electric circuit diagram



TKL00528

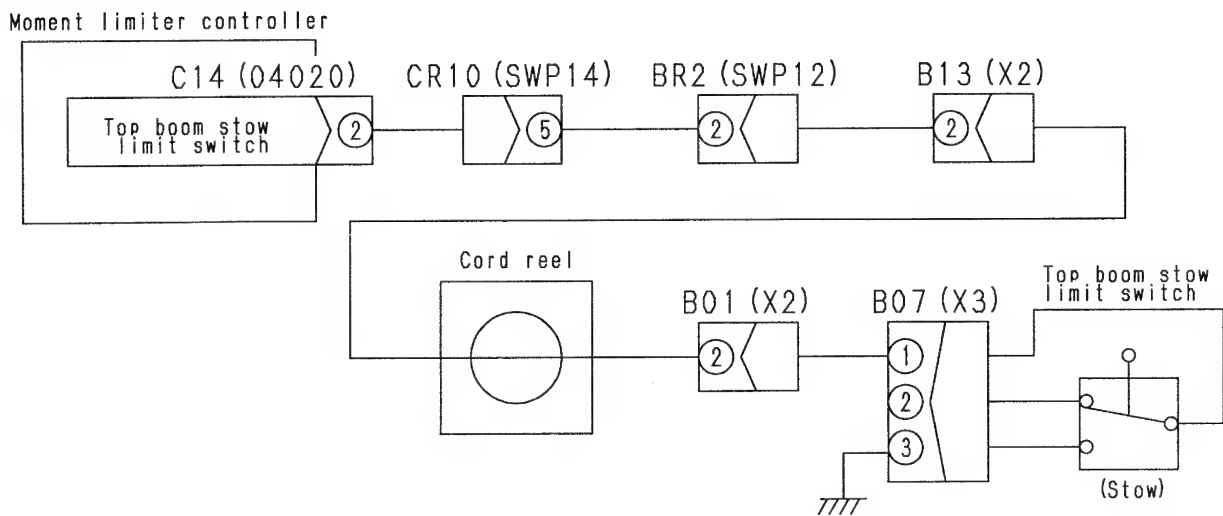
EM-48 OSS error EA1 (Abnormality in top boom stow limit switch) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EM-49 Related electric circuit diagram



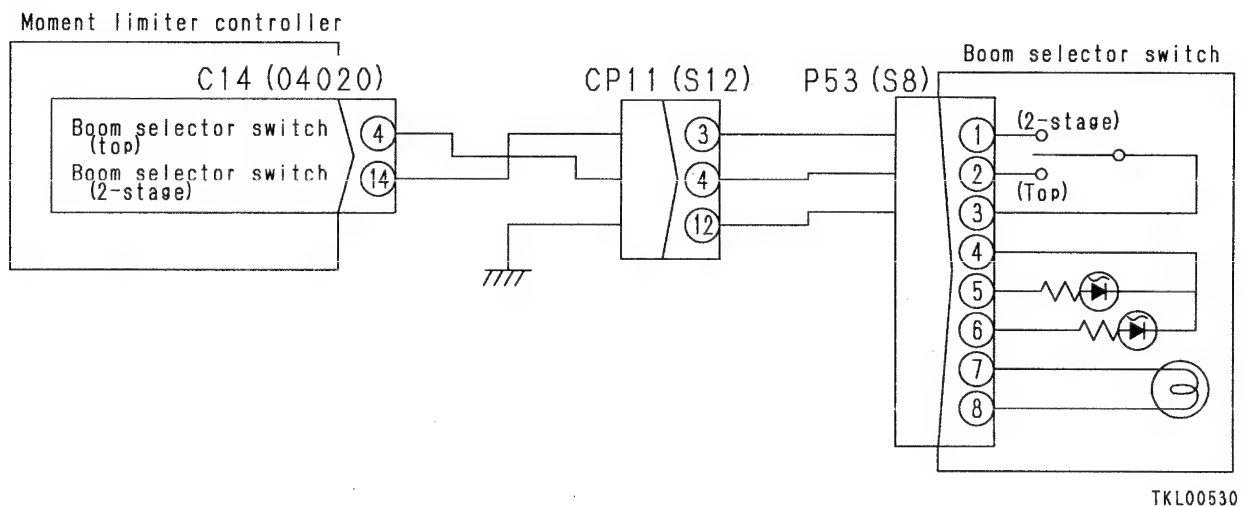
TKL00529

EM-49 OSS error EA2 (Abnormality in boom selector switch) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

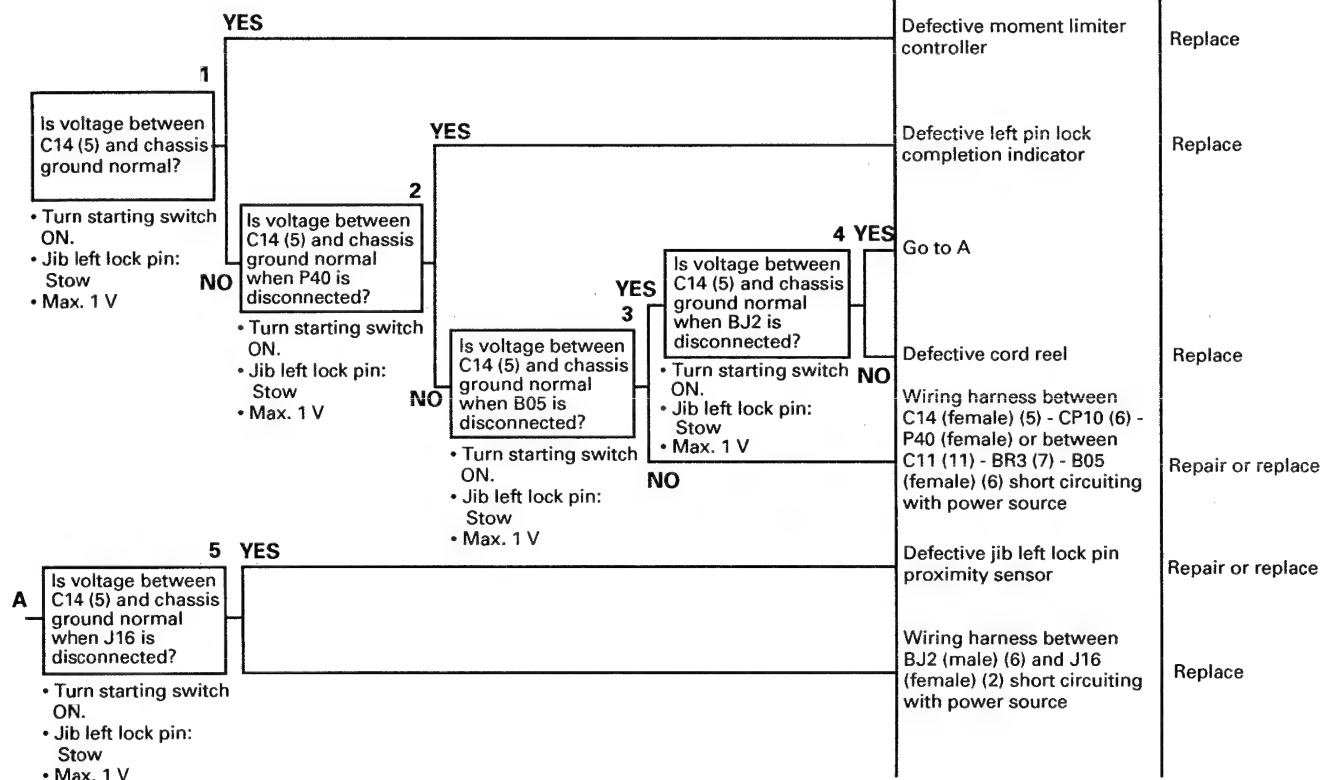
		Cause	Remedy
<p>1 Is resistance between C14 (female) (4) and chassis ground normal?</p> <p>• Turn starting switch OFF. • Disconnect C14. • Boom selector switch: Boom • Min. 1 MΩ</p> <p>YES</p> <p>2 Is resistance between C14 (female) (14) and chassis ground normal?</p> <p>• Turn starting switch OFF. • Disconnect C14. • Boom selector switch: Boom • Min. 1 MΩ</p> <p>NO</p> <p>4 YES</p> <p>Is resistance between C14 (female) (14) and chassis ground normal when P53 is disconnected?</p> <p>• Turn starting switch OFF. • Disconnect C14. • Min. 1 MΩ</p> <p>NO</p>	YES	Defective moment limiter controller	Replace
	3 YES	Defective boom selector switch	Replace
	3 NO	Wiring harness between C14 (female) (14) - CP11 (3) - P53 (male) (1) short circuiting with chassis ground	Repair or replace
	4 NO	Defective boom selector switch	Replace
		Wiring harness between C14 (male) (4) - CP11 (4) - P53 (male) (2) short circuiting with chassis ground	Repair or replace

EM-49 Related electric circuit diagram



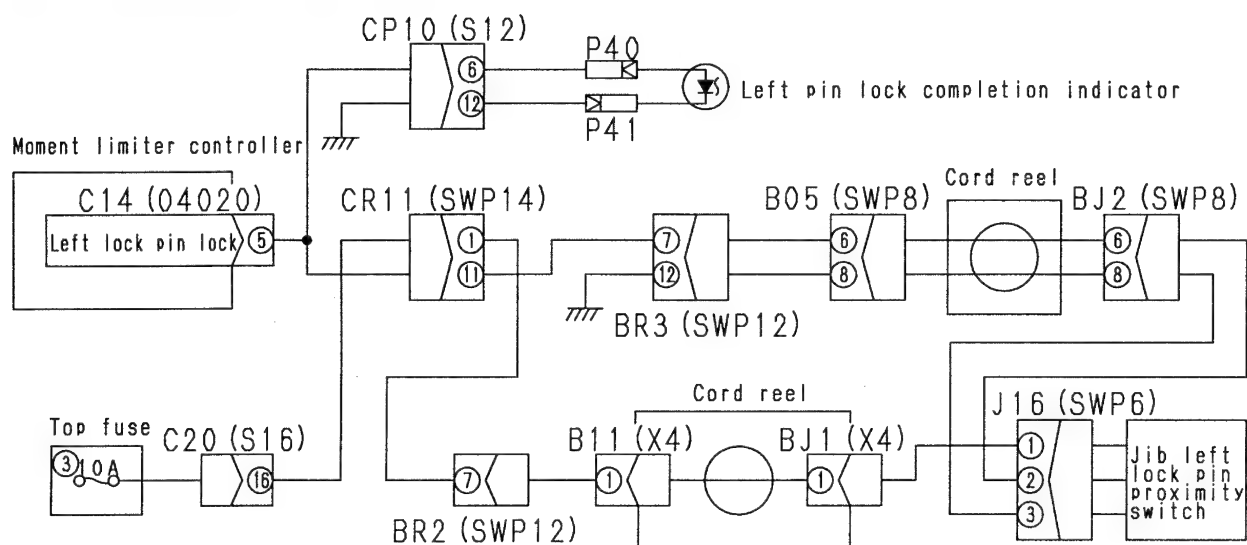
EM-50 OSS error EA3 (Jib left lock pin proximity sensor short circuited with power source) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

EM-50 Related electric circuit diagram



TKL00531

EM-52 OSS error EA5 (Abnormality in PTO mode switch [travel mode switch input]) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

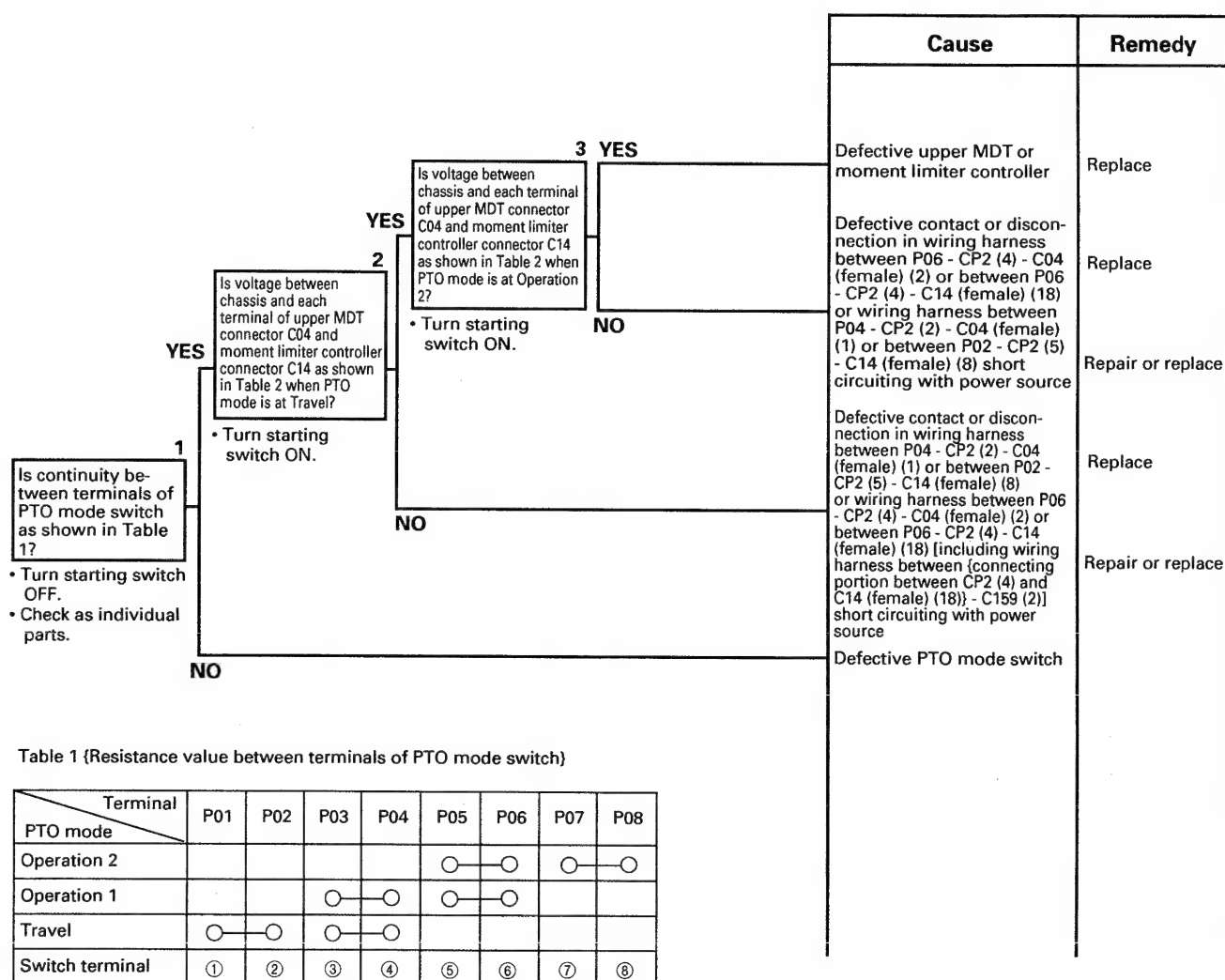


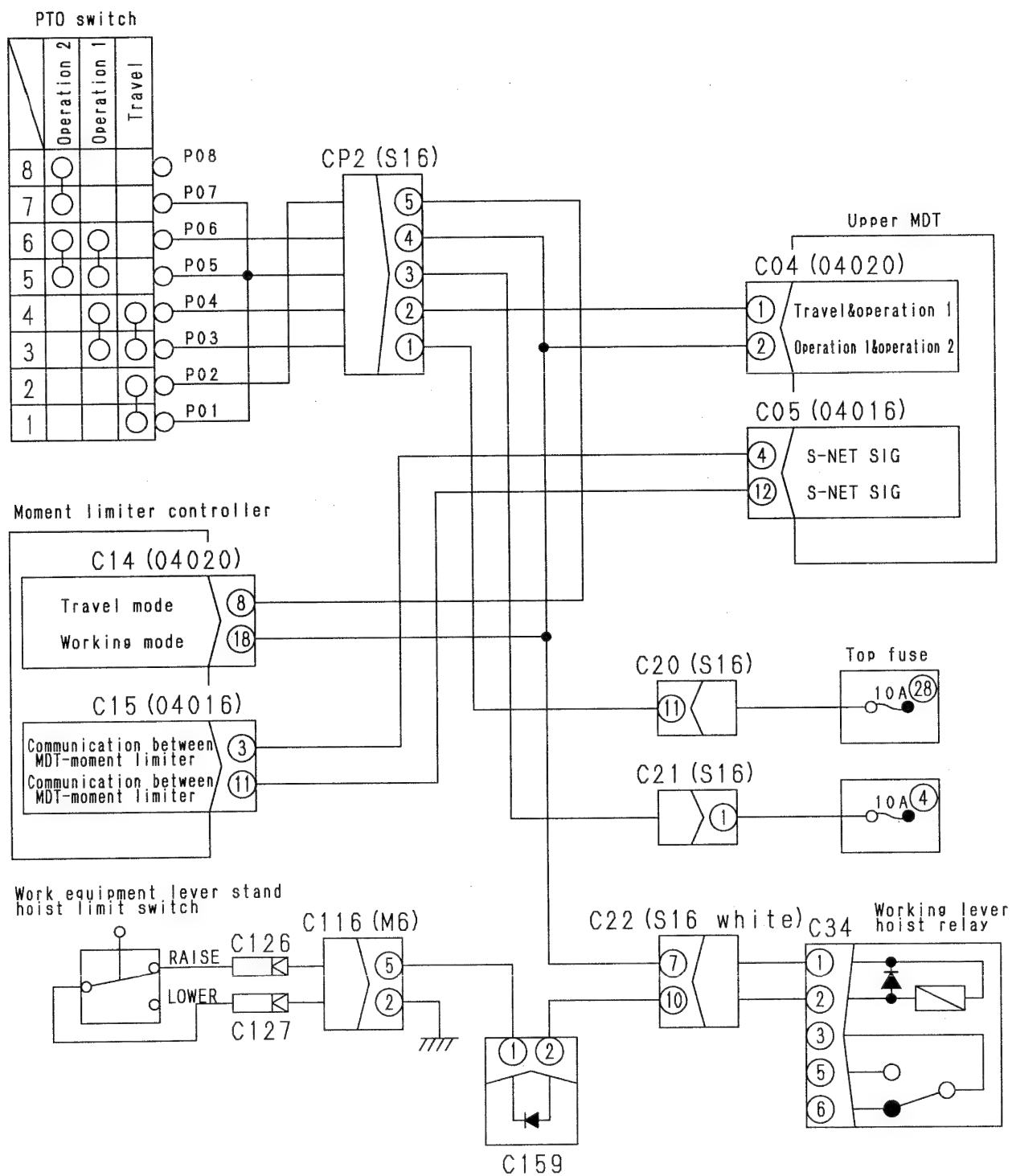
Table 1 (Resistance value between terminals of PTO mode switch)

Terminal PTO mode	P01	P02	P03	P04	P05	P06	P07	P08
Operation 2					○—○		○—○	
Operation 1			○—○		○—○			
Travel	○—○		○—○					
Switch terminal	①	②	③	④	⑤	⑥	⑦	⑧

Table 2 (Voltage between PTO mode switch and each terminal of upper MDT connector C04 and moment limiter controller connector C14)

Upper MDT connector C04	Moment limiter controller connector	Travel	Operation 1	Operation 2
Between (1) - chassis	—	20 – 30 V	20 – 30 V	Max. 1
Between (2) - chassis	—	Max. 1	20 – 30 V	20 – 30 V
—	Between (8) - chassis	20 – 30 V	Max. 1	Max. 1
—	Between (18) - chassis	Max. 1	20 – 30 V	20 – 30 V

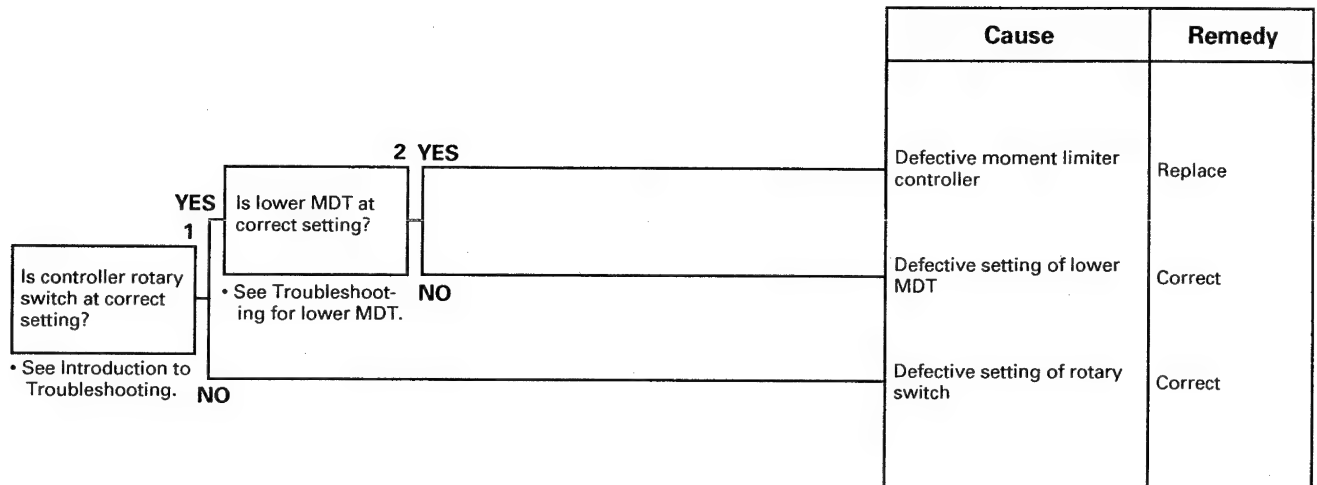
EM-52 Related electric circuit diagram



023S02

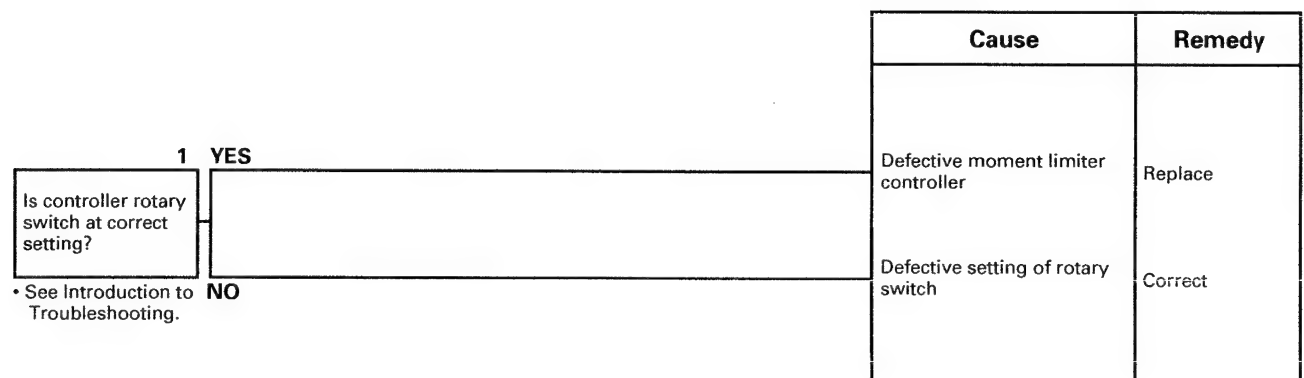
TKL00532

EM-53 OSS error EA6 (H/X selection doesn't match) is displayed



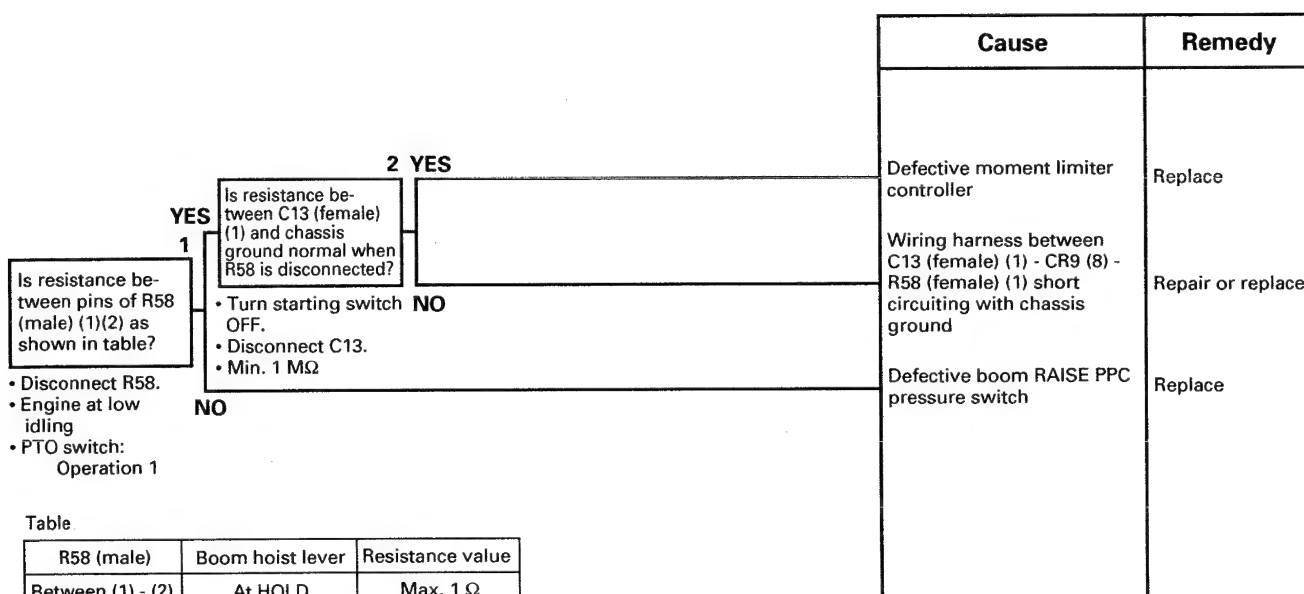
023S02

EM-54 OSS error EA7 (Specification selection rotary switch setting not available) is displayed



EM-55 OSS error EA8 (Boom RAISE PPC pressure switch short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



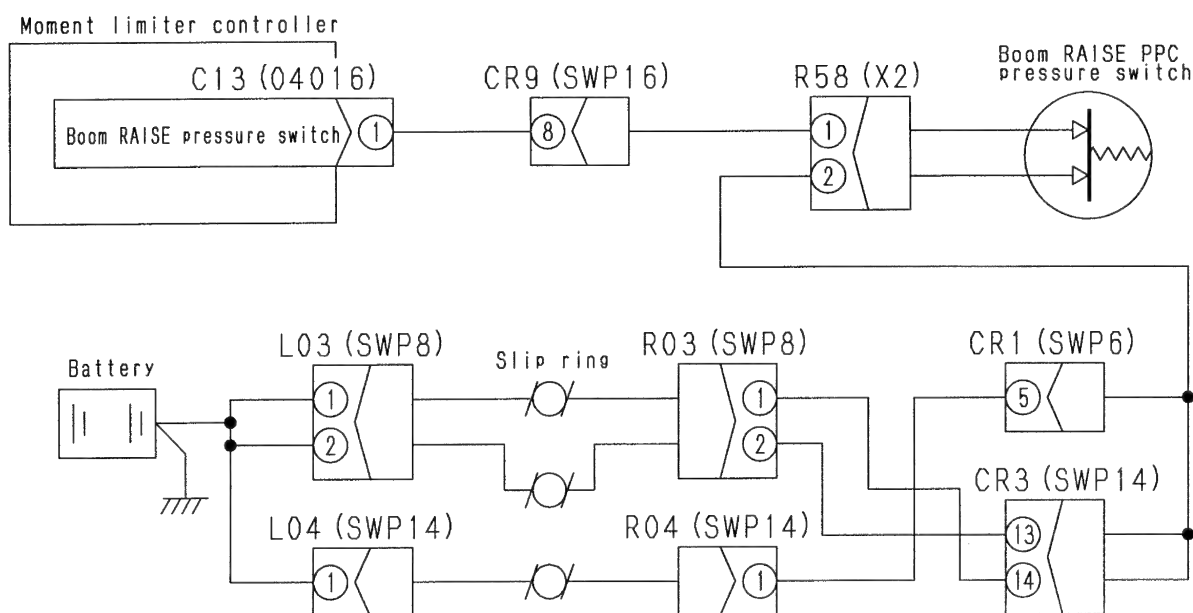
Table

R58 (male)	Boom hoist lever	Resistance value
Between (1) - (2)	At HOLD	Max. 1 Ω
Between (1) - (2)	Operated to RAISE	Min. 1 MΩ

★ Operate the boom hoist lever in small movements.

023S02

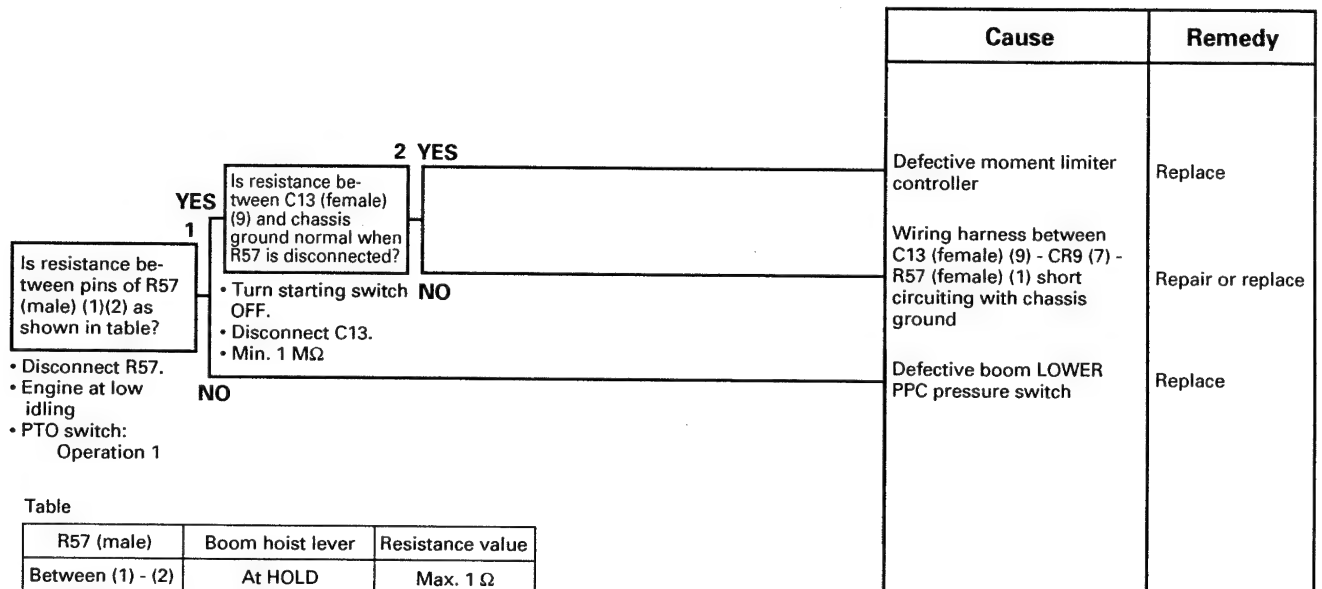
EM-55 Related electric circuit diagram



TKL00533

EM-56 OSS error EA9 (Boom LOWER PPC pressure switch short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

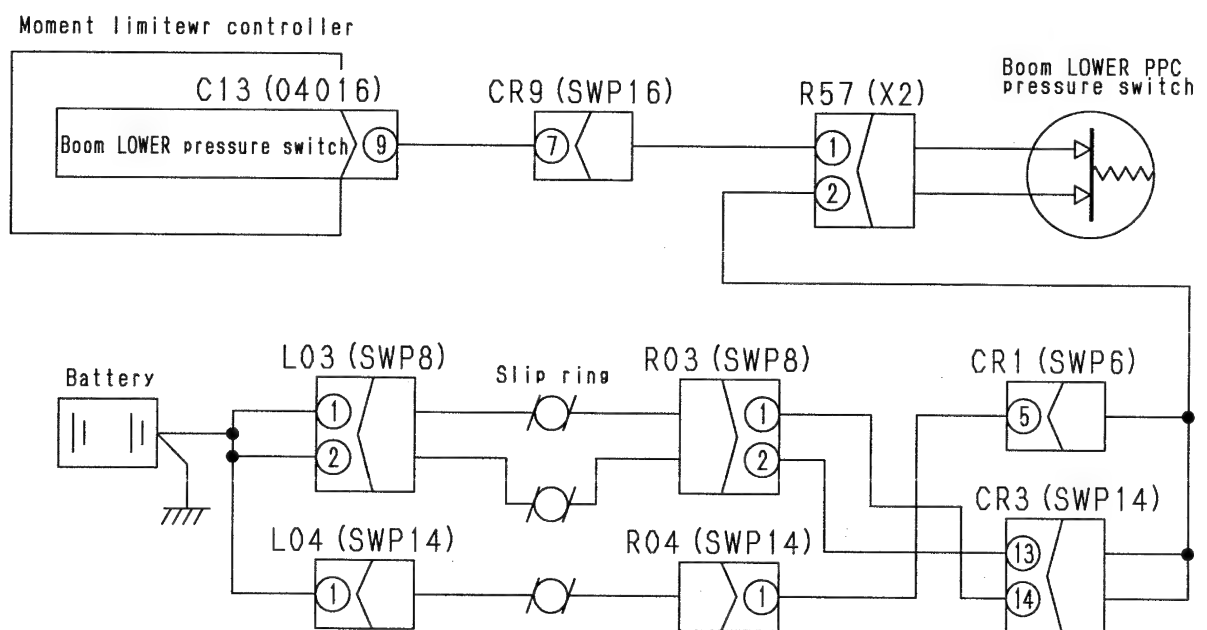


Table

R57 (male)	Boom hoist lever	Resistance value
Between (1) - (2)	At HOLD	Max. 1 Ω
Between (1) - (2)	Operated to LOWER	Min. 1 M Ω

★ Operate the boom hoist lever in small movements.

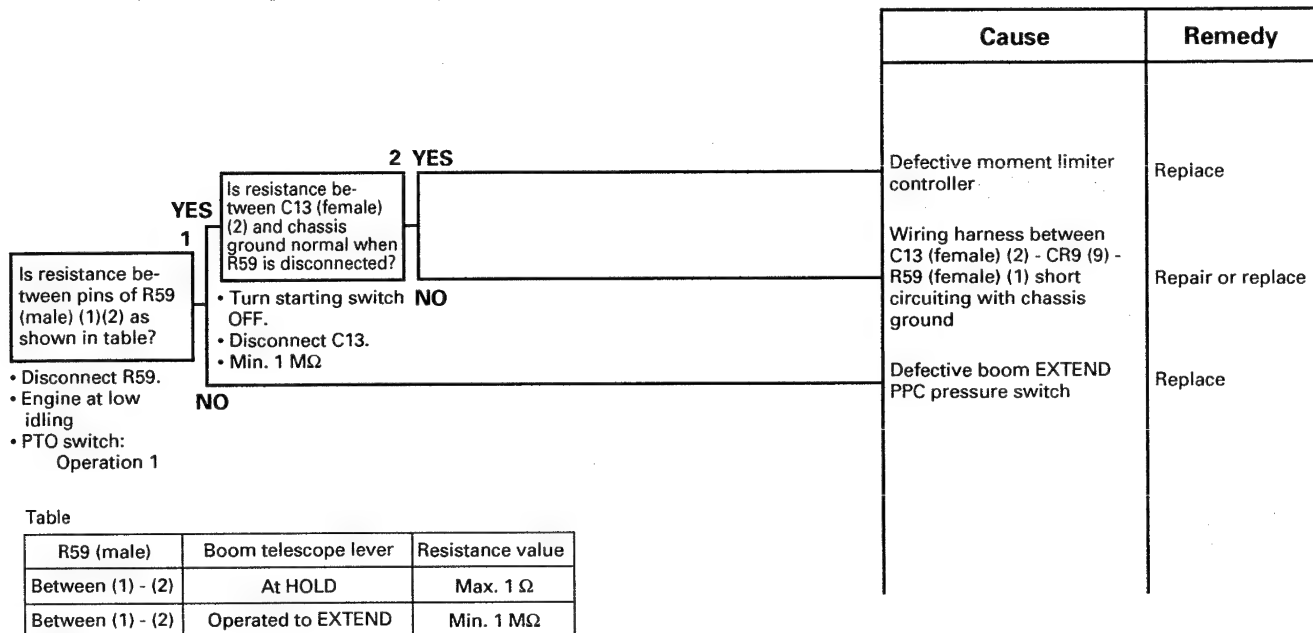
EM-56 Related electric circuit diagram



TKL00534

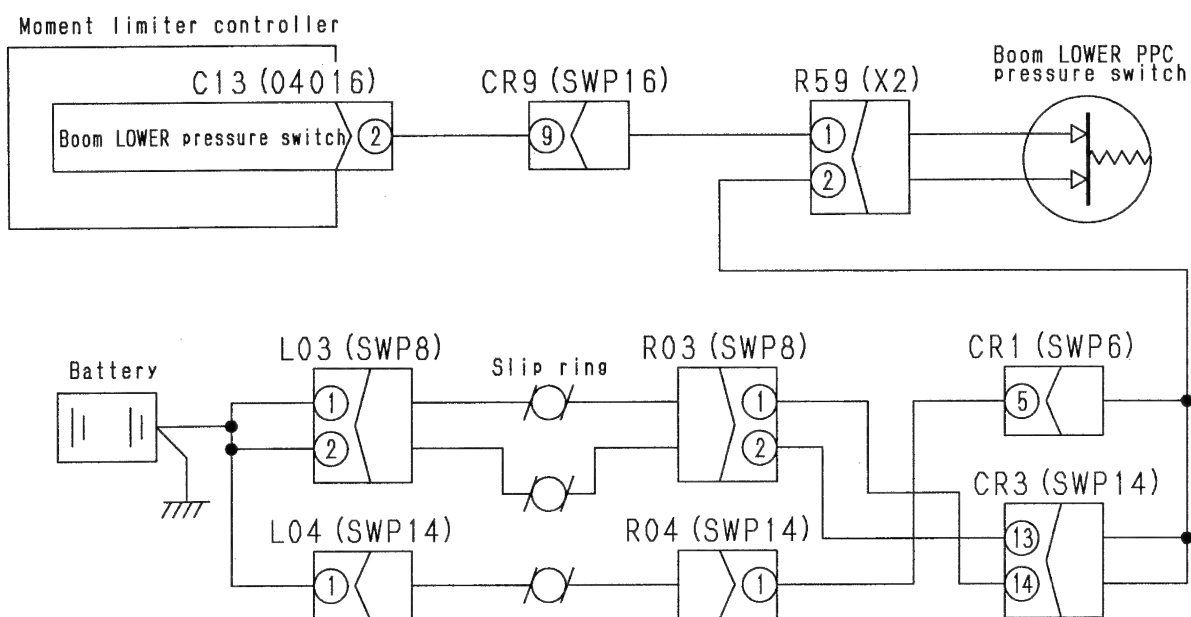
EM-57 OSS error EAA (Boom EXTEND PPC pressure switch short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



★ Operate the boom telescope lever in small movements.

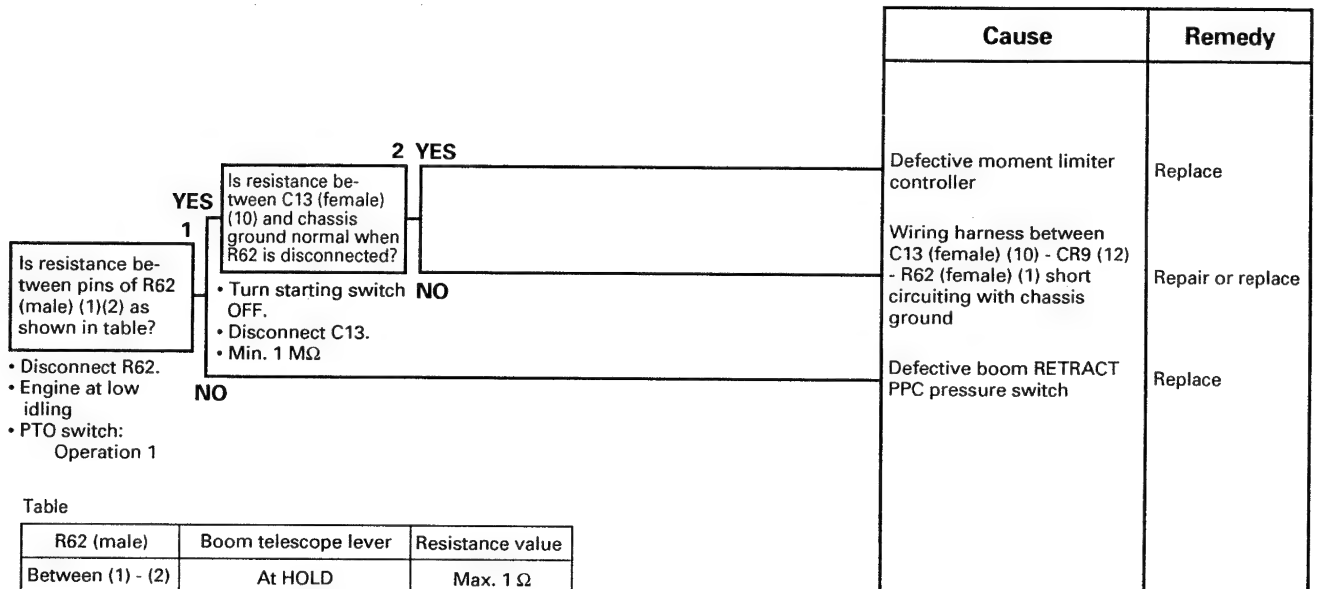
EM-57 Related electric circuit diagram



TKL00535

EM-58 OSS error EAB (Boom RETRACT PPC pressure switch short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

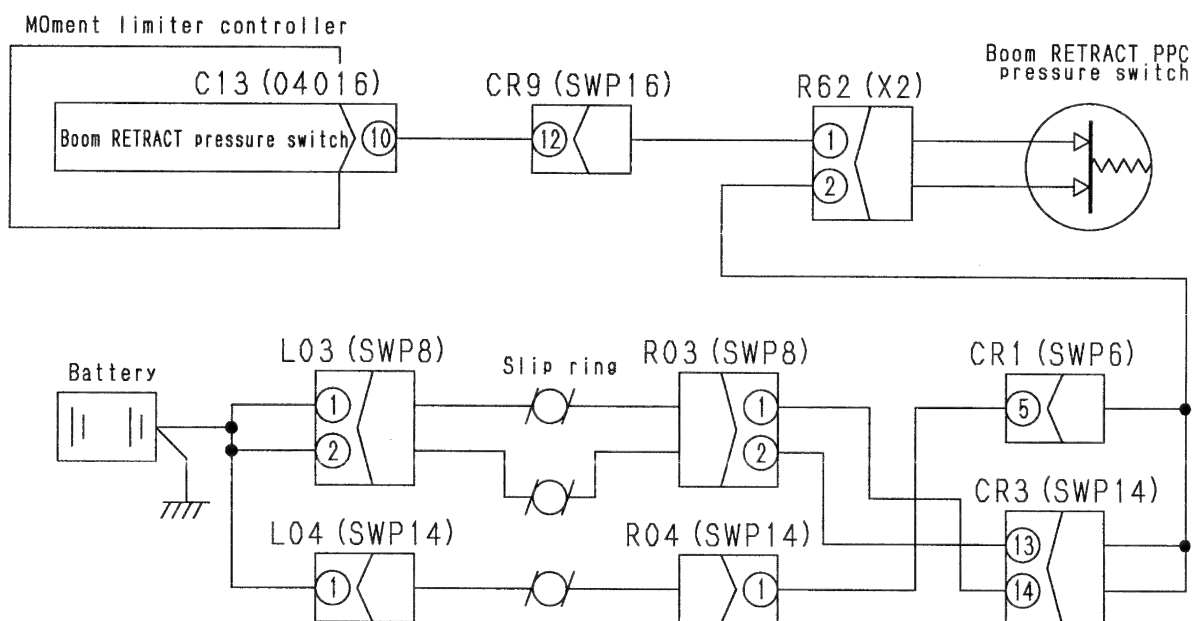


Table

R62 (male)	Boom telescope lever	Resistance value
Between (1) - (2)	At HOLD	Max. 1 Ω
Between (1) - (2)	Operated to RETRACT	Min. 1 MΩ

★ Operate the boom telescope lever in small movements.

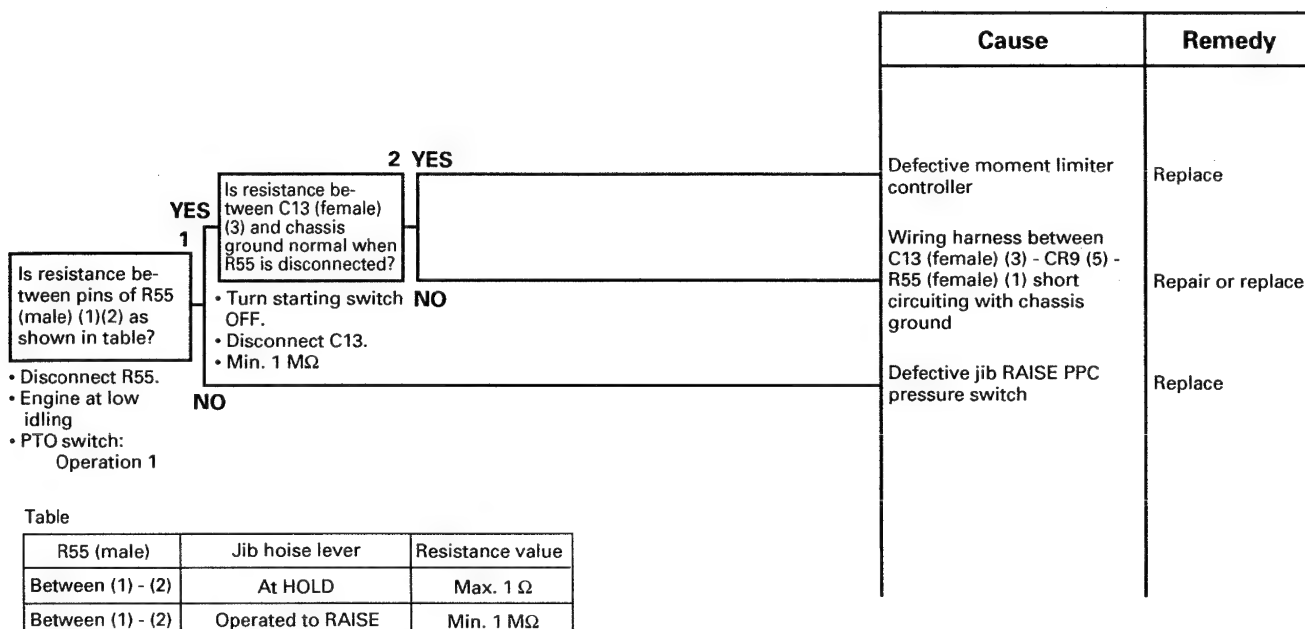
EM-58 Related electric circuit diagram



TKL00536

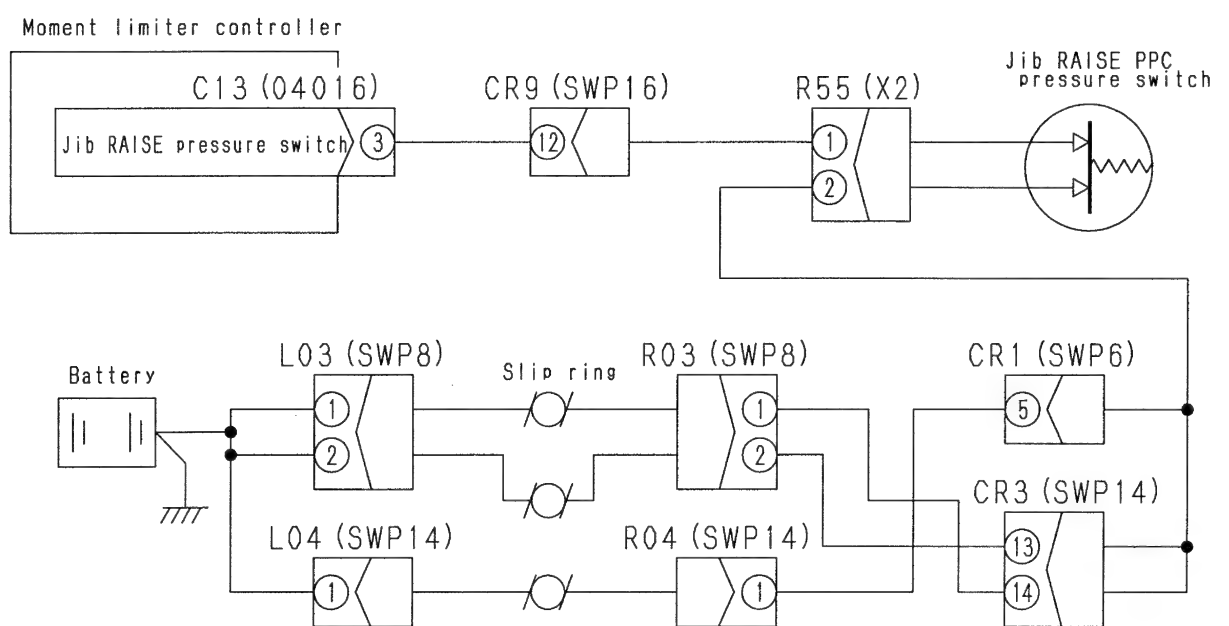
EM-59 OSS error EAC (Jib RAISE PPC pressure switch short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



★ Operate the jib hoise lever in small movements.

EM-59 Related electric circuit diagram

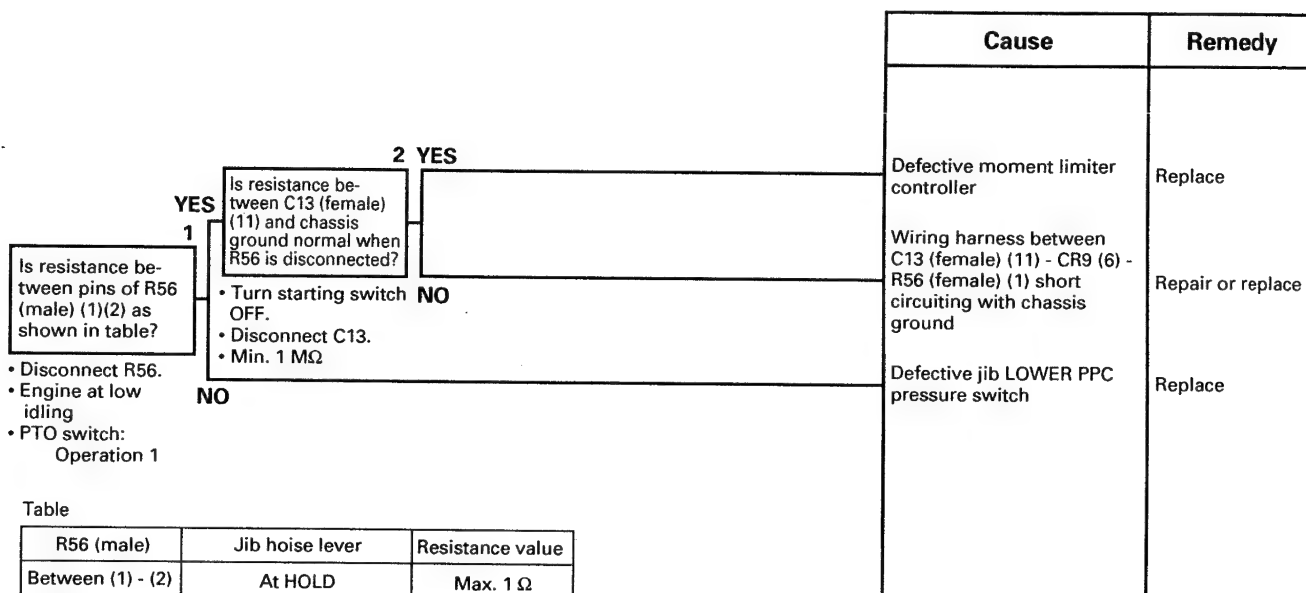


TKL00537

023S02

EM-60 OSS error EAD (Jib LOWER PPC pressure switch short circuited with ground) is displayed

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

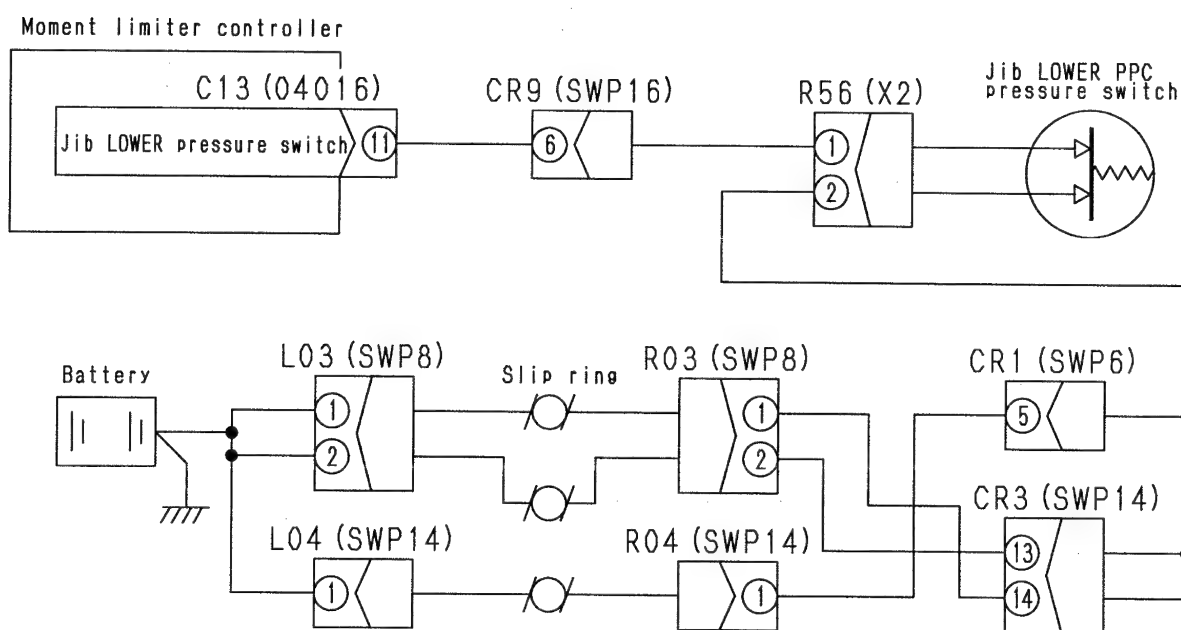


Table

R56 (male)	Jib hoise lever	Resistance value
Between (1) - (2)	At HOLD	Max. 1 Ω
Between (1) - (2)	Operated to LOWER	Min. 1 MΩ

★ Operate the jib hoise lever in small movements.

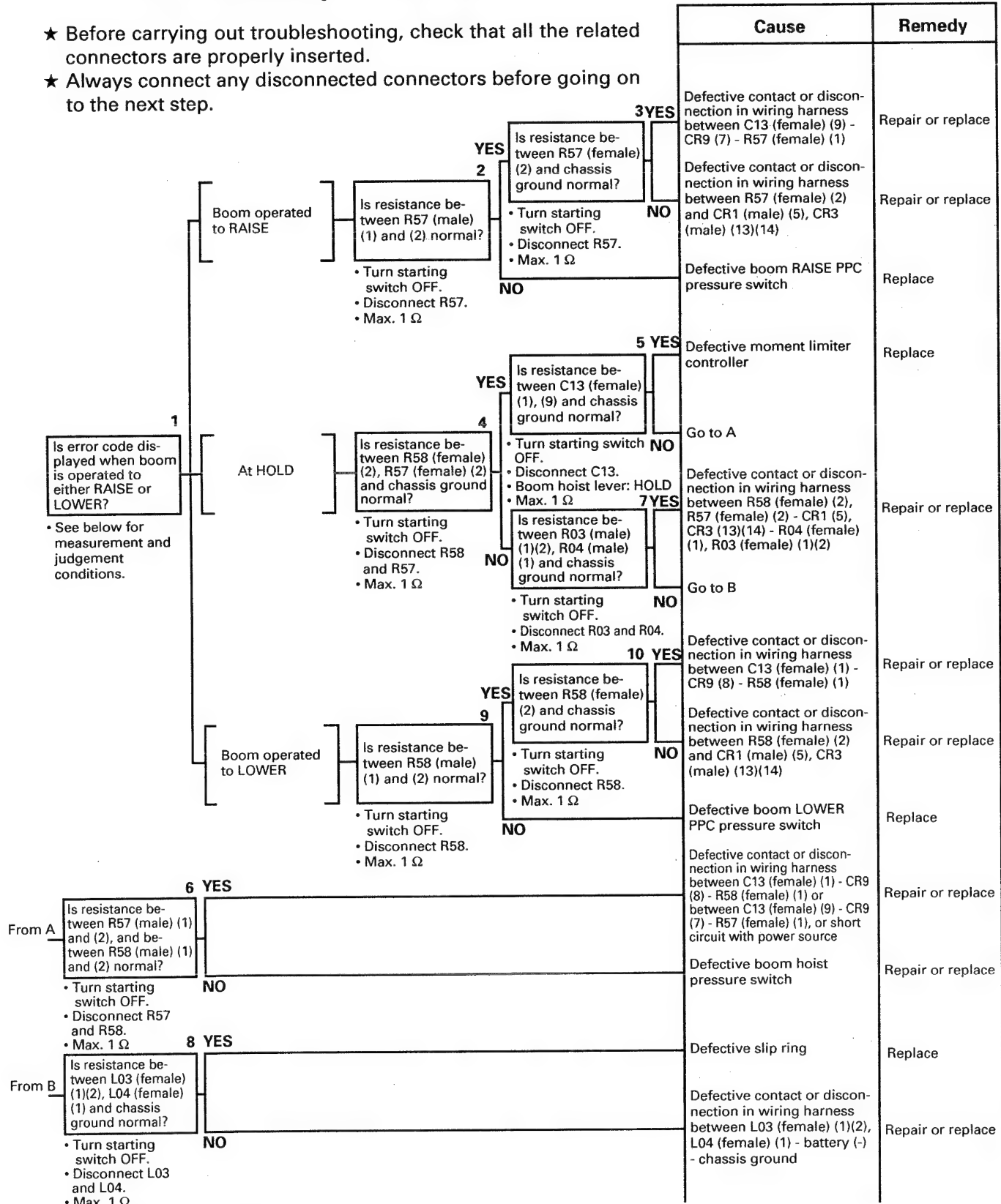
EM-60 Related electric circuit diagram



TKL00538

EM-61 OSS error EB0 (Boom RAISE + LOWER PPC pressure switch input simultaneously) is displayed

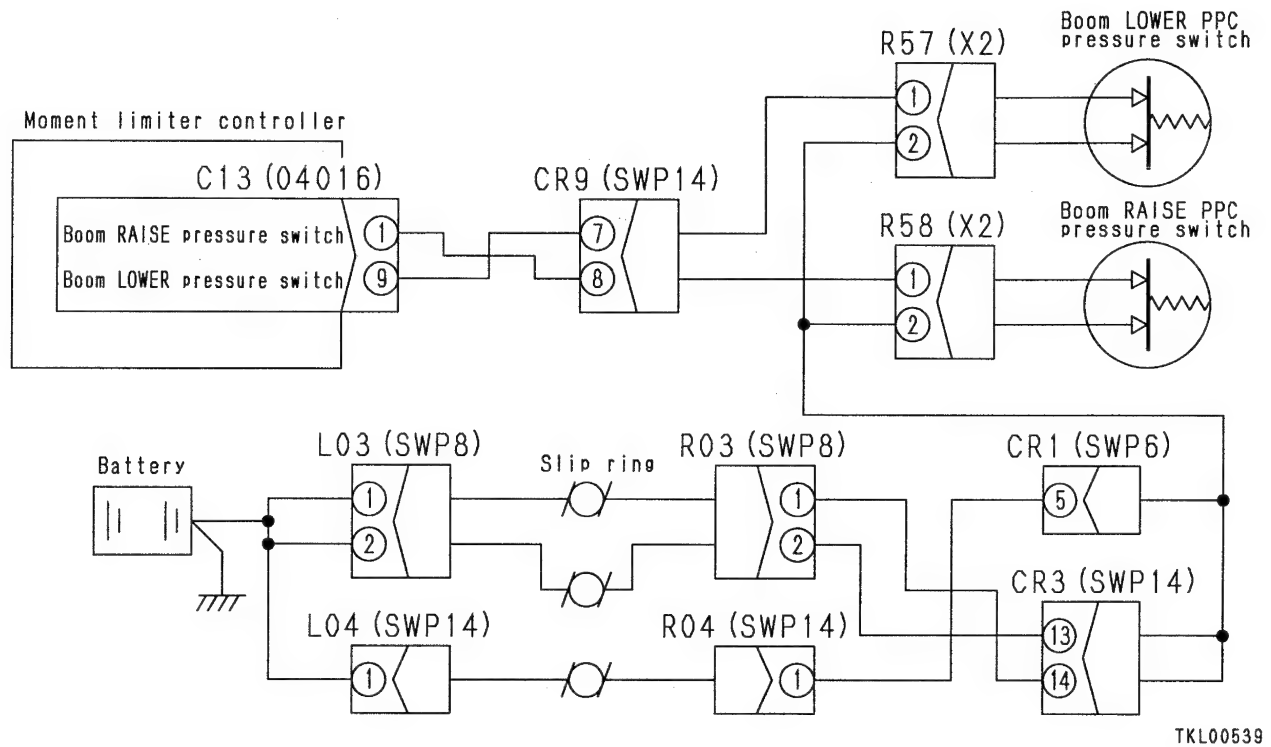
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



★ Procedure for Troubleshooting 1

- 1) Turn the starting switch ON, set the PTO switch to Operation 1 or Operation 2, then check if an error code is displayed.
- 2) If an error code is not displayed in Step 1), start the engine, operate the boom hoist lever and check the display.

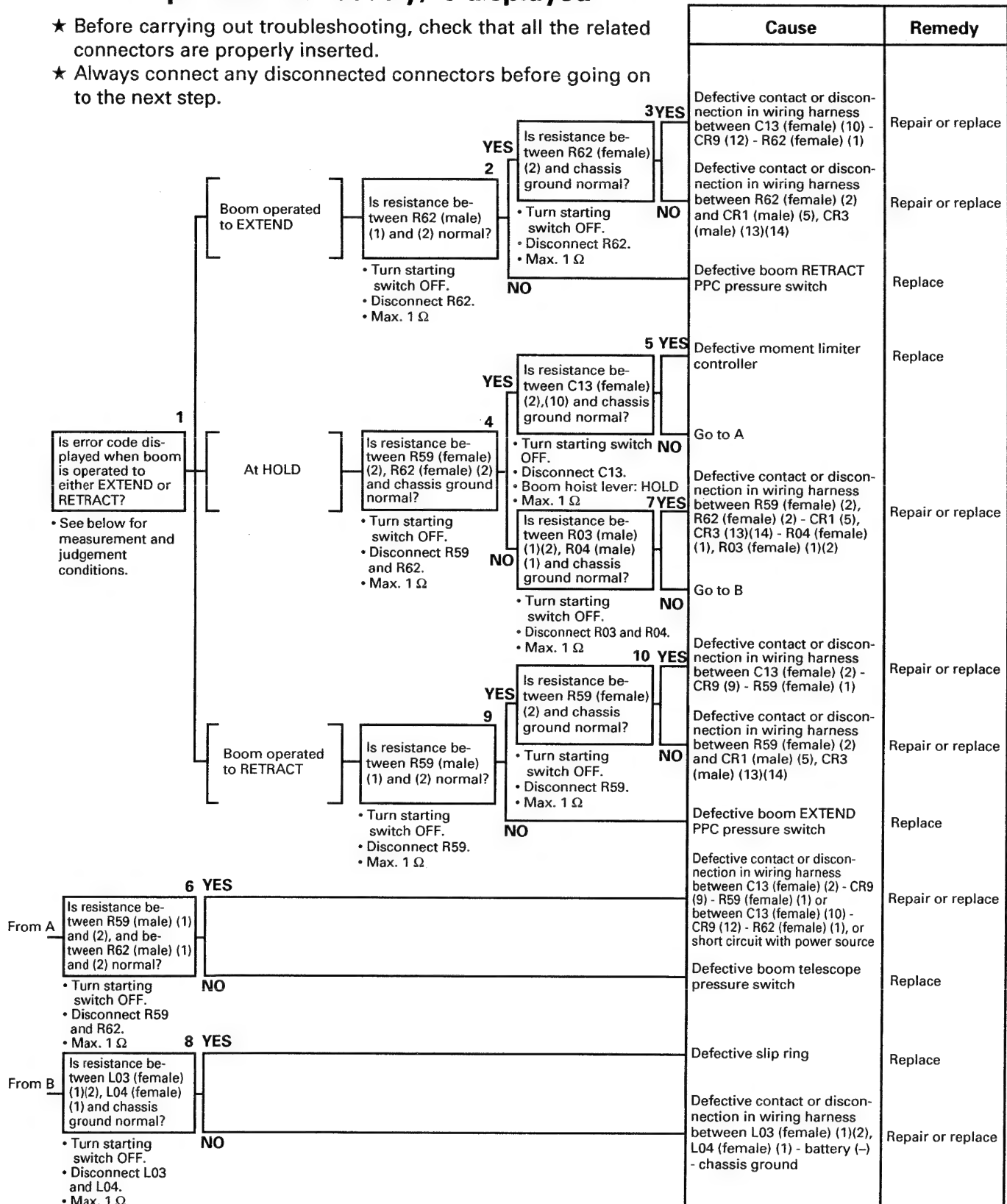
EM-61 Related electric circuit diagram



023S02

EM-62 OSS error EB1 (Boom EXTEND + RETRACT PPC pressure switch input simultaneously) is displayed

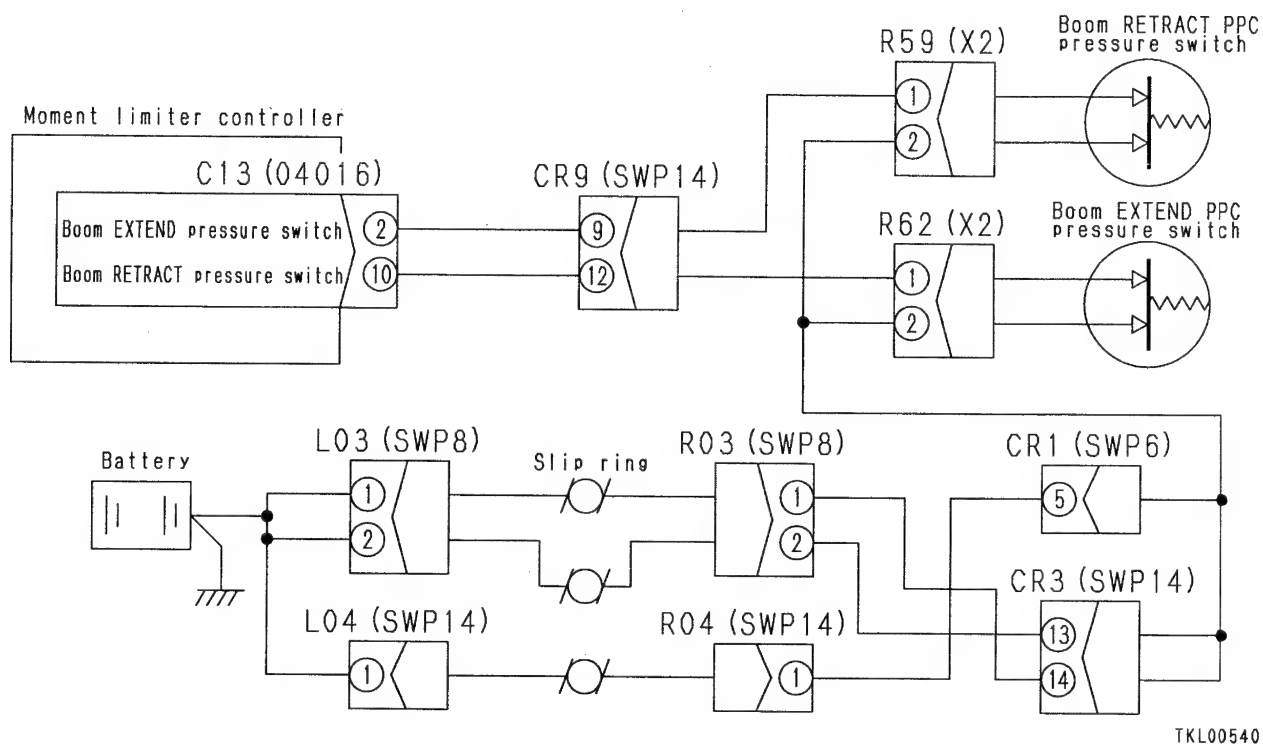
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



★ Procedure for Troubleshooting 1

- 1) Turn the starting switch ON, set the PTO switch to Operation 1 or Operation 2, then check if an error code is displayed.
- 2) If an error code is not displayed in Step 1), start the engine, operate the boom hoist lever and check the display.

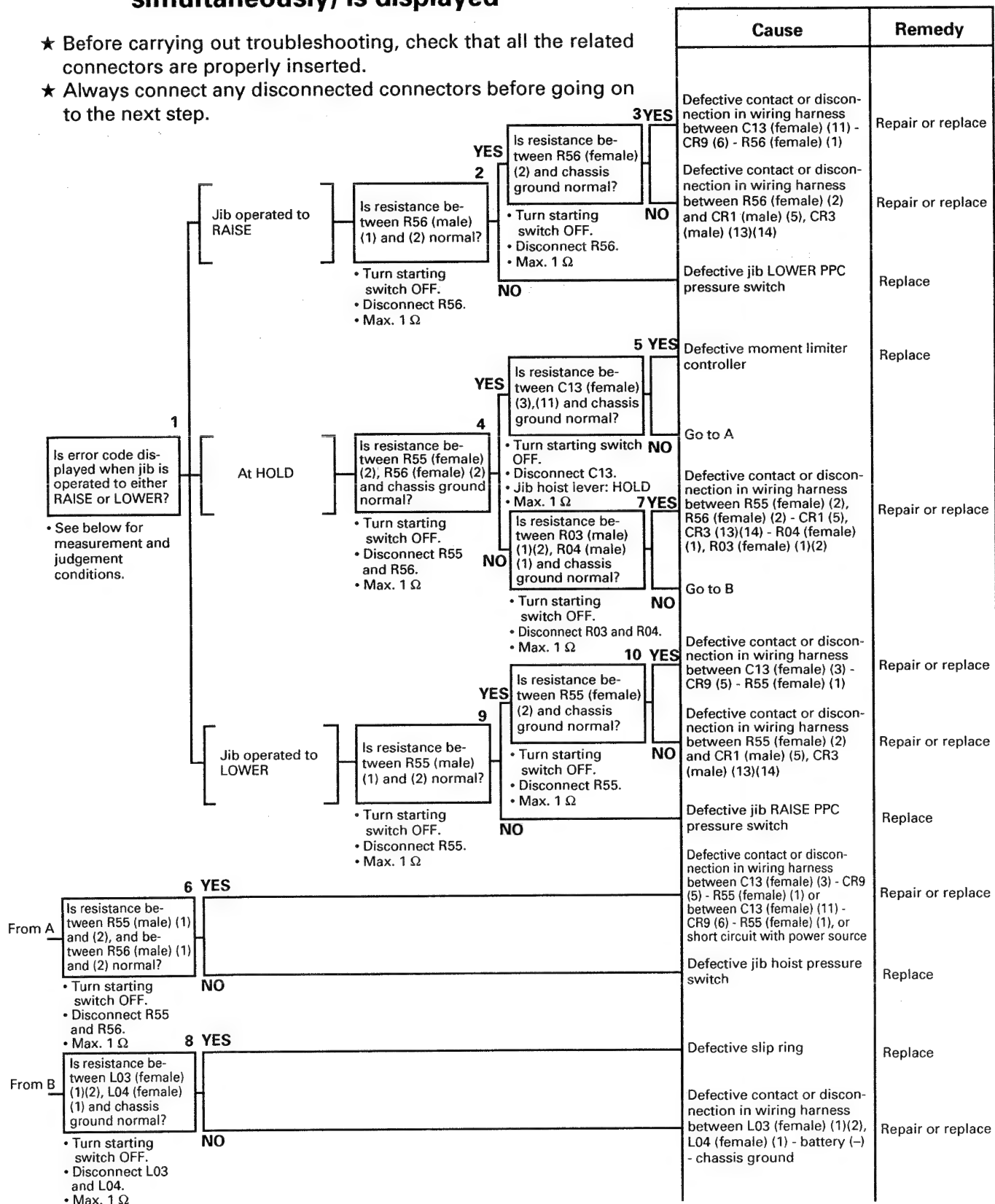
EM-62 Related electric circuit diagram



023S02

EM-63 OSS error EB2 (Jib RAISE + LOWER PPC pressure switch input simultaneously) is displayed

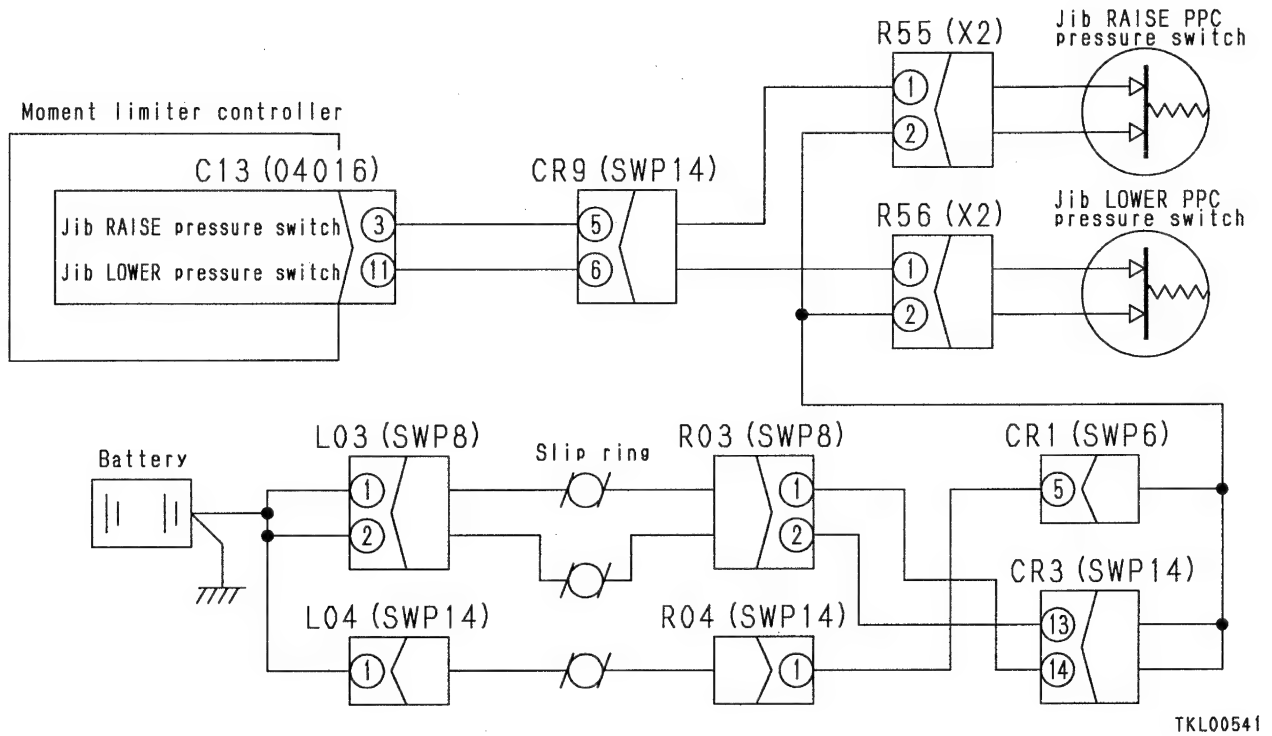
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



★ Procedure for Troubleshooting 1

- 1) Turn the starting switch ON, set the PTO switch to Operation 1 or Operation 2, then check if an error code is displayed.
- 2) If an error code is not displayed in Step 1), start the engine, operate the boom hoist lever and check the display.

EM-63 Related electric circuit diagram

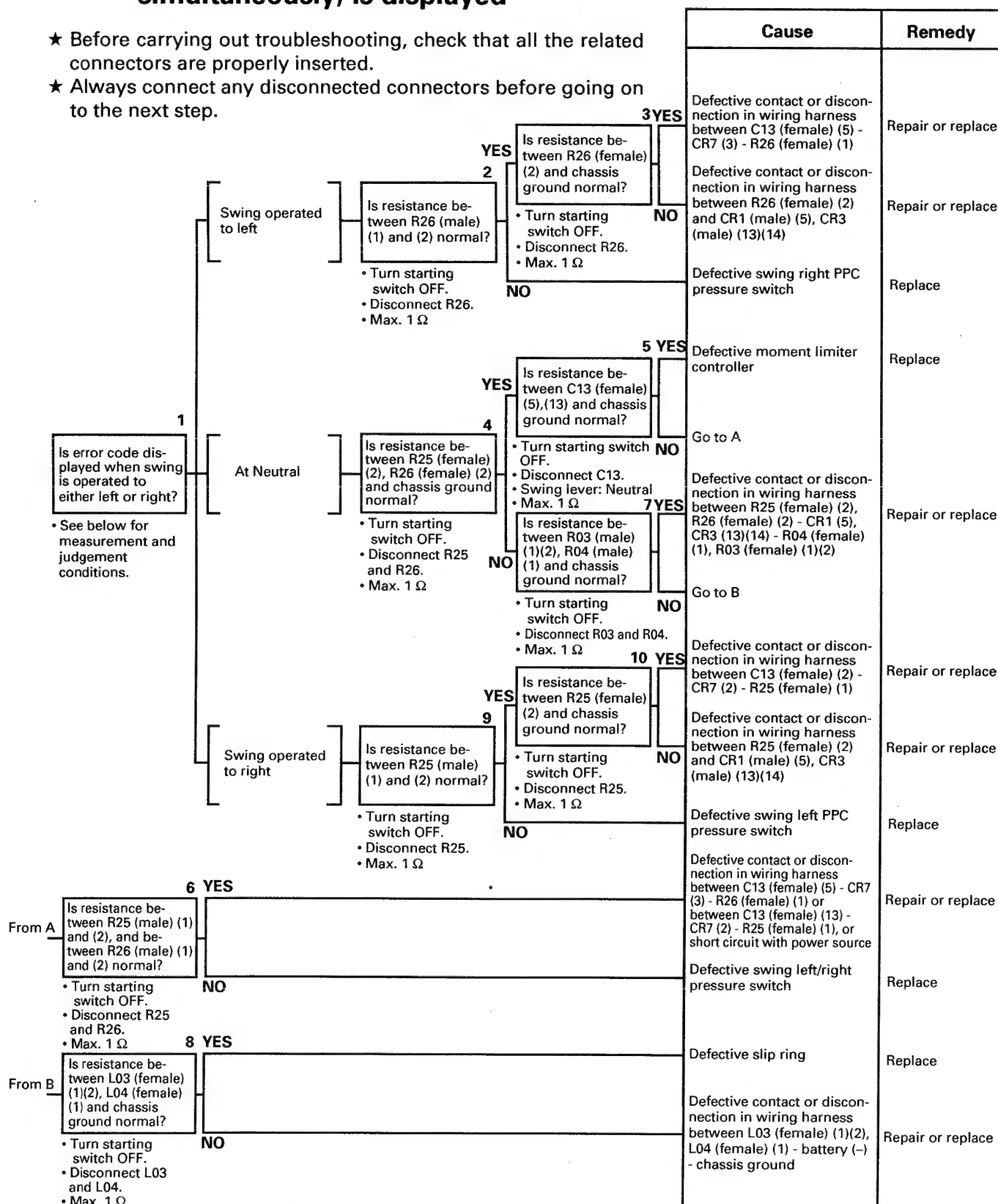


023S02

EM-64 OSS error EB3 (Swing left + right PPC pressure switch input simultaneously) is displayed

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

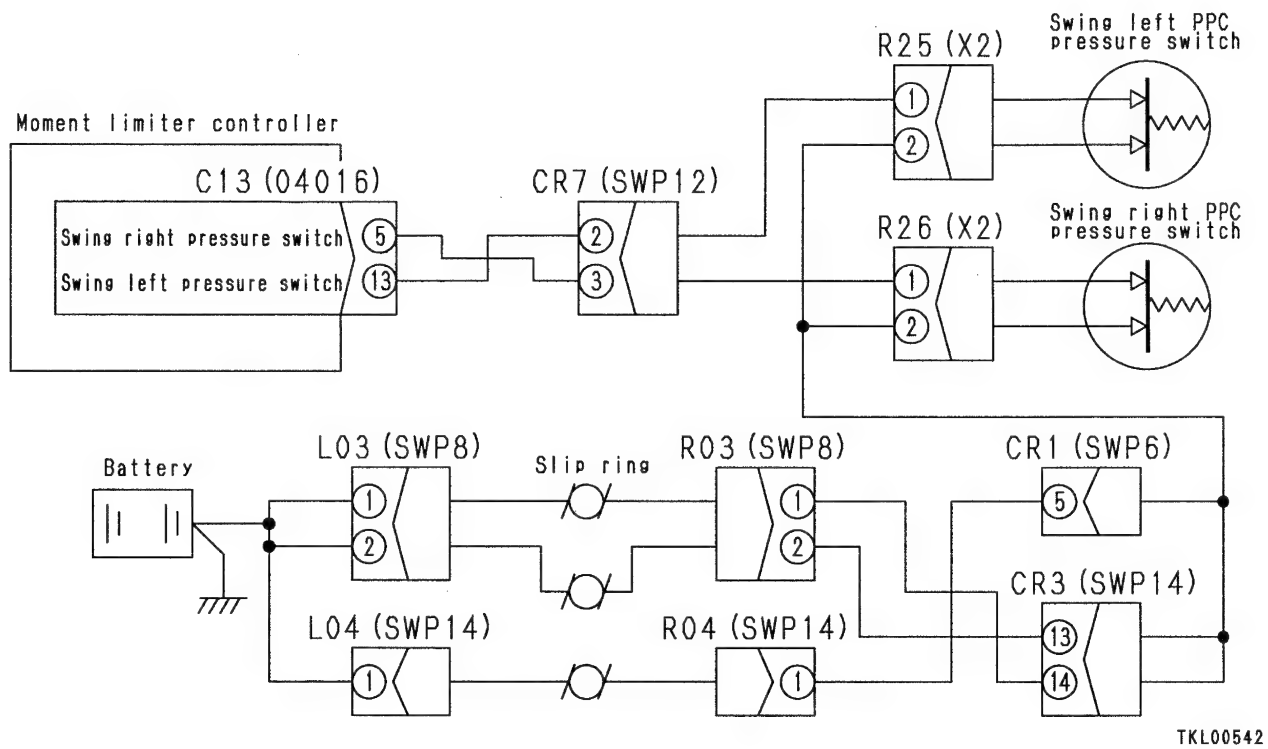


023S02

★ Procedure for Troubleshooting 1

- 1) Turn the starting switch ON, set the PTO switch to Operation 1 or Operation 2, then check if an error code is displayed.
- 2) If an error code is not displayed in Step 1), start the engine, operate the boom hoist lever and check the display.

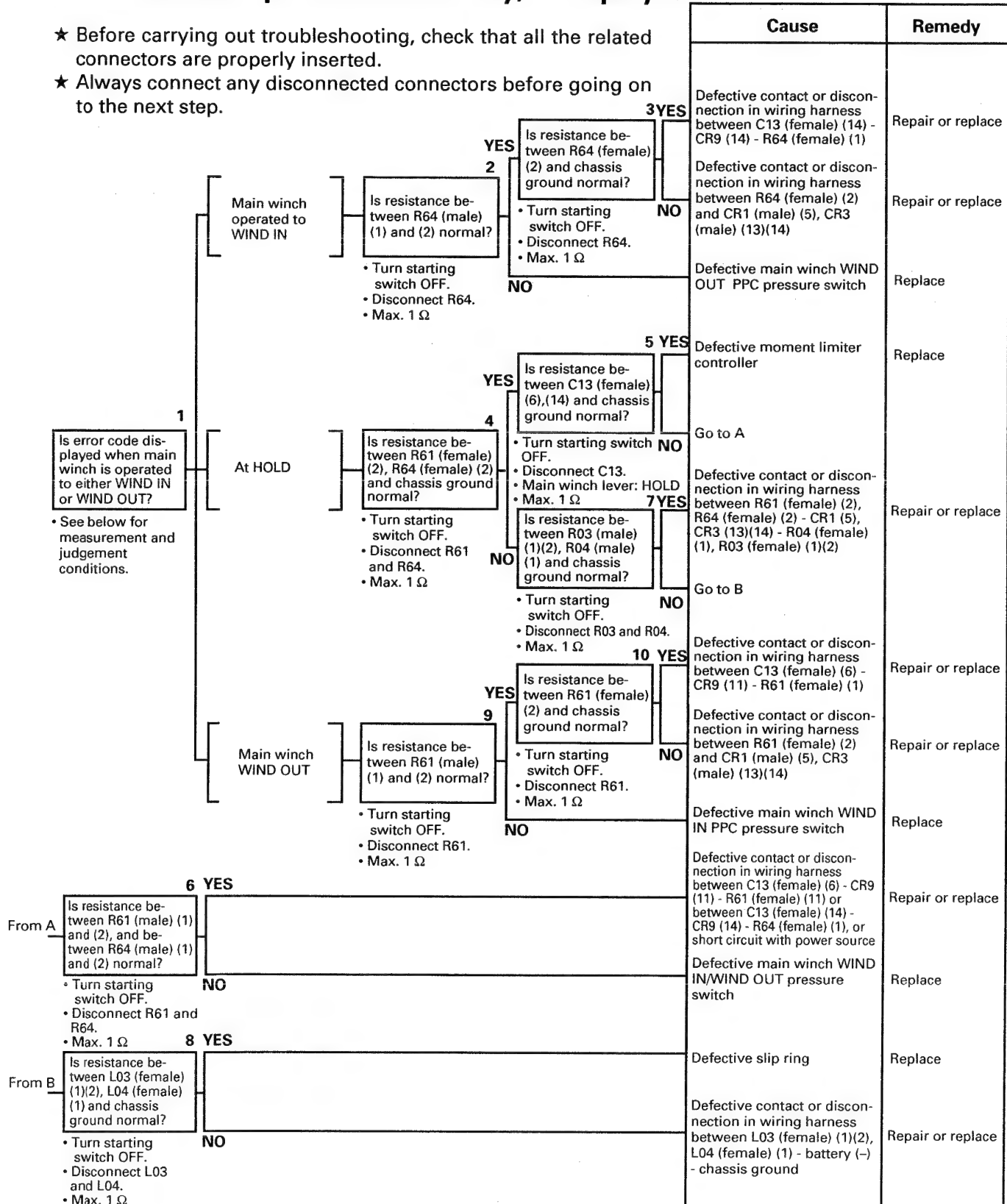
EM-64 Related electric circuit diagram



023S02

EM-65 OSS error EB4 (Main winch WIND IN + WIND OUT PPC pressure switch input simultaneously) is displayed

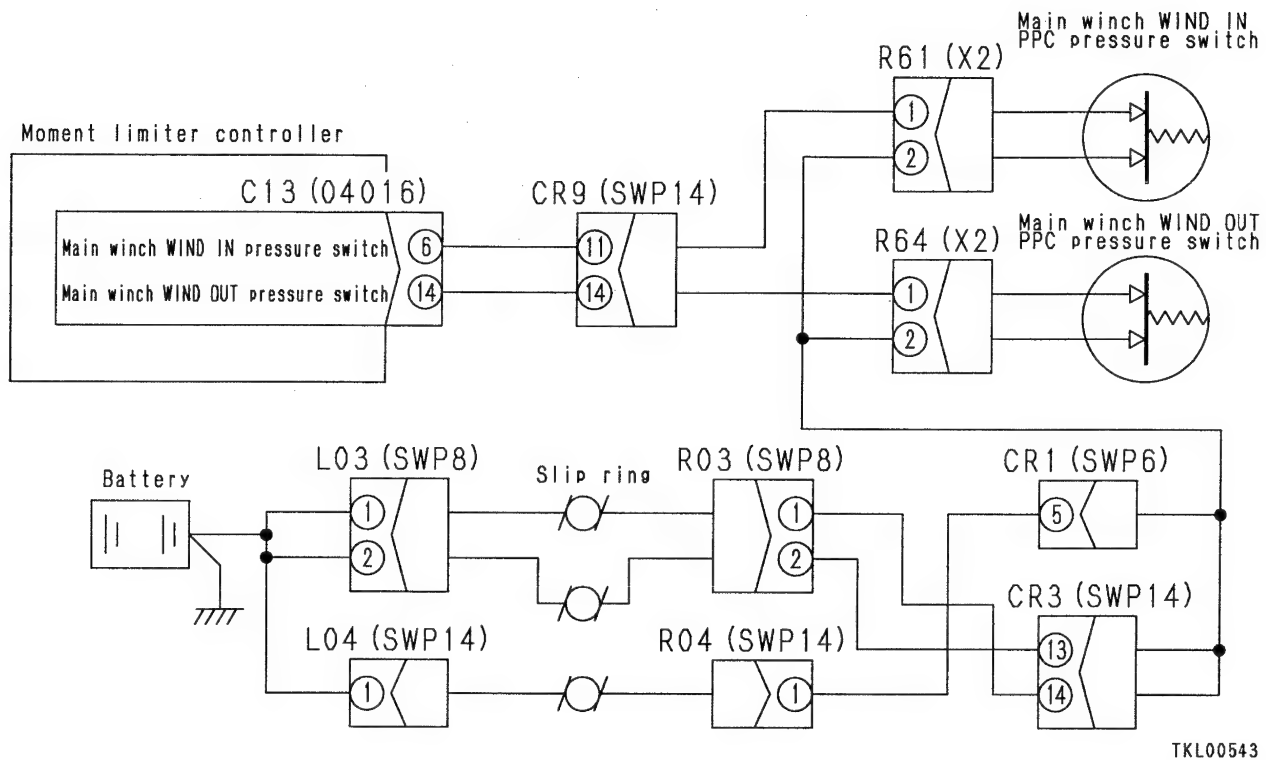
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



★ Procedure for Troubleshooting 1

- 1) Turn the starting switch ON, set the PTO switch to Operation 1 or Operation 2, then check if an error code is displayed.
- 2) If an error code is not displayed in Step 1), start the engine, operate the boom hoist lever and check the display.

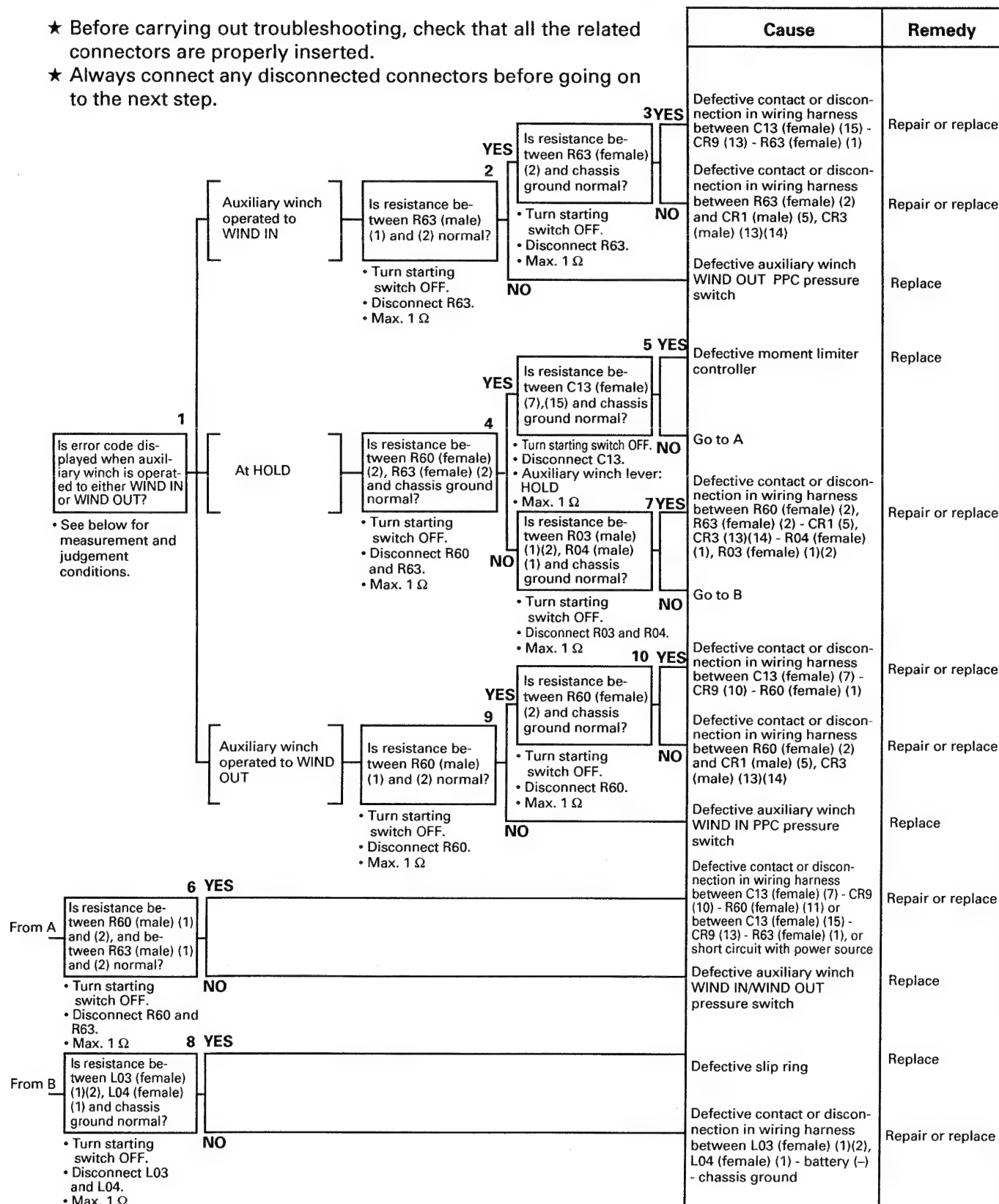
EM-65 Related electric circuit diagram



023S02

EM-66 OSS error EB5(Auxiliary winch WIND IN + WIND OUT PPC pressure switch input simultaneously) is displayed

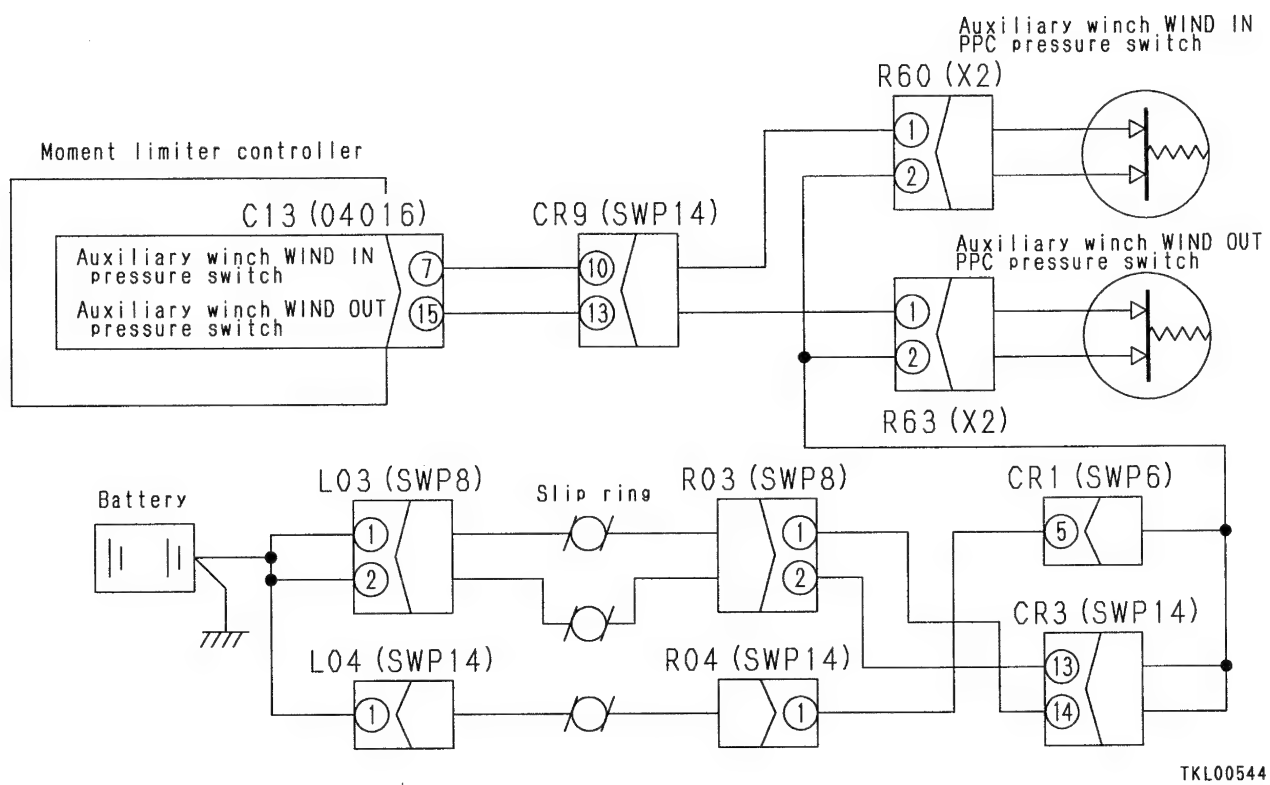
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



★ Procedure for Troubleshooting 1

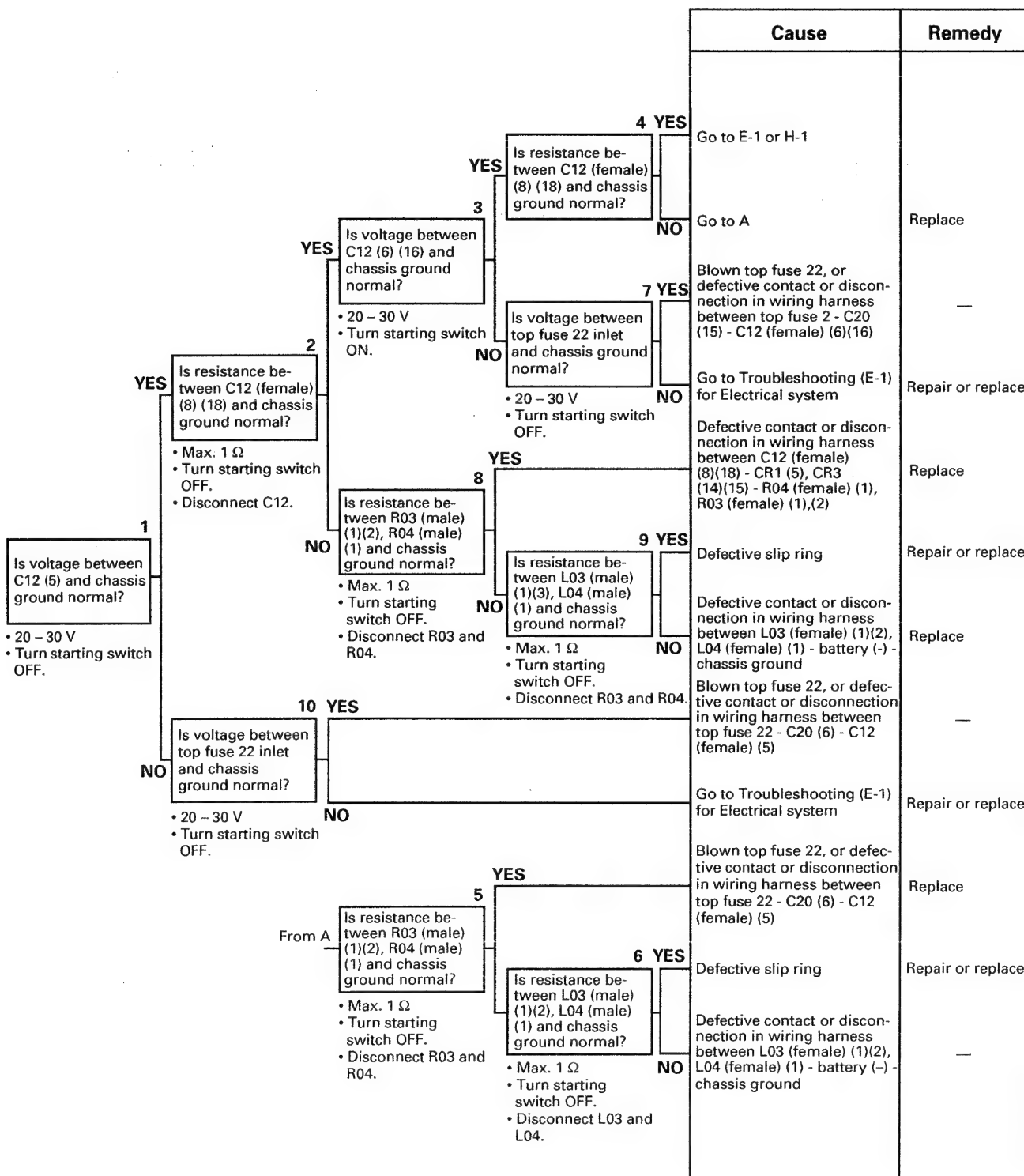
- 1) Turn the starting switch ON, set the PTO switch to Operation 1 or Operation 2, then check if an error code is displayed.
- 2) If an error code is not displayed in Step 1), start the engine, operate the boom hoist lever and check the display.

EM-66 Related electric circuit diagram



023S02

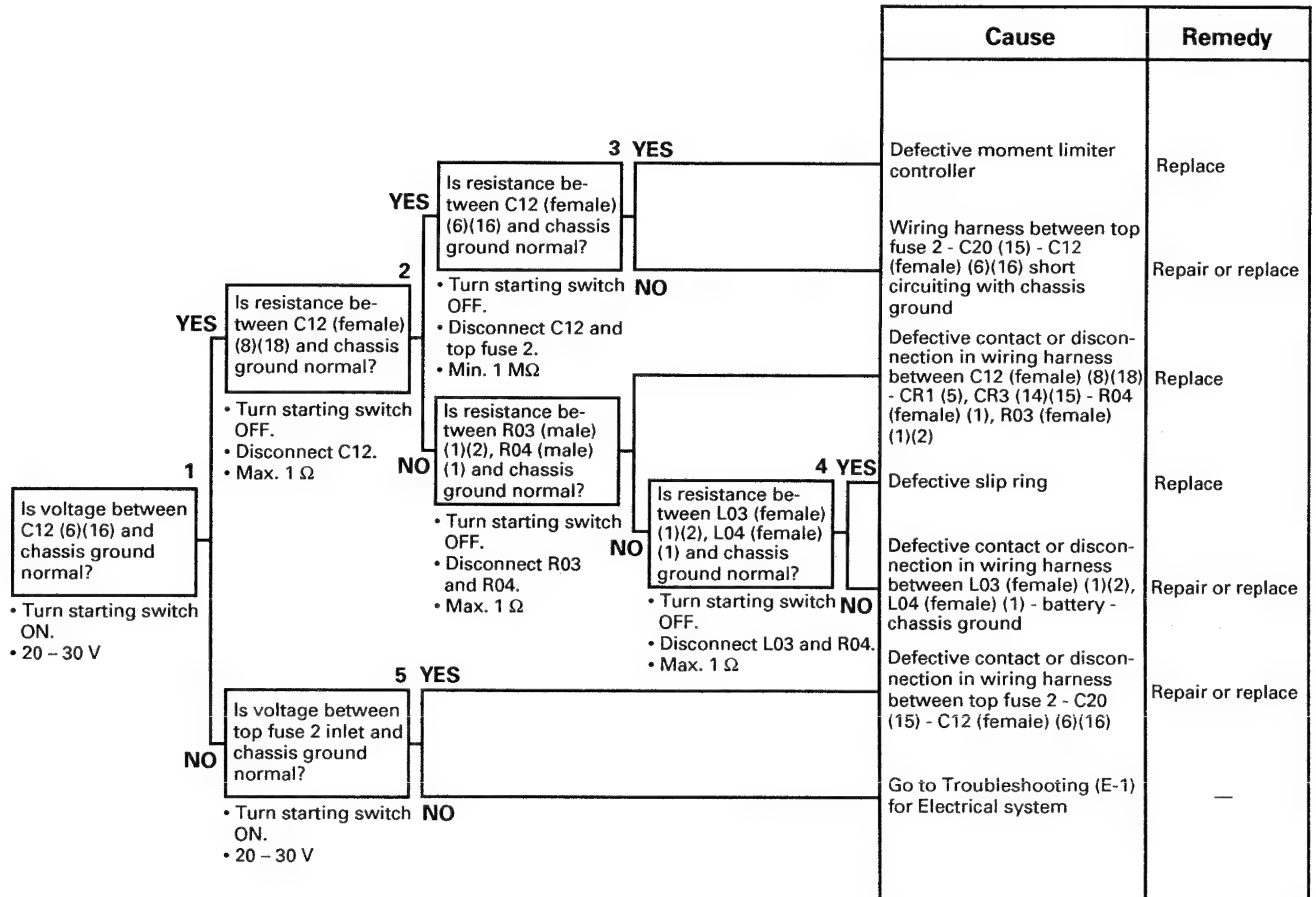
- ★ Check that top fuse 22 (back-up) and top fuse 2 (main) are not blown.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



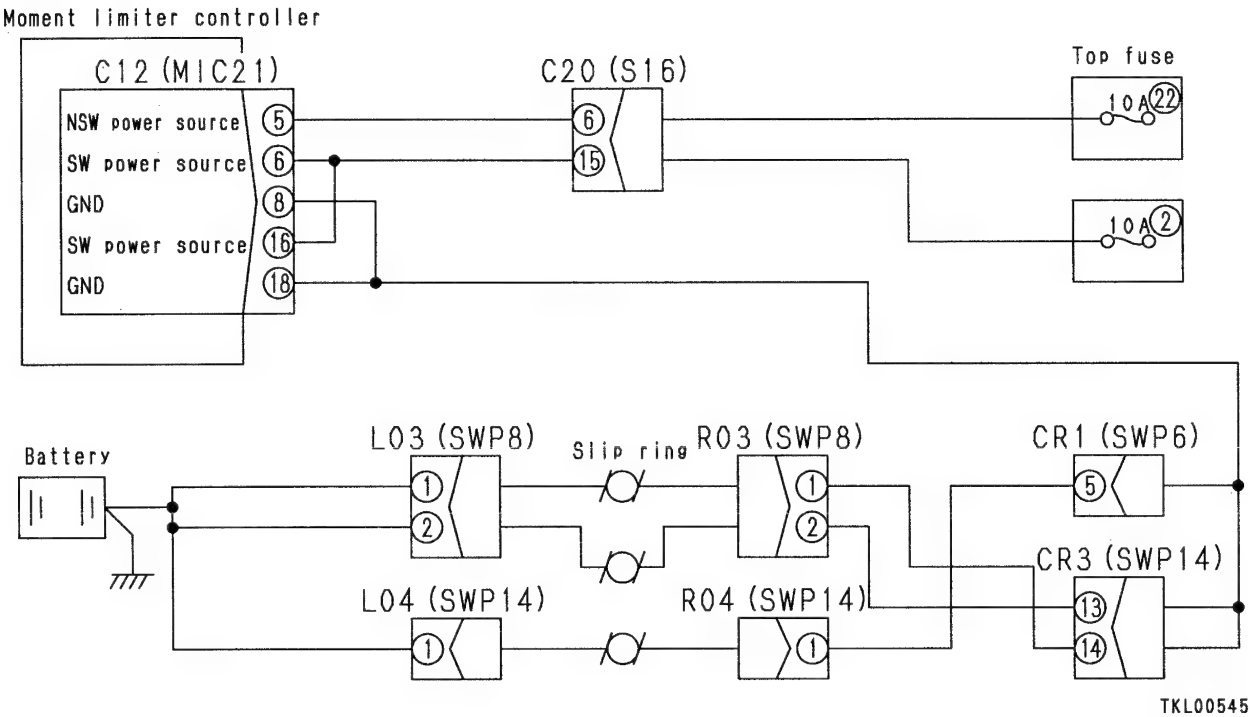
023S02

b) Abnormality in main power source

- ★ Check that top fuse 22 (back-up) and top fuse 2 (main) are not blown.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



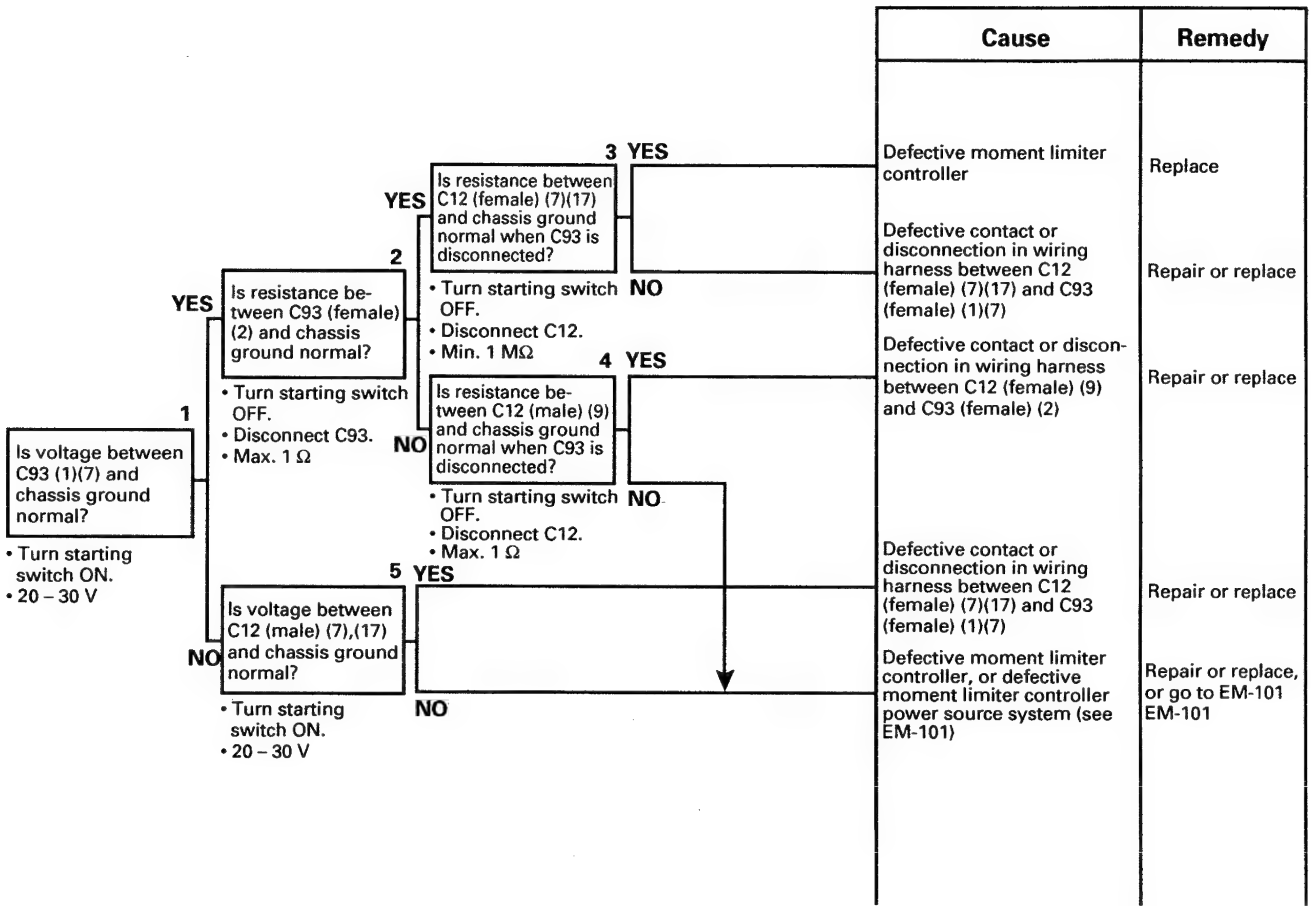
EM-101 Related electric circuit diagram



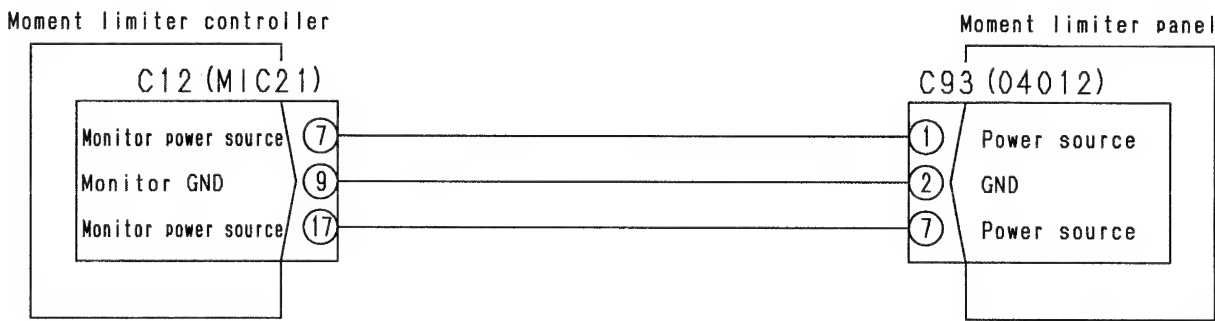
023S02

EM-102 Abnormality in moment limiter panel power source system

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



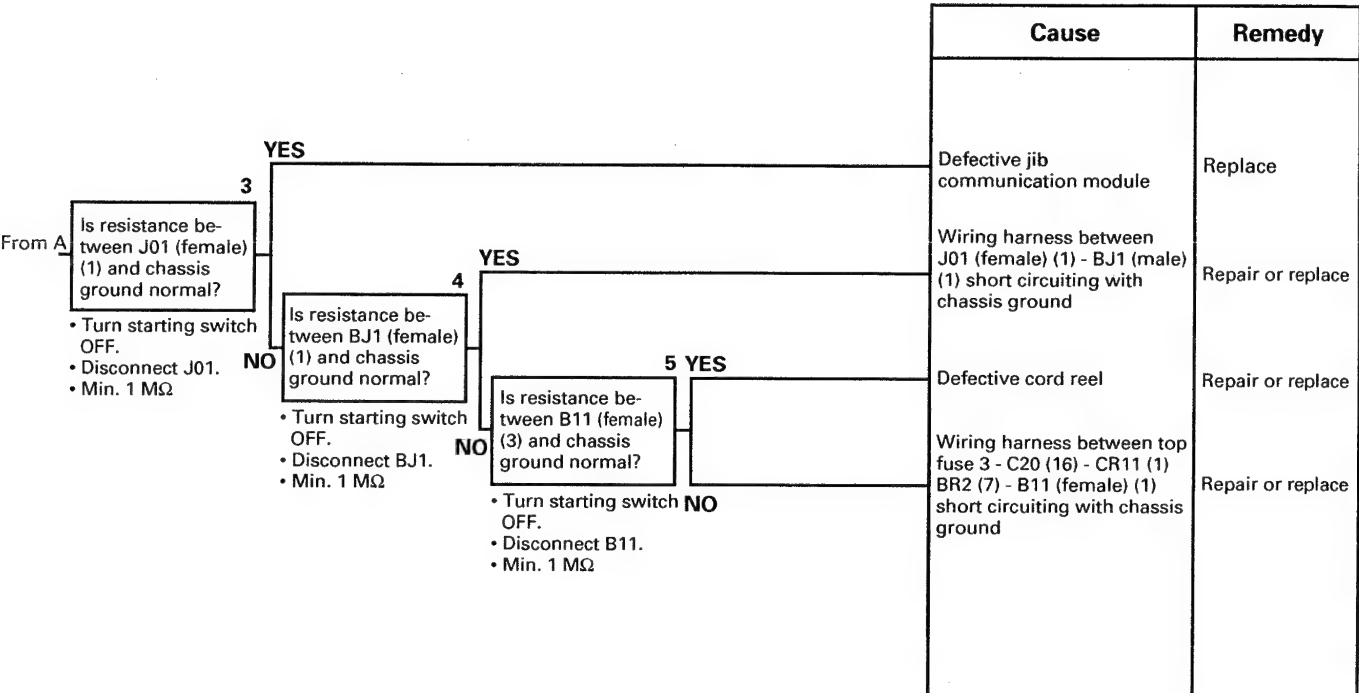
EM-102 Related electric circuit diagram



TKL00546

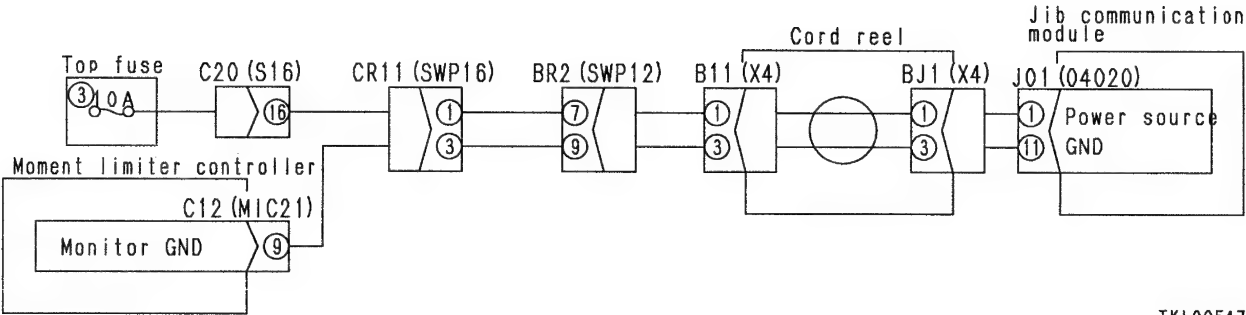
- ★ Check that top fuse 3 is not blown. (If it is blown, carry out troubleshooting for Items 3 to 5.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.





023S02

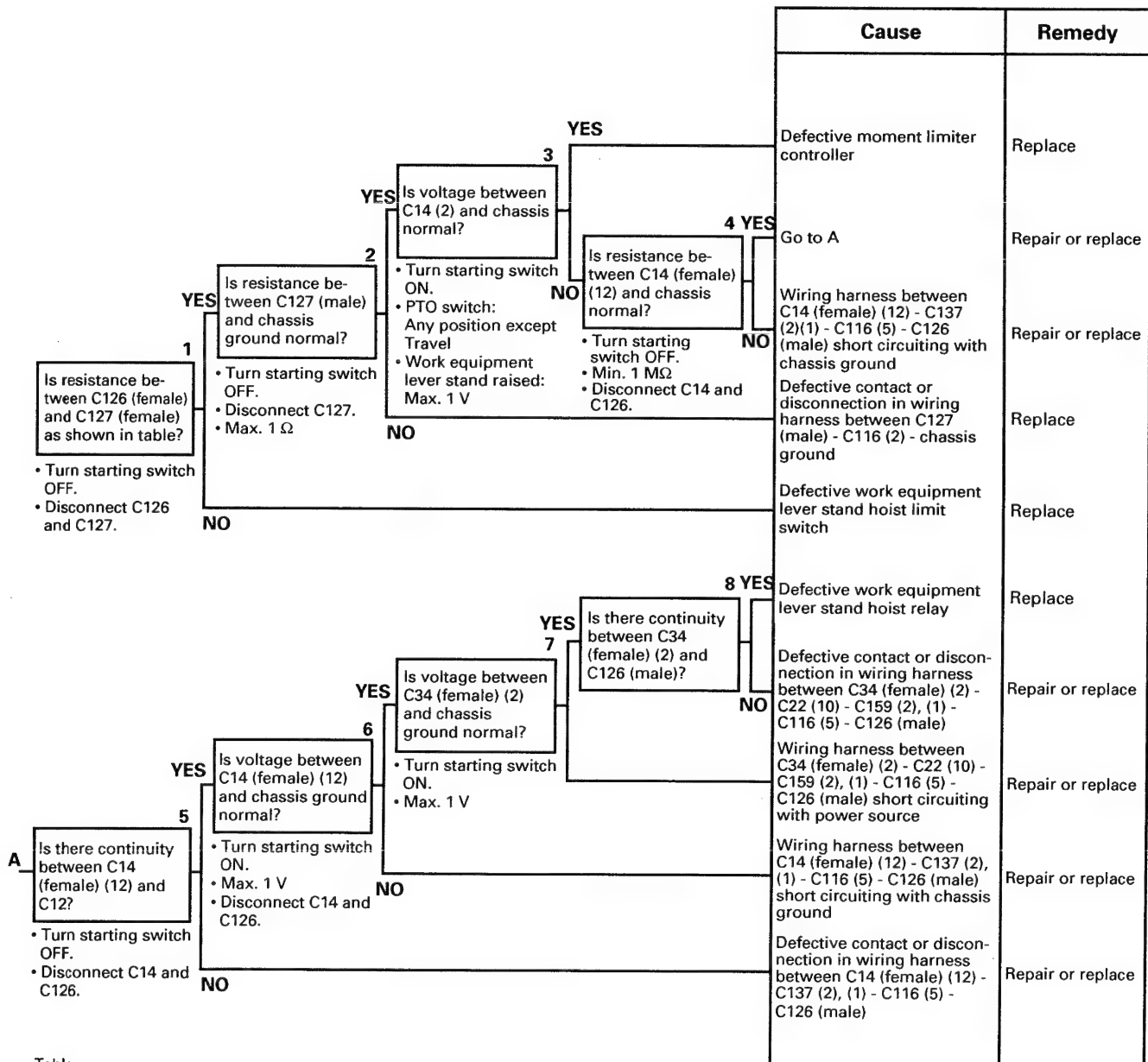
EM-103 Related electric circuit diagram



TKL00547

EM-104 Does not enter working mode (work equipment and winch do not work)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ (1) If the problem is "Short circuit with chassis ground"
(NO line from Troubleshooting Item 4 and short circuit inside work equipment lever stand limit switch), automatic stop is not carried out even when the work equipment lever stand is lowered.
- (2) If the problem is "Disconnection" or "Short circuit with power source", the "Work equipment lever stand lowered" message is displayed and the work equipment (boom, winch) do not work when the work equipment lever stand is raised.

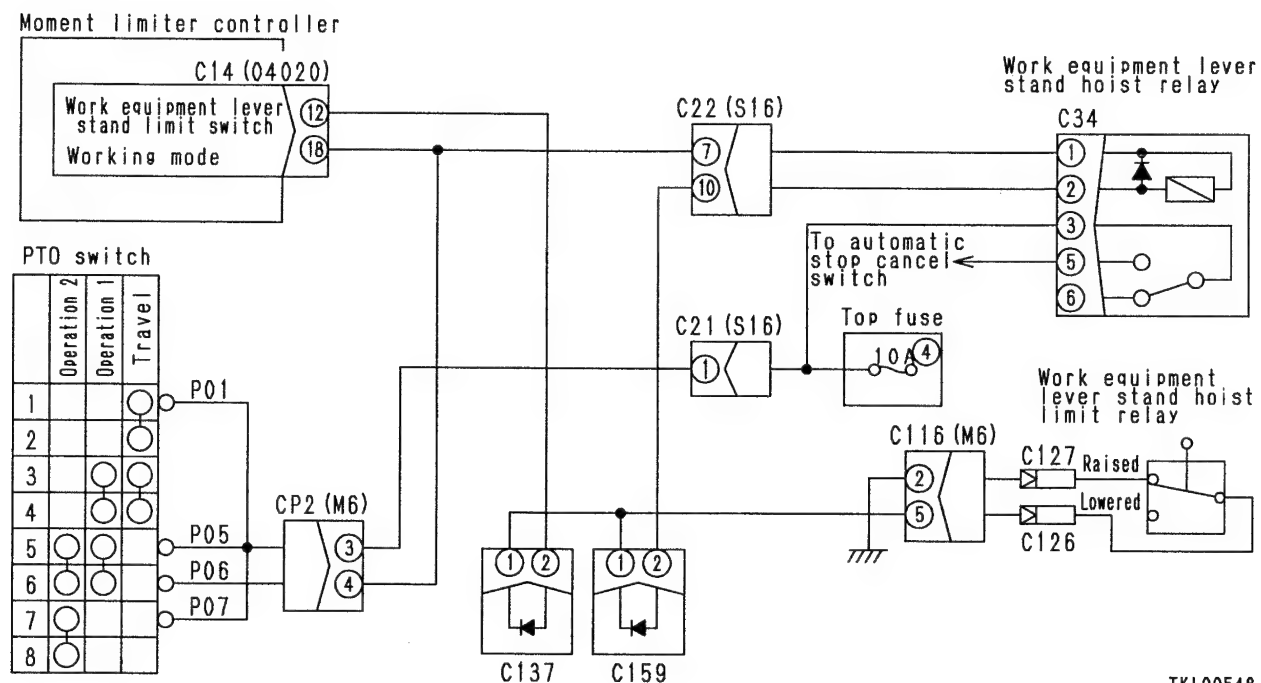


Table

	Work equipment lever stand	Resistance value
Between C126 (female) – C127 (male)	Lowered (Travel position)	Min. 1 M Ω
	Raised (Working position)	Max. 1 Ω

023S02

EM-104 Related electric circuit diagram



TKL00548

023S02

106 Abnormality in winch overwind limit switch system

Specification (jib stowed)

When no error code is displayed.

When carrying out troubleshooting, check that all the related connectors are properly inserted.

Always connect any disconnected connectors before going on to the next step.

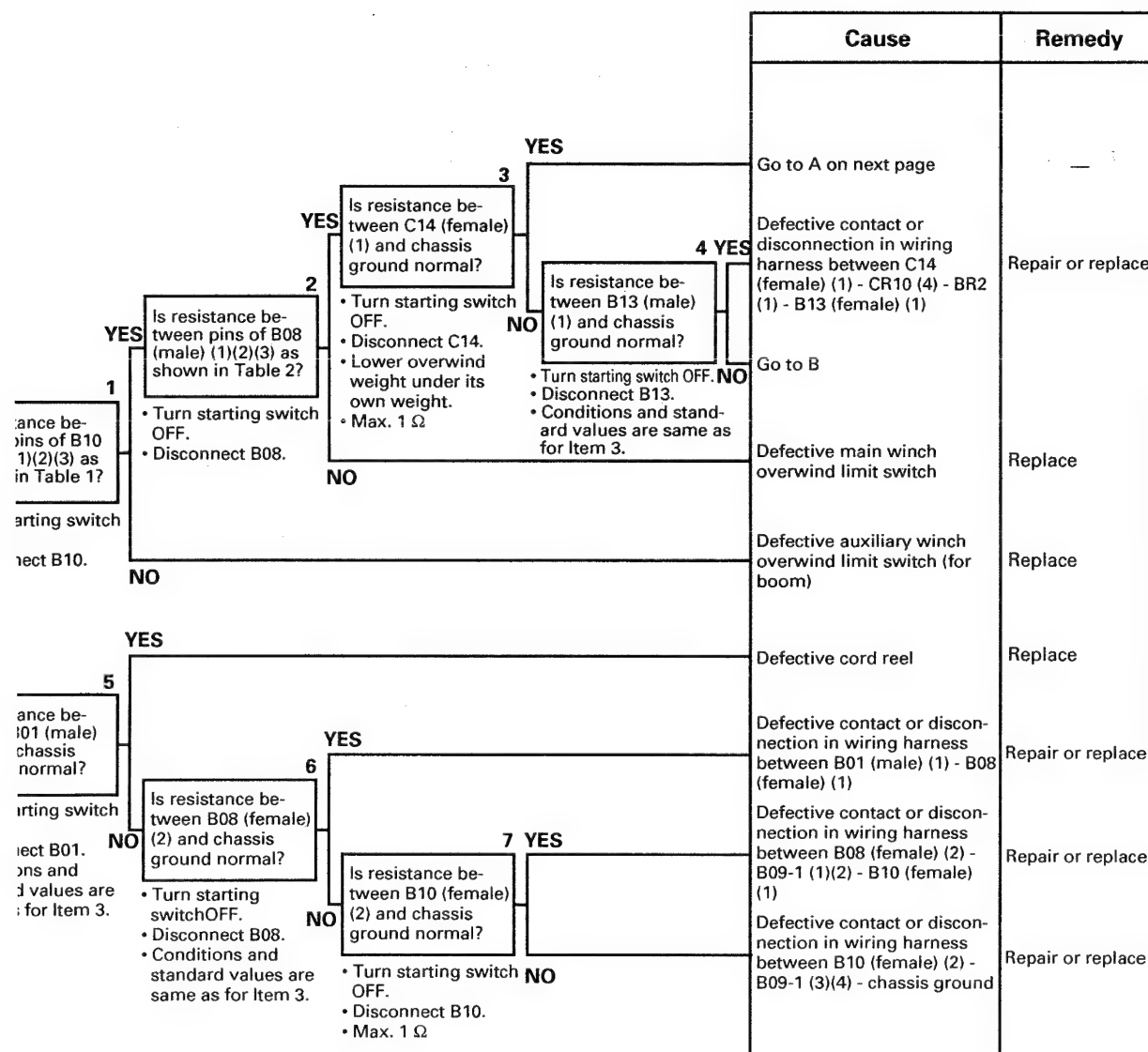


Table 2

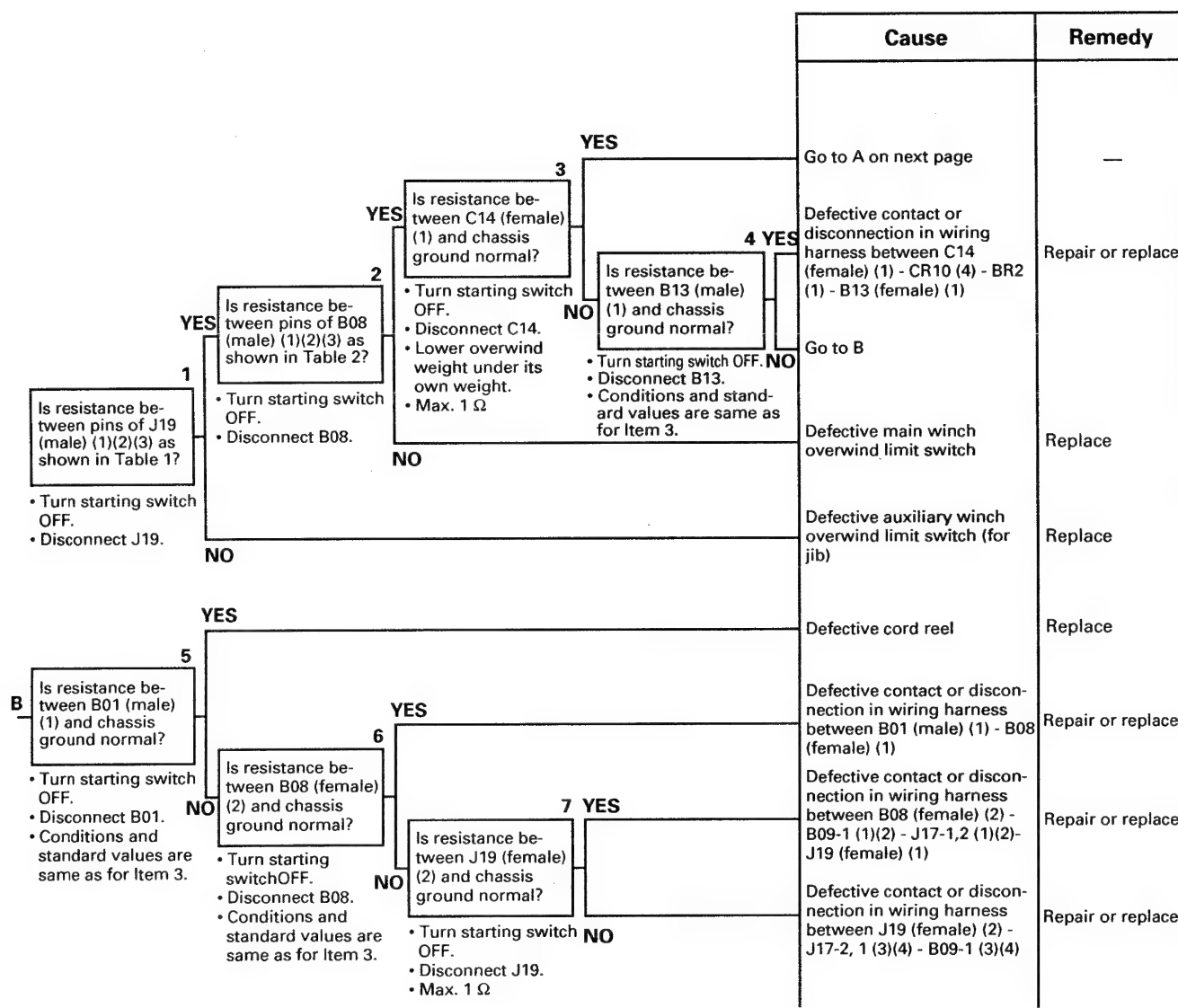
(male)	Auxiliary winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

B08 (male)	Main winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

b) Jib specification machine (1st jib operations)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection



023S02

Table 1

J19 (male)	Auxiliary winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

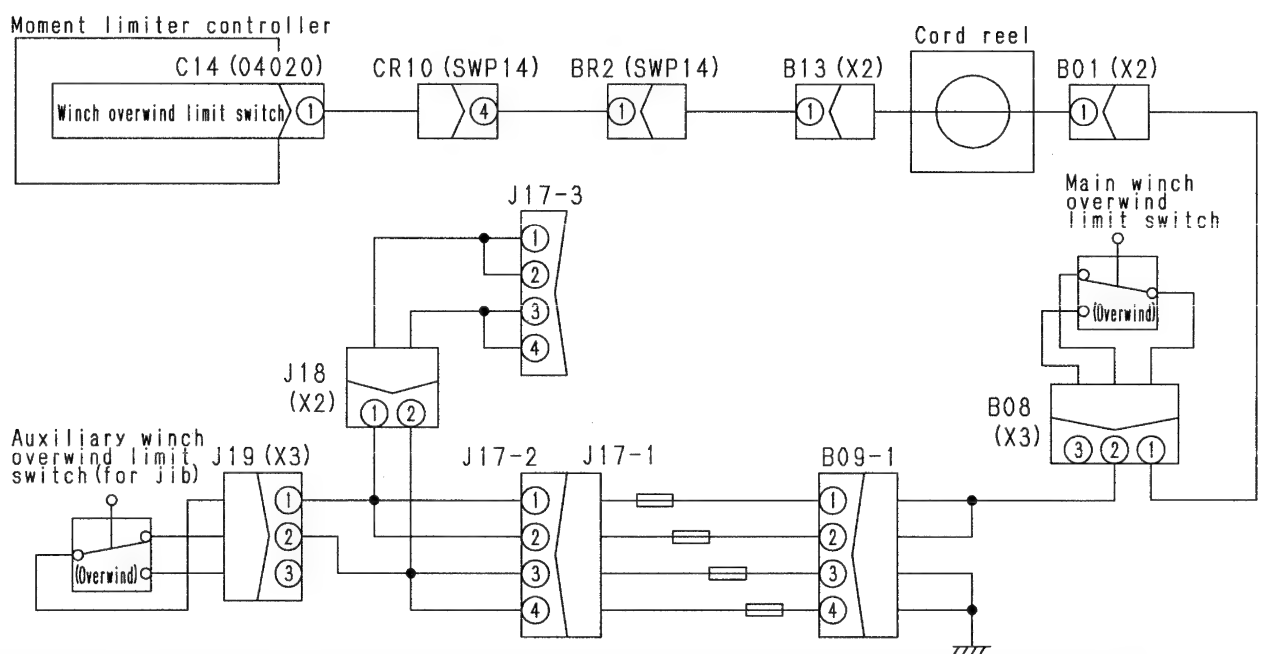
Table 2

B08 (male)	Main winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

Short circuit with ground

Short circuit with ground				Cause	Remedy	
A	<div>1</div> <div>Is resistance between C14 (female) (1) and chassis ground normal when J19 is disconnected?</div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect C14.</div><div>• Lower overwind weight under its own weight</div><div>• Min. 1 MΩ</div></div>	YES	<div>2</div> <div>Is resistance between J19 (male) (1) and chassis ground normal?</div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect J19.</div><div>• Min. 1 MΩ</div></div>	NO	Defective moment limiter controller	Replace
		YES	<div>3</div> <div>Is resistance between C14 (female) (1) and chassis ground normal when B08 is disconnected?</div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect C14.</div><div>• Min. 1 MΩ</div></div>	NO	Defective auxiliary winch overwind limit switch (for jib)	Replace
		YES	<div>4</div> <div>Is resistance between B08 (male) (1) and chassis ground normal?</div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect B08.</div><div>• Min. 1 MΩ</div></div>	NO	Wiring harness between B08 (female) (2) - B09-1 (1)(2) - J17-1,2 (1)(2) - J19 (1) or between J18 (1)-J17-3 (female) (1)(2) short circuiting with chassis ground	Repair or replace
		YES	<div>5</div> <div>Is resistance between C14 (female) (1) and chassis ground normal when B01 is disconnected?</div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect C14.</div><div>• Min. 1 MΩ</div></div>	NO	Defective main winch overwind limit switch	Replace
		YES	<div>6</div> <div>Is resistance between C14 (female) (1) and chassis ground normal when B13 is disconnected?</div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect C14.</div><div>• Min. 1 MΩ</div></div>	NO	Wiring harness between B01 (male) (1) - B08 (female) (1) short circuiting with chassis ground	Repair or replace
		YES		Defective cord reel	Replace	
		NO		Wiring harness between C14 (female) (1) - CR10 (4) - BR2 (1) - B13 (female) (1) short circuiting with chassis ground	Repair or replace	
		NO				
		NO				
		NO				

EM-106 b) Related electric circuit diagram



TKL00550

c) Jib specification machine (2nd jib operations)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

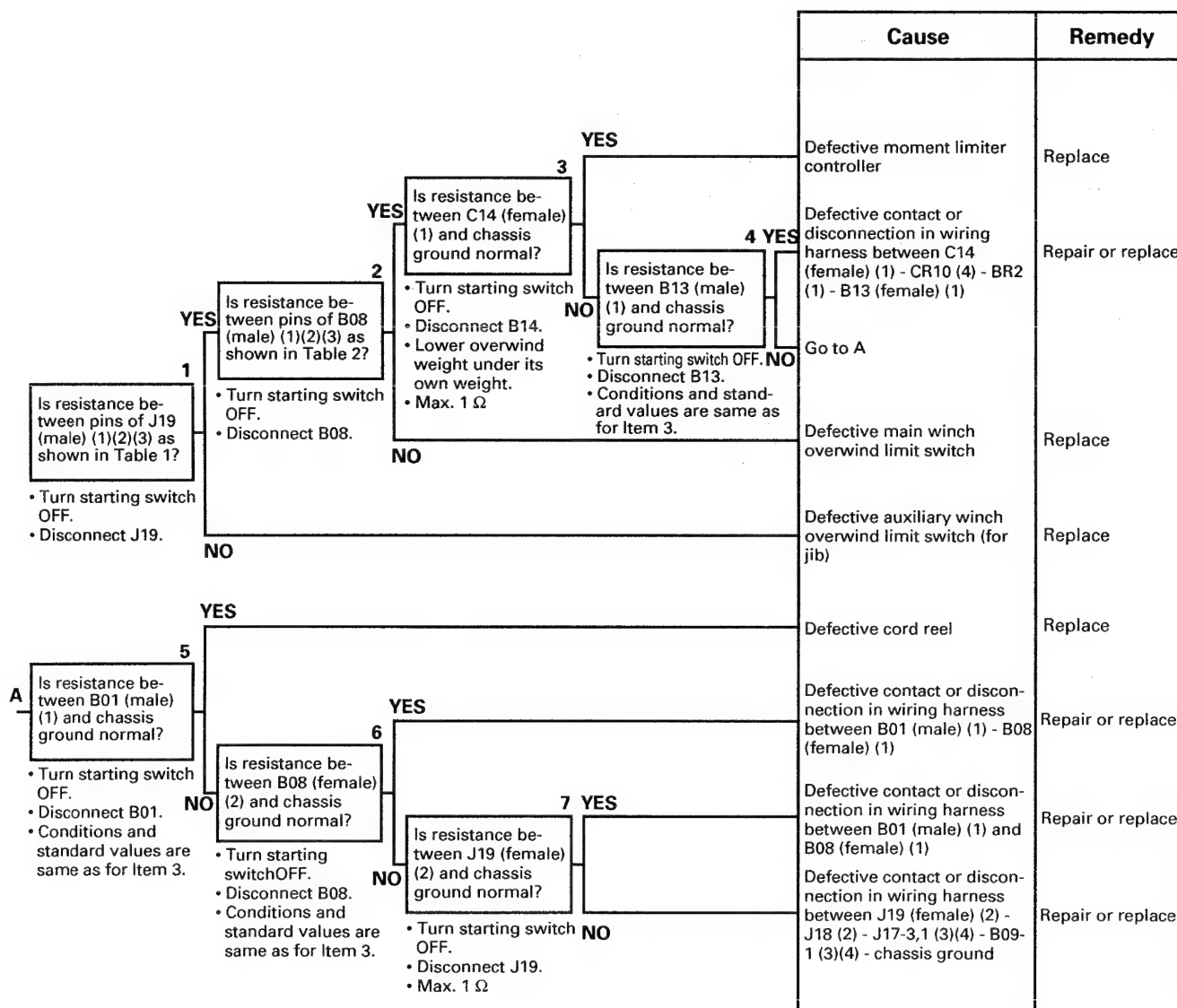


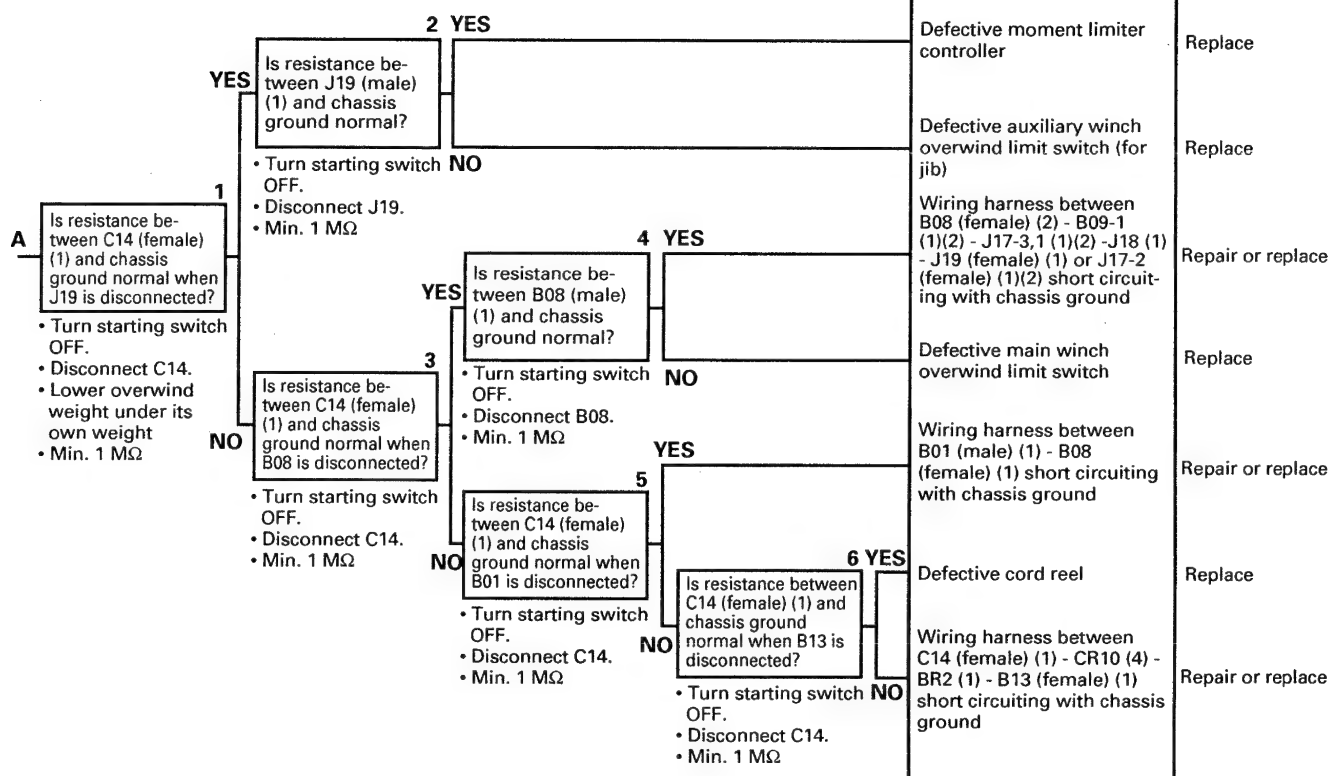
Table 1

J19 (male)	Auxiliary winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

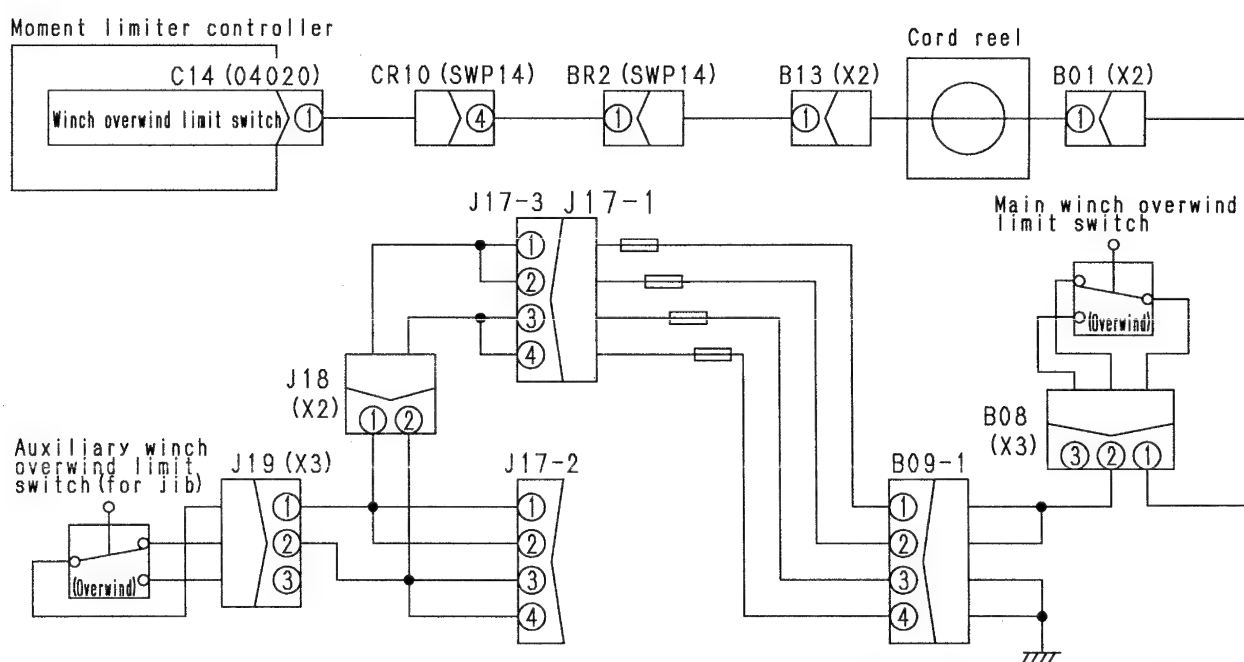
Table 2

B08 (male)	Main winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

Short circuit with ground



EM-106 c) Related electric circuit diagram



TKL00551

023S02

d) Jibless specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

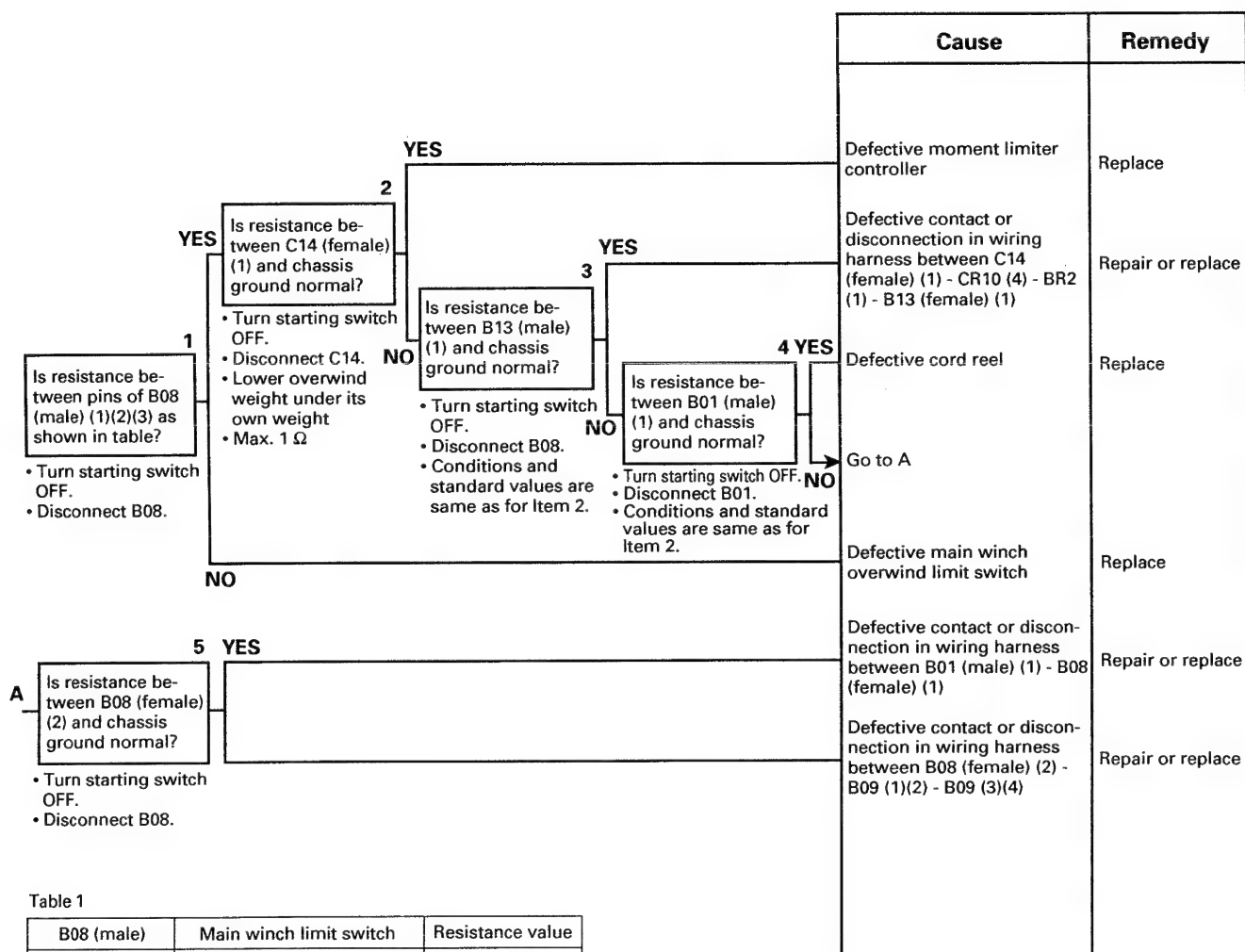


Table 1

B08 (male)	Main winch limit switch	Resistance value
Between (1) - (2)	Lower overwind weight under its own weight	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Lift up overwind weight by hand	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

023S02

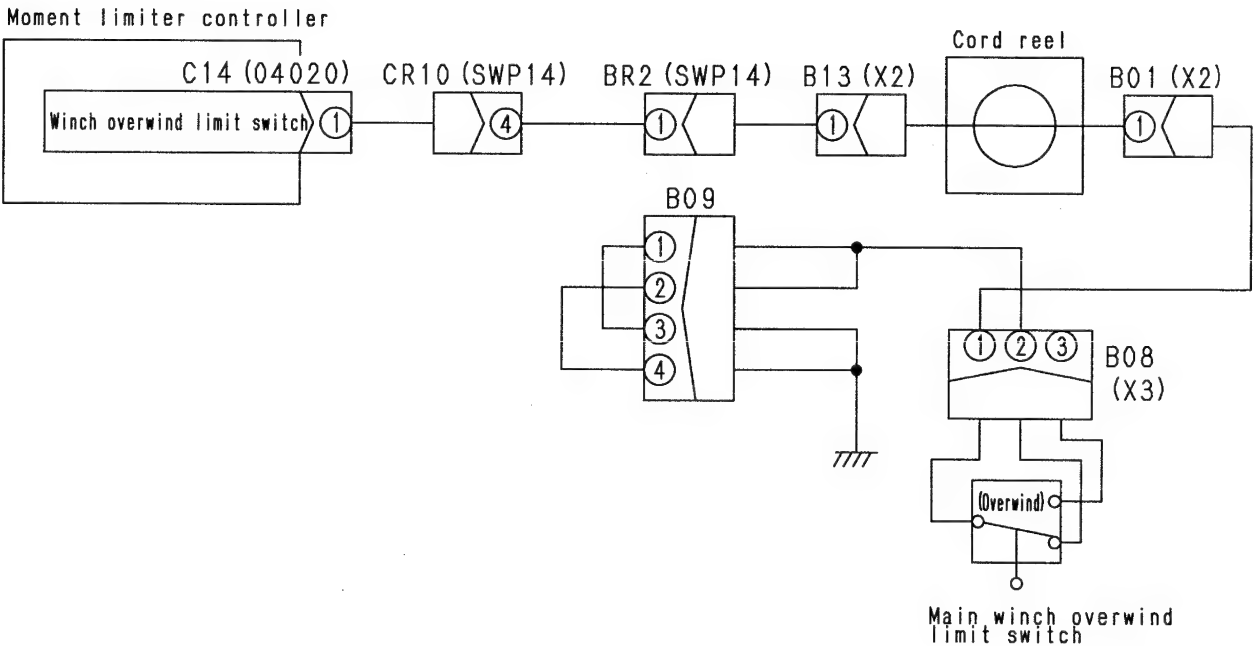
Short circuit with ground

		Cause	Remedy
<div>2 YES</div>		Defective moment limiter controller	Repair or replace
<div>1</div> <div>Is resistance between B08 (male) (1) and chassis ground normal?</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect B08.</div> <div>• Min. 1 MΩ</div> <div>NO</div>		Defective main winch overwind limit switch	Replace
<div>3 YES</div>		Wiring harness between B01 (male) (1) and B08 (female) (1)	Repair or replace
<div>3</div> <div>Is resistance between C14 (female) (1) and chassis ground normal when B08 is disconnected?</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C14.</div> <div>• Min. 1 MΩ</div> <div>NO</div>		Defective cord reel	Replace
<div>4 YES</div>		Wiring harness between C14 (female) (1) - CR10 (4) - BR2 (1) - B13 (female) (1) short circuiting with chassis ground	Repair or replace
<div>4</div> <div>Is resistance between C14 (female) (1) and chassis ground normal when B13 is disconnected?</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect B08.</div> <div>• Min. 1 MΩ</div> <div>NO</div>			

Wiring harness between B01 (male) (1) and B08 (female) (1)

Repair or replace

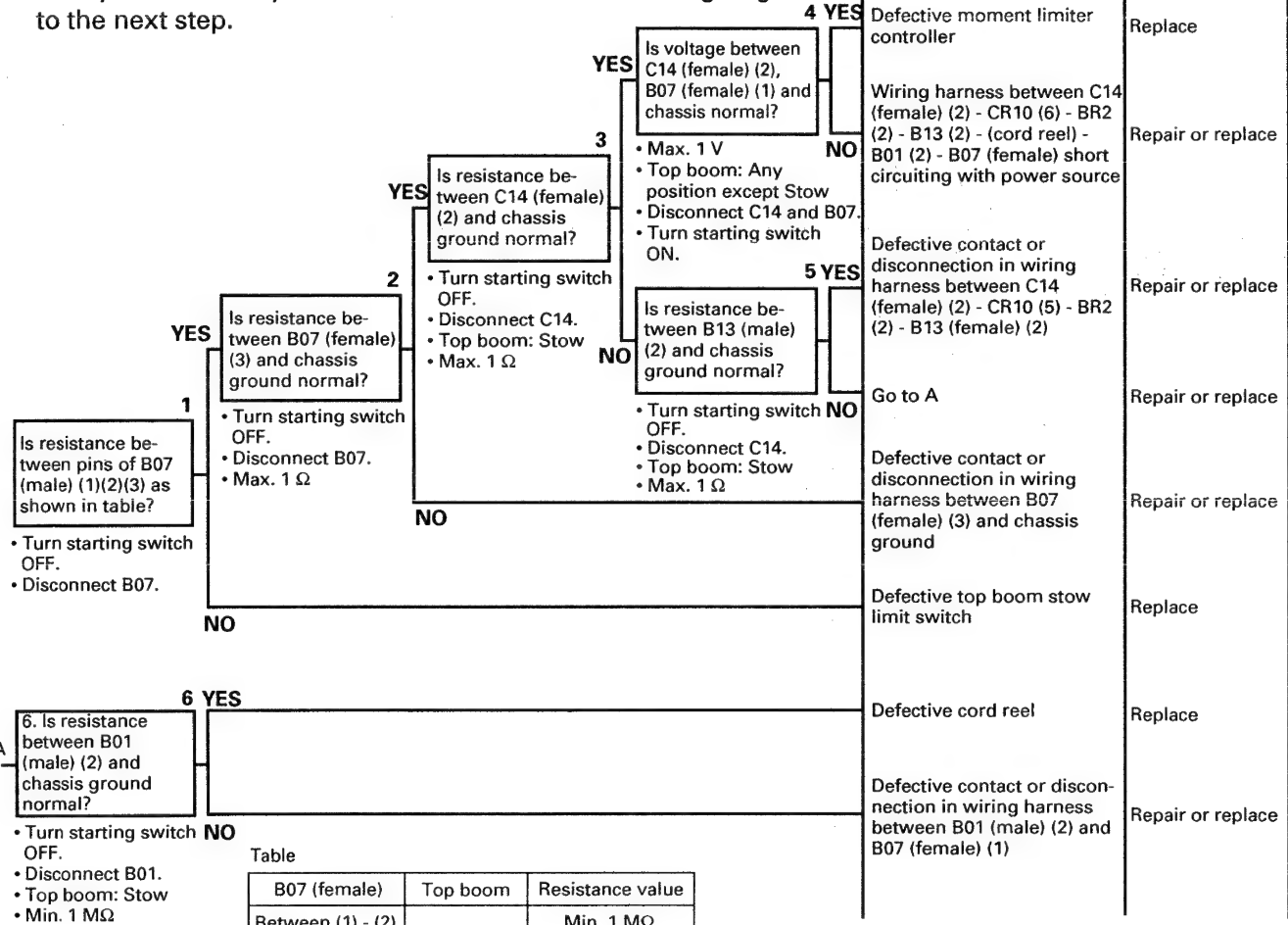
EM-106 d) Related electric circuit diagram



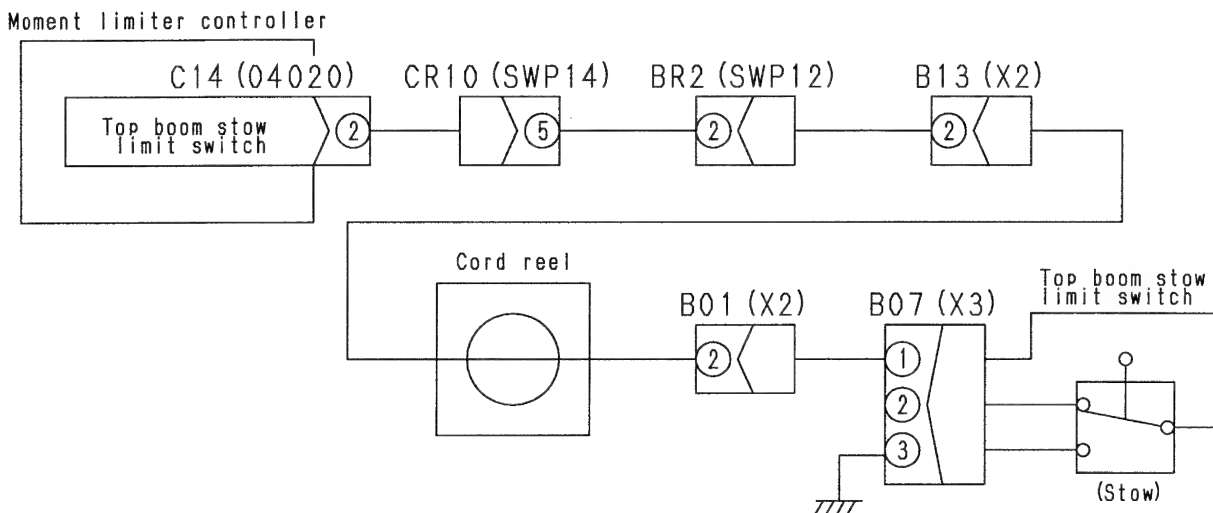
TKL00552

EM-106-1 Lifting capacity is limited (abnormality in top boom stow limit switch)

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

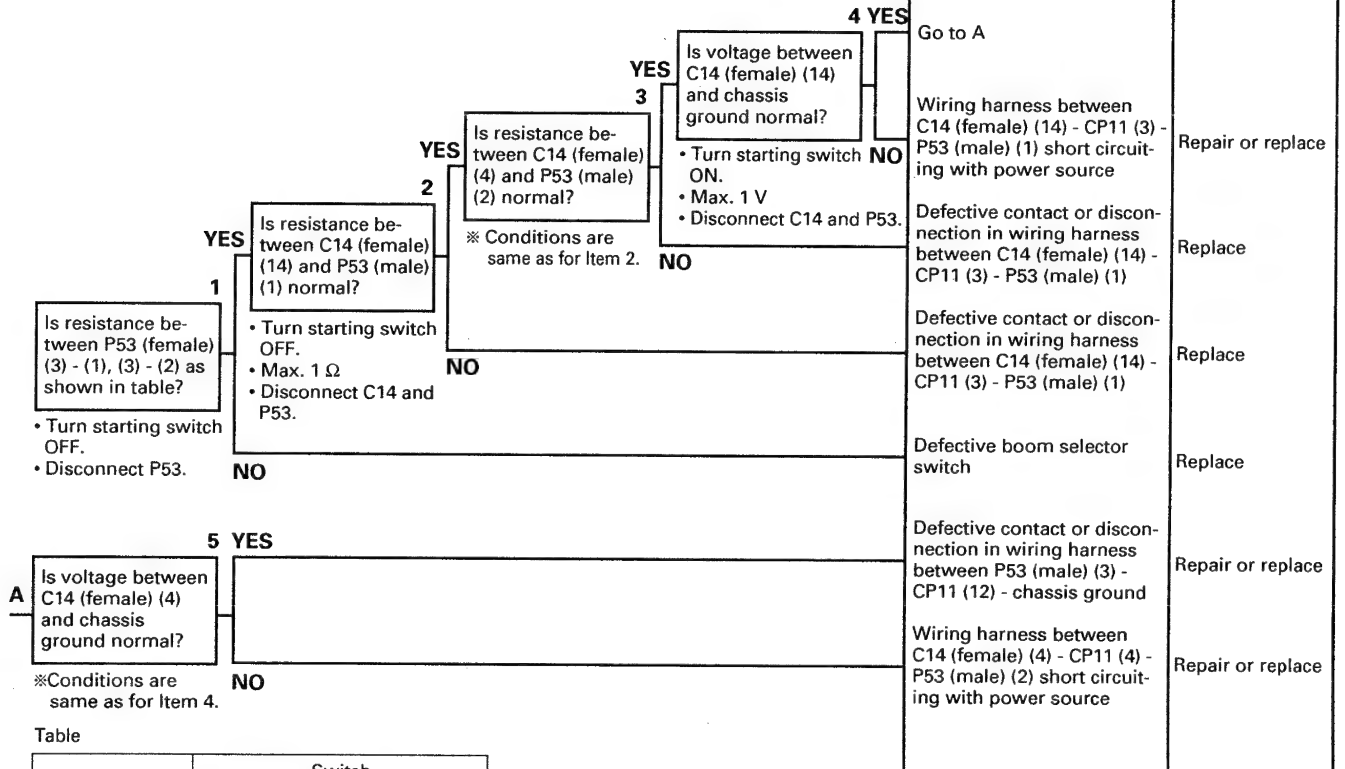


EM-106-1 Related electric circuit diagram

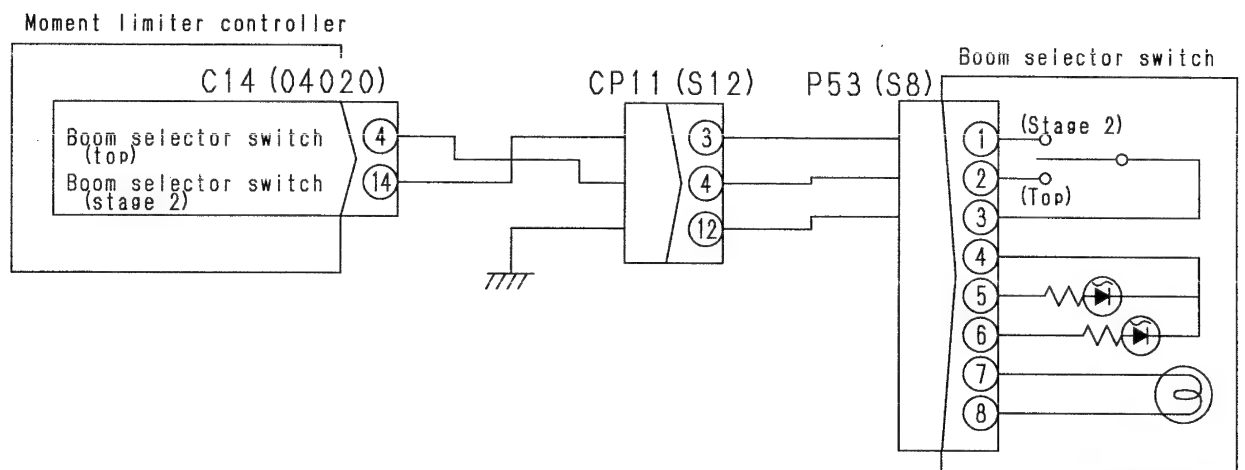


EM-106-2 Boom telescope cannot be selected (top or 2nd) (usual operations are normal) (defective boom selector switch system)

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



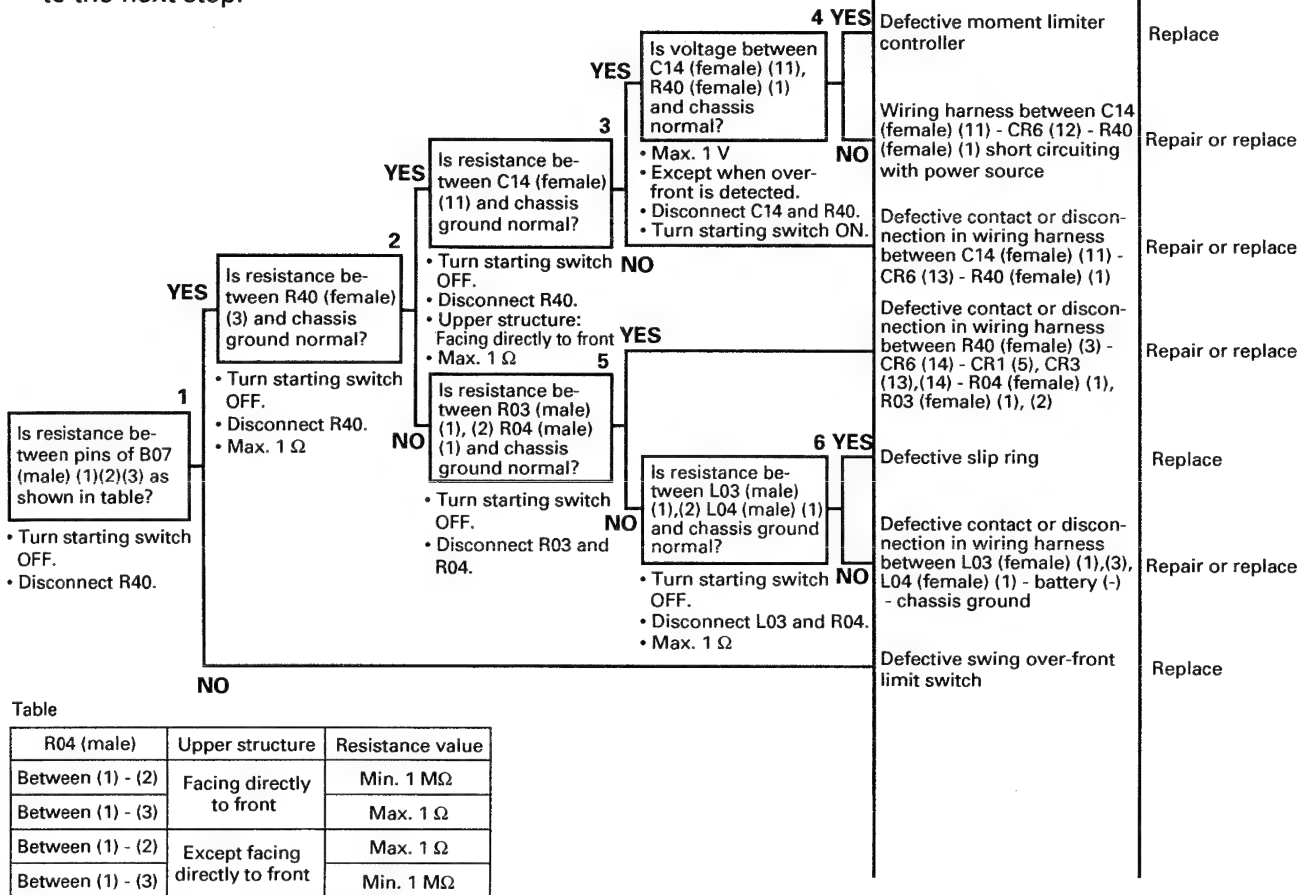
EM-106-2 Related electric circuit diagram



TKL00553

EM-106-3 Abnormality in swing over-front limit switch

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

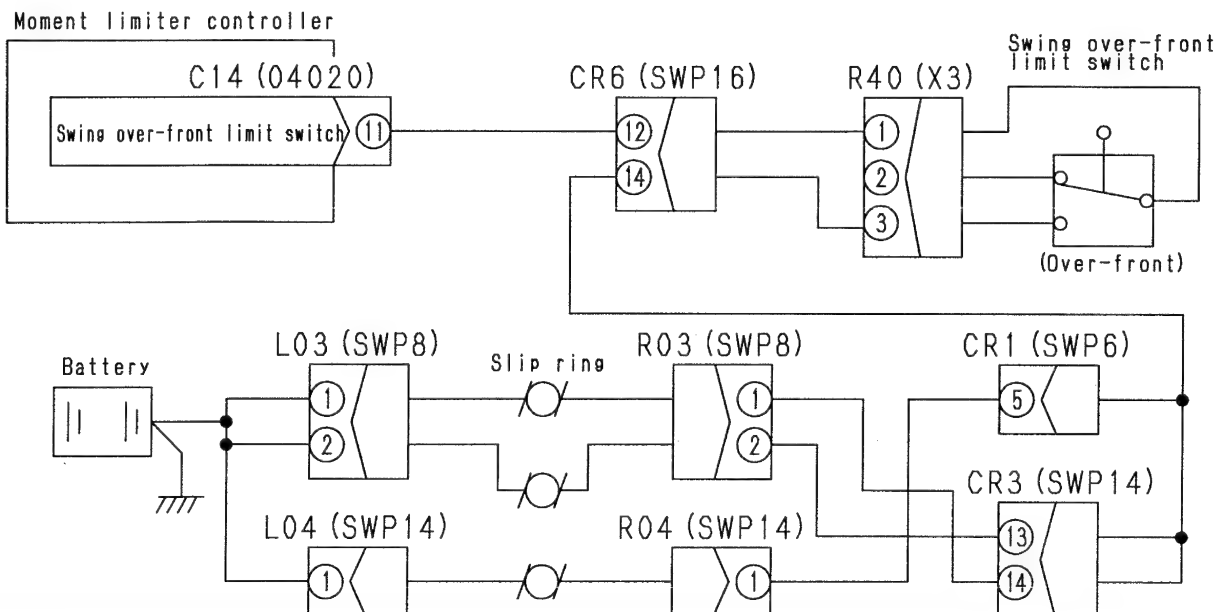


Table

R04 (male)	Upper structure	Resistance value
Between (1) - (2)	Facing directly to front	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω
Between (1) - (2)	Except facing directly to front	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ

- ★ The upper structure is facing directly to the front at the position where it is locked with the lock

EM-106-3 Related electric circuit diagram



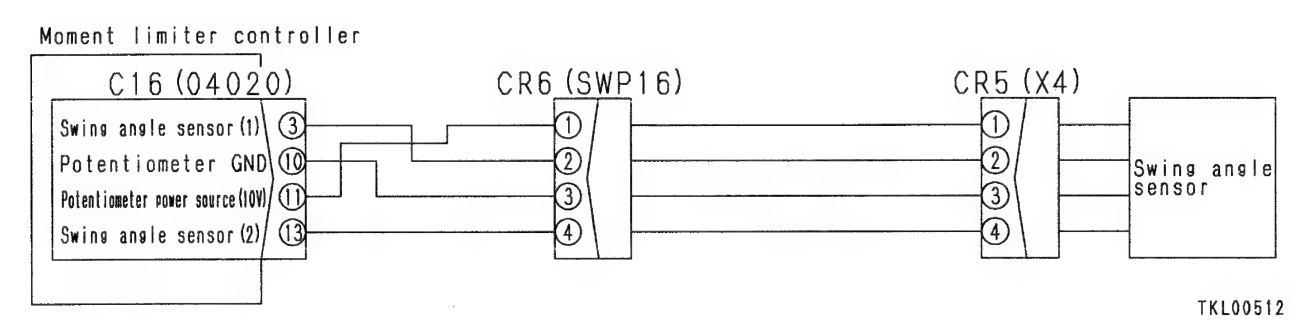
TKL00528

EM-106-4 Abnormality in swing angle sensor (2) system

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

			Cause	Remedy			
<div>1</div> <div>Is voltage between CR5 (1) and (3) normal?</div> <div>• Turn starting switch ON. • PTO switch: Operation 2 • 13 – 17 V</div> <div>YES</div> <div>NO</div>	<div>2</div> <div>Is voltage between CR5 (4) and (3) normal?</div> <div>• Turn starting switch ON. • PTO switch: Operation 2 • 13 – 17 V</div> <div>YES</div> <div>NO</div>	<div>3</div> <div>Is voltage between C16 (13) - (10) normal?</div> <div>※ Conditions are same as for Item 2.</div> <div>YES</div> <div>NO</div>	Defective moment limiter controller	Replace			
			<div>4</div> <div>Is resistance between CR5 (female) (4) and chassis ground normal?</div> <div>• Turn starting switch OFF. • Min. 1 MΩ • Disconnect CR65 and C16.</div> <div>YES</div> <div>NO</div>	Defective contact or disconnection in wiring harness between C16 (female) (13) - CR6 (4) - CR5 (female) (4)	Repair or replace		
				<div>5</div> <div>Is resistance between CR5 (female) (3) and C16 (female) (10) normal?</div> <div>• Turn starting switch OFF. • Max. 1 Ω • Disconnect CR5 and C16.</div> <div>YES</div> <div>NO</div>	Defective swing angle sensor	Replace	
					<div>6</div> <div>Is resistance between CR5 (female) (3) and C16 (female) (10) normal?</div> <div>• Turn starting switch OFF. • Max. 1 Ω • Disconnect CR5 and C16.</div> <div>YES</div> <div>NO</div>	Wiring harness between CR5 (female) (4) - CR6 (4) - C13 (female) (13) short circuiting with chassis ground	Repair or replace
						<div>7</div> <div>Is resistance between CR5 (female) (3) and C16 (female) (10) normal?</div> <div>• Turn starting switch OFF. • Max. 1 Ω • Disconnect CR5 and C16.</div> <div>YES</div> <div>NO</div>	Wiring harness between CR5 (female) (4) - CR6 (4) - C13 (female) (13) short circuiting with power source
			<div>8</div> <div>Is resistance between CR5 (female) (3) and C16 (female) (10) normal?</div> <div>• Turn starting switch OFF. • Max. 1 Ω • Disconnect CR5 and C16.</div> <div>YES</div> <div>NO</div>	Abnormality in power source (carry out troubleshooting for EM-16)	—		
<div>9</div> <div>Is resistance between CR5 (female) (3) and C16 (female) (10) normal?</div> <div>• Turn starting switch OFF. • Max. 1 Ω • Disconnect CR5 and C16.</div> <div>YES</div> <div>NO</div>	Defective contact or disconnection in wiring harness between CR5 (female) (3) - CR6 (3) - C16 (female) (10)	Repair or replace					

EM-106-4 Related electric circuit diagram



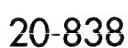
TKL00512

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy	
<p>1</p> <p>Is resistance between C120 (male) (1) and (2) normal?</p> <p>YES</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect C120.</p> <p>• 30 – 110 Ω</p> <p>NO</p>	<p>2</p> <p>Is resistance between R68 (female) and R66 (male) as shown in Table?</p> <p>YES</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect R68 and R66.</p> <p>NO</p>	<p>3</p> <p>Is resistance between C120 (female) (2) and chassis ground normal?</p> <p>YES</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect R66.</p> <p>• 30 – 110 Ω</p> <p>NO</p>	<p>4</p> <p>Is resistance between R66 (female) (2) and chassis ground normal?</p> <p>YES</p> <p>Defective contact or disconnection in wiring harness between C34 (female) (5) - C22 (11) - CR11 (13) - R68 (male)</p> <p>NO</p> <p>Defective contact or disconnection in wiring harness between R66 (female) - JR11 (14) - C116 (3) - C120 (female) (1)</p> <p>Defective contact or disconnection in wiring harness between C120 (female) (2) - C116 (2) - chassis ground</p>	<p>Repair or replace</p> <p>Repair or replace</p> <p>Repair or replace</p>
			Defective main winch brake limit switch	Replace
			Defective main winch free-fall interlock solenoid	Replace

	Work equipment lever stand	Resistance value
Between R68 (female) - R66 (male)	Advance	Min. 1 MΩ
	Depress	Max. 1 Ω

023S02

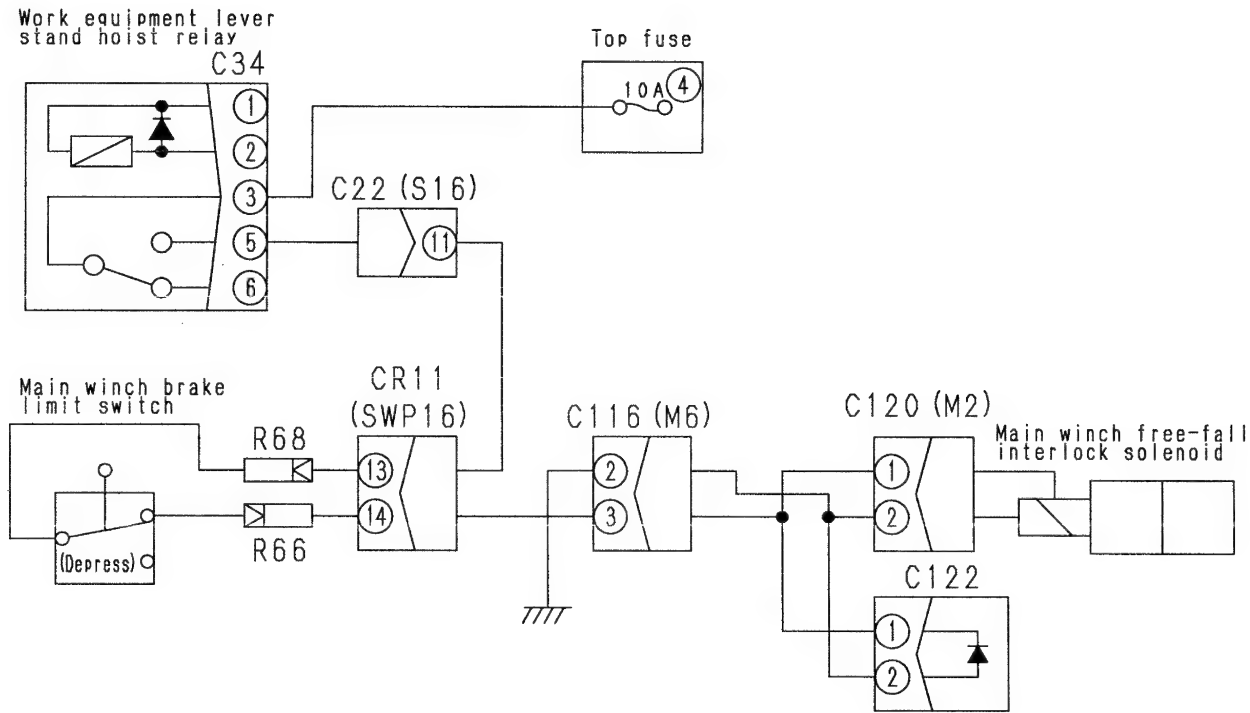


b) Remains in free-fall condition (short circuit with power source)

		Cause	Remedy
<div> <div> <div>1</div> <div>Is voltage between R66 (male) and chassis ground normal?</div> </div> <div> <div>2 YES</div> <div>Is voltage between C120 and chassis ground normal when R66 is disconnected?</div> </div> </div> <div> <div>NO</div> <div>Conditions and standard values are same as for Item 1.</div> </div>	YES	Defective main winch free-fall interlock solenoid	Replace
	NO	Wiring harness between R66 (female) - CR11 (14) - C116 (3) - C120 (female) (1) short circuiting with power source	Repair or replace
	NO	Defective main winch brake limit switch	Replace

- Disconnect R66.
- Turn starting switch ON.
- PTO switch: Operation 2
- Work equipment lever stand: Raised
- Brake pedal: Depress
- Max. 1 V

EM-107 Related electric circuit diagram



TKL00554

EM-108 Auxiliary winch does not switch to free-fall or remains in free-fall condition (abnormality in auxiliary winch free-fall interlock solenoid system)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Does not switch to free-fall (disconnection, short circuit with chassis ground)

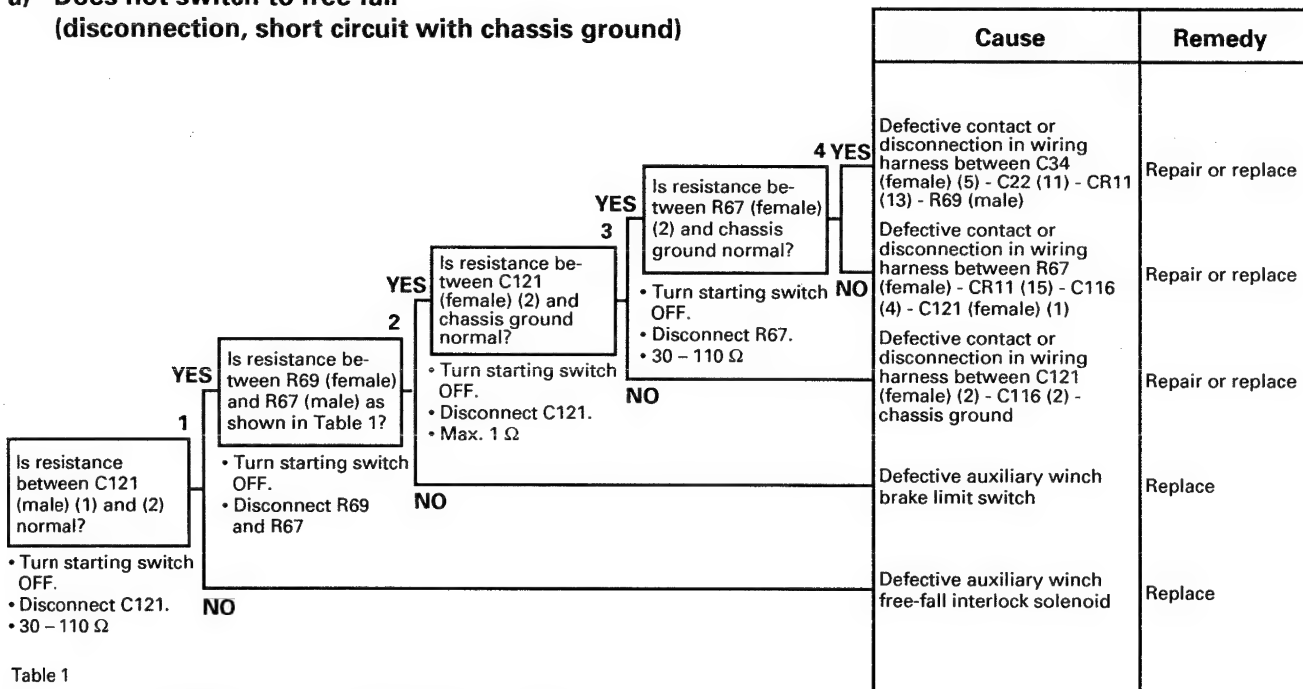


Table 1

	Auxiliary winch brake pedal	Resistance value
Between R69 (female) - R67 (male)	Release	Min. 1 M Ω
	Depress	Max. 1 Ω

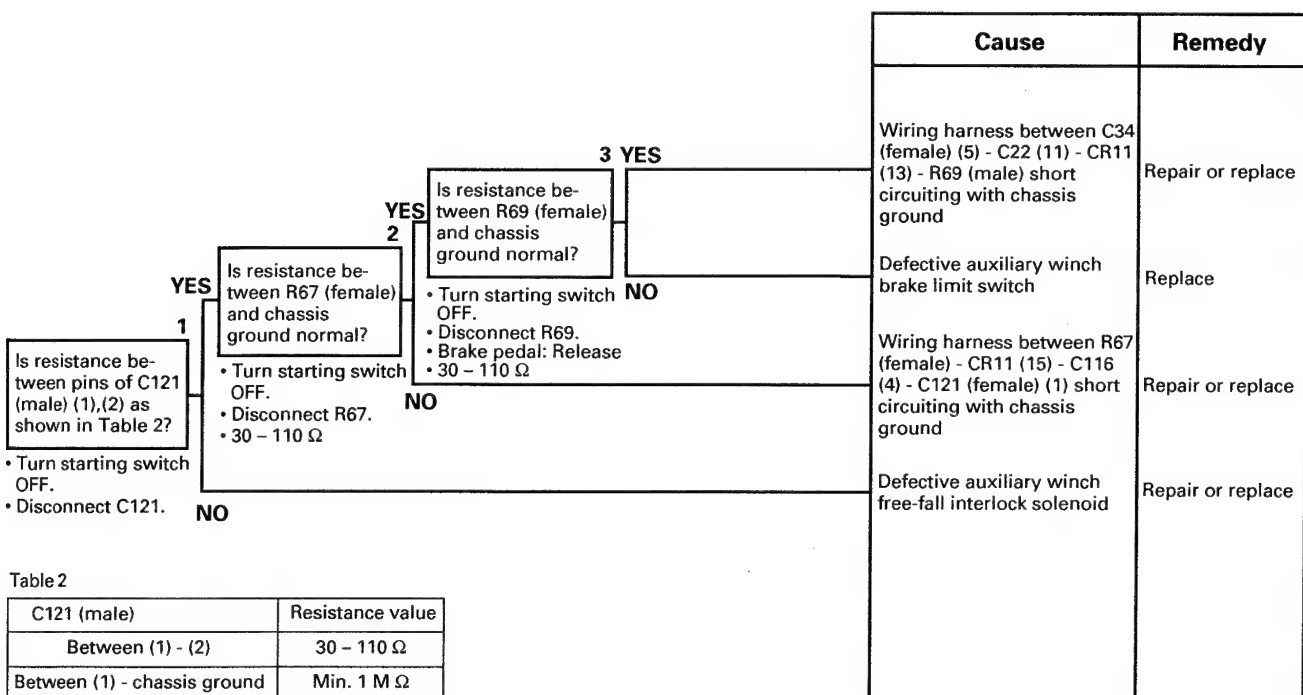
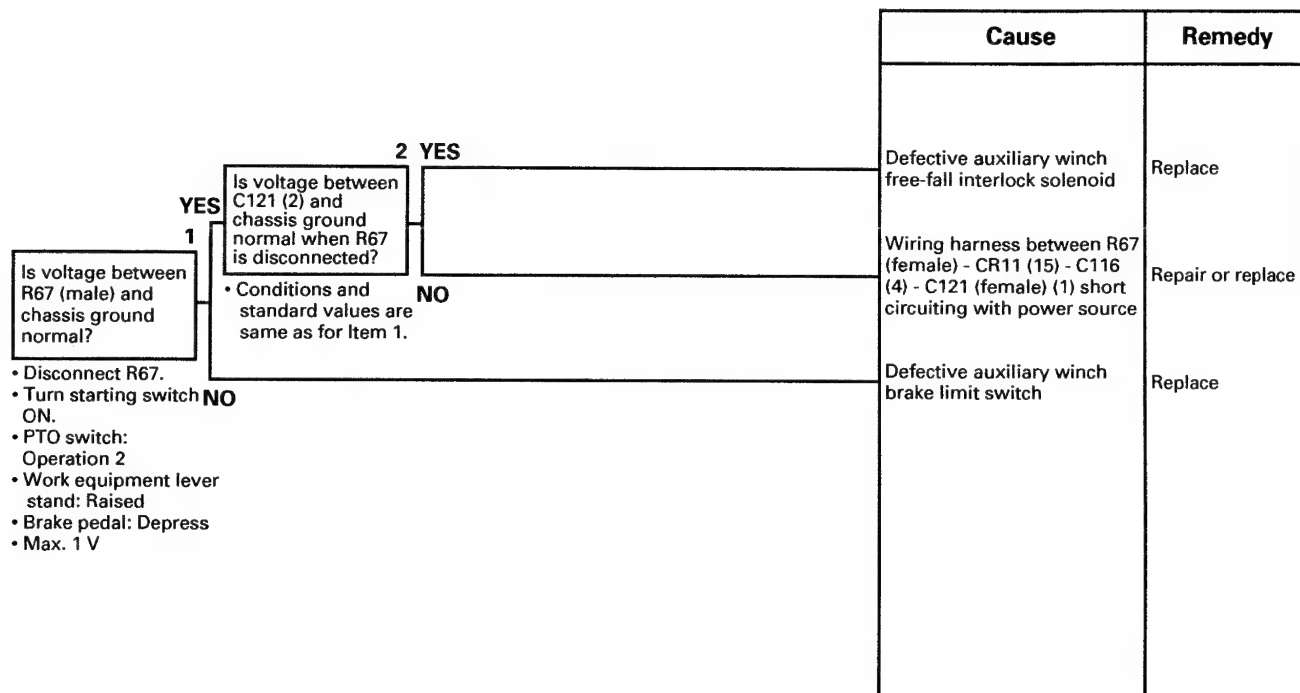


Table 2

C121 (male)	Resistance value
Between (1) - (2)	30 – 110 Ω
Between (1) - chassis ground	Min. 1 M Ω

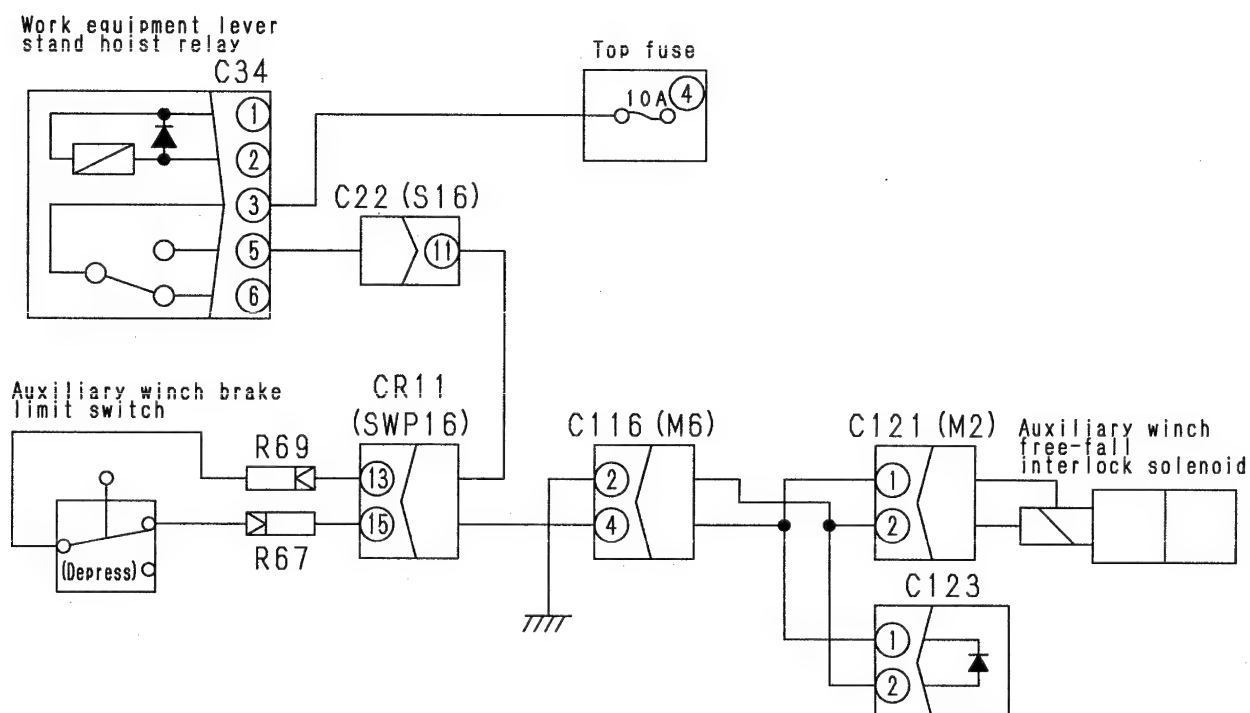
023S02

b) Remains in free-fall condition (short circuit with power source)



023S02

EM-108 Related electric circuit diagram

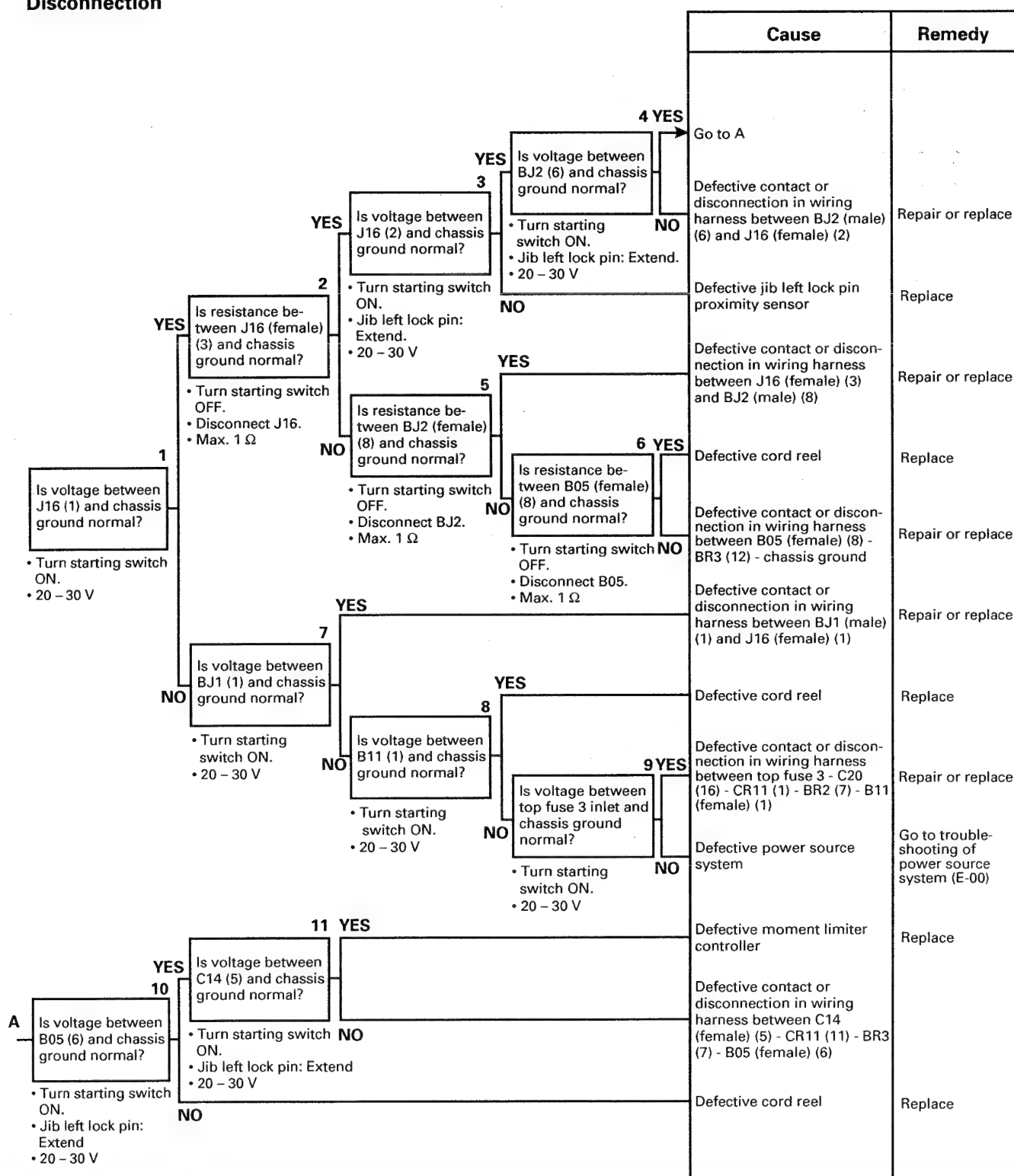


TKL00555

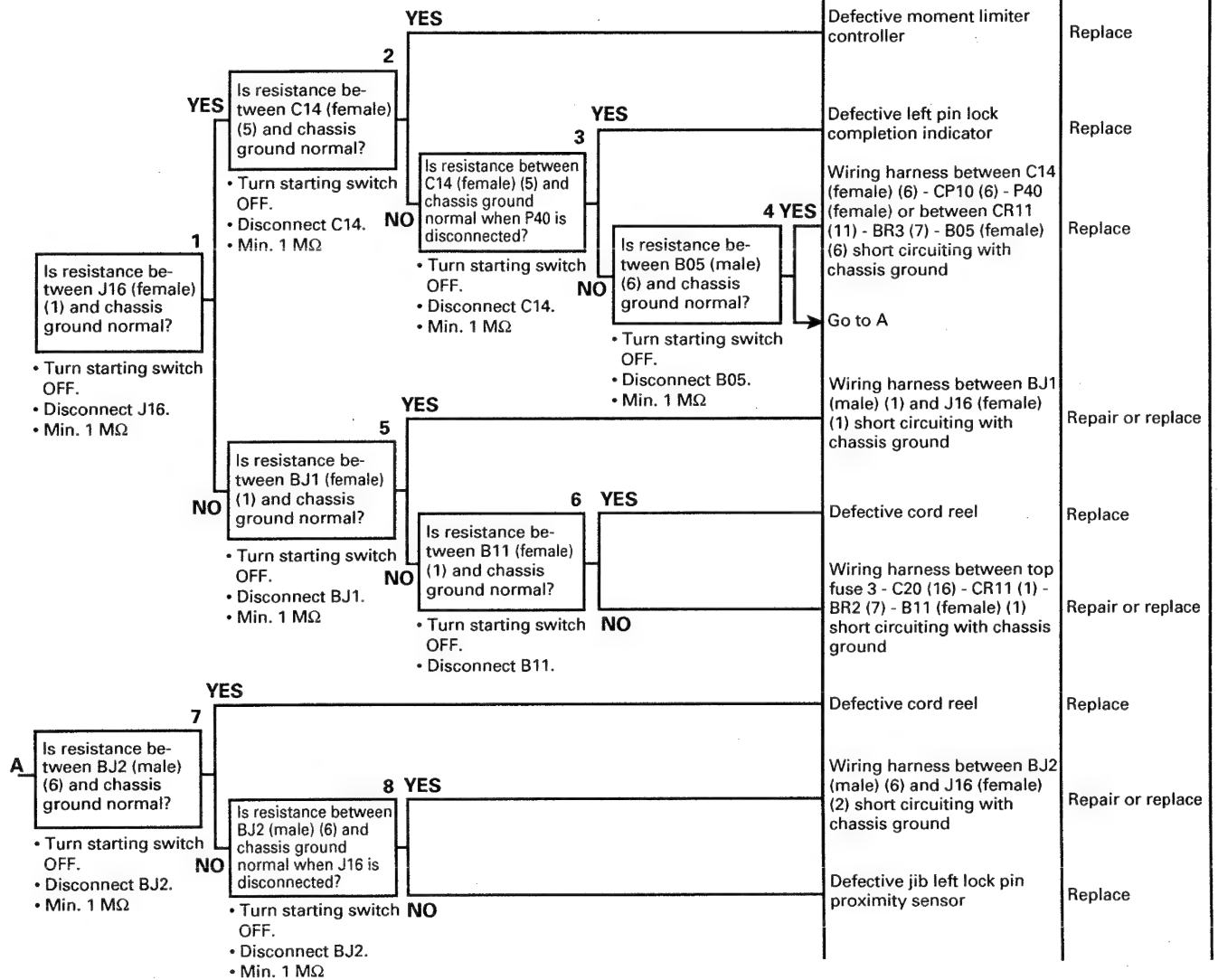
EM-109 Abnormality in jib left lock pin proximity sensor system

- ★ When no error code is displayed.
- ★ Check that top fuse 18 is not blown. (If it is blown, carry out troubleshooting for “Short circuit with chassis ground”.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

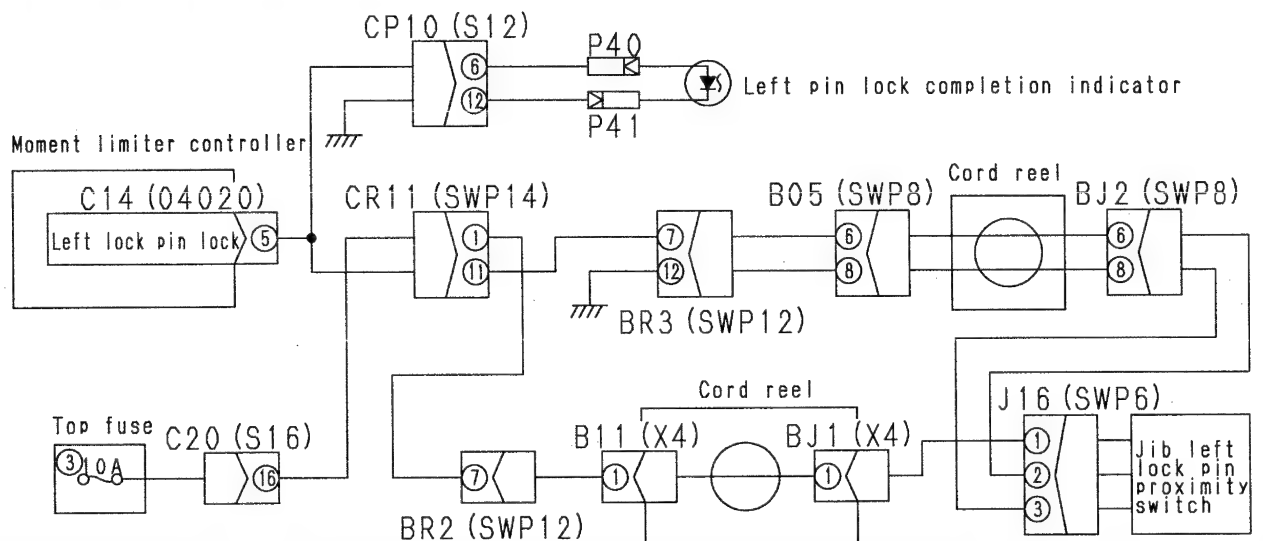
Disconnection



Short circuit with chassis ground



EM-109 Related electric circuit diagram

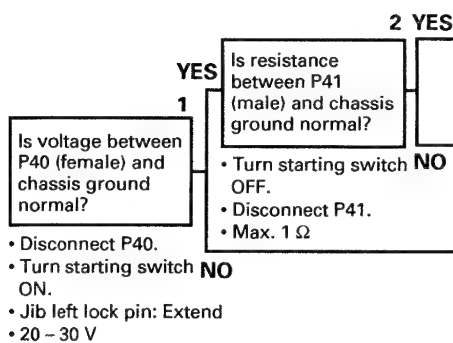


TKL00531

EM-110 Abnormality in left lock pin completion indicator system

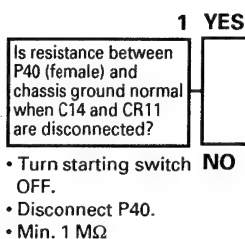
- ★ When no error code is displayed.
- ★ Check that the jib left lock pin proximity is normal. (If there is any abnormality, carry out troubleshooting for that problem first.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection



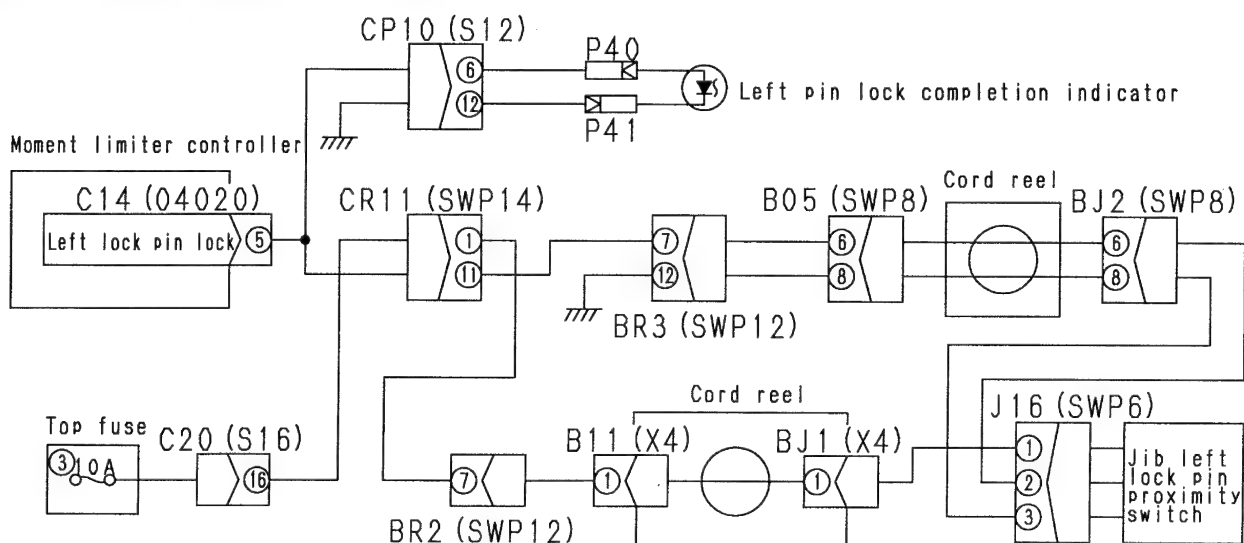
Cause	Remedy
Defective left pin lock completion indicator	Replace
Defective contact or dis-connection in wiring harness between P41 (male) - CP10 (12) - chassis ground	Repair or replace
Defective contact or dis-connection in wiring harness between C14 (female) (5) - CP10 (6) - P40 (female)	Repair or replace

Short circuit with chassis ground



Cause	Remedy
Defective left pin lock completion indicator	Replace
Wiring harness between C14 (female) (5) - CP10 (6) - P40 (female) short circuiting with chassis ground	Repair or replace

EM-110 Related electric circuit diagram



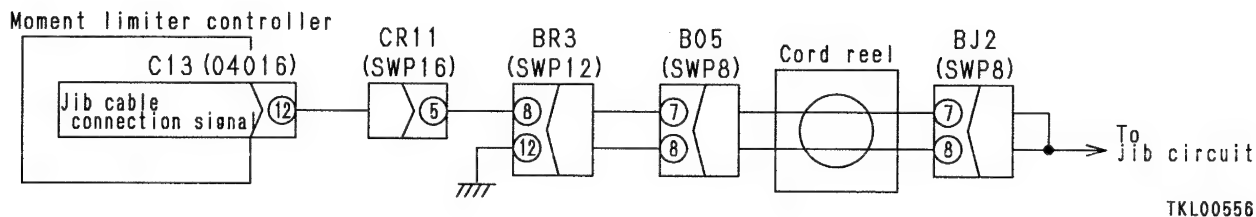
TKL00531

EM-111 Abnormality in jib cable connection signal system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
023S02	1 Is resistance between C13 (female) (12) and BJ2 (female) (7) normal? • Turn starting switch OFF. • Disconnect C13 and BJ2. • Connect BJ2. • Max. 1 Ω		
	YES 2 Is resistance between BJ2 (female) (8) and chassis ground normal? • Turn starting switch OFF. • Disconnect BJ2. • Max. 1 Ω		
	YES 3 Is resistance between C13 (female) (12) and chassis ground normal when BJ2 is disconnected? • Turn starting switch OFF. • Disconnect C13. • Min. 1 MΩ		
	YES 4 Is voltage between C13 (female) (12) and chassis ground normal? • Turn starting switch ON. • Max. 1 V • Disconnect C13 and BJ2.	4 YES Defective moment limiter controller Replace	
	NO 5 Is resistance between B05 (male) (7) and chassis ground normal when BJ2 is disconnected? • Turn starting switch OFF. • Disconnect B05. • Min. 1 MΩ	5 YES Wiring harness between C13 (female) (12) - CR11 (6) - BR3 (8) - B05 (7) - cord reel - BJ2 (7) short circuiting with power source Repair or replace	
	NO 6 Is resistance between B05 (male) (7) - BJ2 (female) (7) normal? • Turn starting switch OFF. • Disconnect B05 and BJ2. • Max. 1 Ω	6 YES Wiring harness between C13 (female) (12) - CR11 (5) - BR3 (8) - B05 (female) (7) short circuiting with chassis ground Replace	
		NO Defective cord reel including wiring harness between B05 (male) (7) - BJ2 (female) (7) Repair or replace	
		Defective contact or disconnection in wiring harness between BJ2 (female) (7) - cord reel - B05 (8) - BR3 (12) - chassis ground Repair or replace	
		Defective contact or disconnection in wiring harness between C13 (female) (12) - CR11 (5) - BR3 (8) - B05 (female) (7) Repair or replace	
		Defective contact or disconnection in wiring harness between B05 (male) (7) - cord reel - BJ2 (female) (7) Repair or replace	

EM-111 Related electric circuit diagram



EM-112 Abnormality in jib automatic EXTEND/STOW relay system

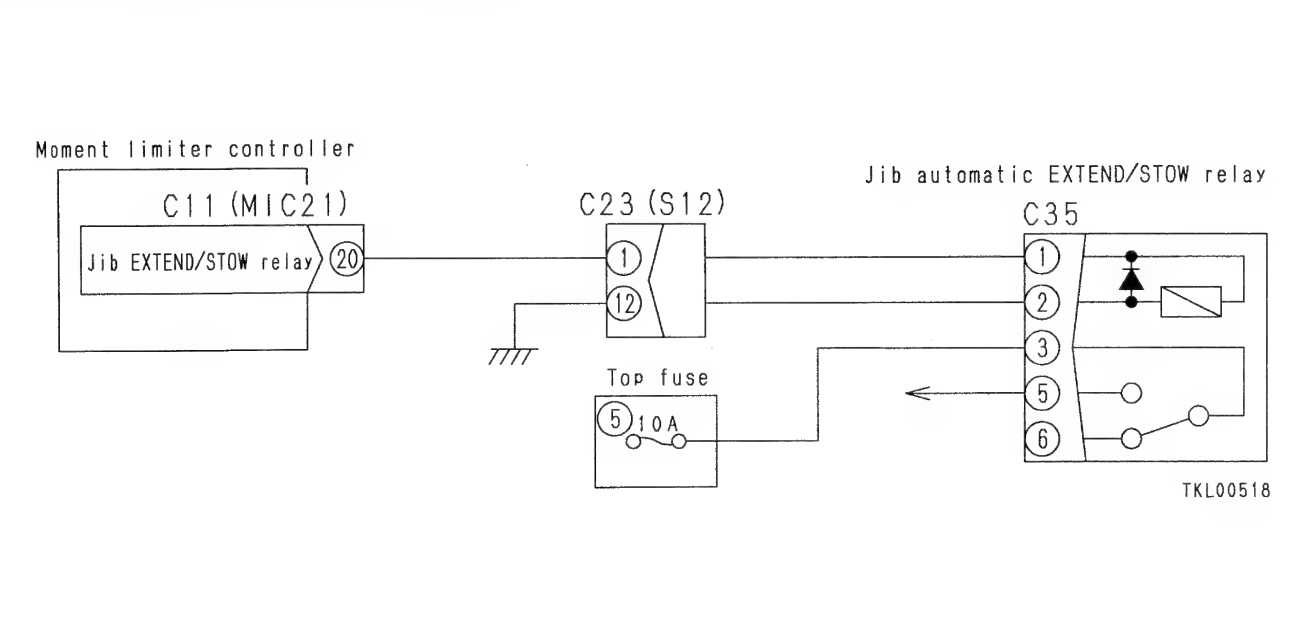
- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

			Cause	Remedy
<div> <div> <div>1</div> <div>Is resistance between C35 (female) (1) and (2) normal?</div> <div> • Turn starting switch OFF. • Disconnect C35. • 200 – 400 Ω </div> </div> <div> <div>YES</div> <div>Is resistance between C35 (female) (2) and chassis ground normal?</div> <div> • Turn starting switch OFF. • Disconnect C35. • Max. 1 Ω </div> </div> <div> <div>NO</div> <div>Is resistance between C11 (female) (20) and chassis ground normal?</div> <div> • Turn starting switch OFF. • Disconnect C11. • 290±29 Ω </div> </div> </div>	<div> <div>3 YES</div> <div>Defective moment limiter controller</div> </div>	<div> <div>Replace</div> </div>	<div> <div>Defective contact or disconnection in wiring harness between C11 (female) (20) - C23 (1) - C35 (female) (1)</div> <div>Defective contact or disconnection in wiring harness between C35 (female) (2) - C23 (12) - chassis ground</div> <div>Defective jib automatic EXTEND/STOW relay</div> </div>	<div> <div>Repair or replace</div> <div>Repair or replace</div> <div>Replace</div> </div>

023S02

EM-112 Related electric circuit diagram



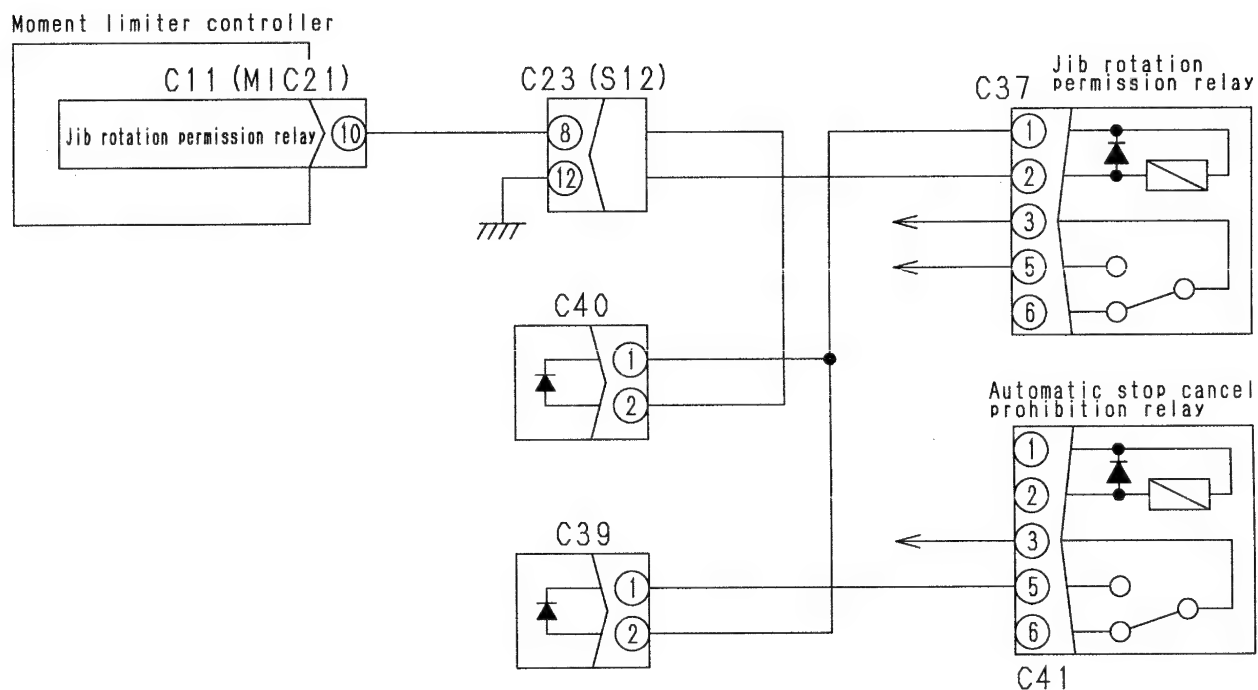
EM-113 Abnormality in jib rotation permission relay system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

		Cause	Remedy
<div><div>1</div><div>Is resistance between C37 (female) (1) and (2) normal?</div><div><div>• Turn starting switch OFF.</div><div>• Disconnect C37.</div><div>• 200 – 400 Ω</div></div><div>YES</div><div>2</div><div>Is resistance between C37 (female) (2) and chassis ground normal?</div><div><div>• Turn starting switch OFF.</div><div>• Disconnect C37.</div><div>• Max. 1 Ω</div></div><div>YES</div><div>3</div><div>Is resistance between C11 (female) (10) and chassis ground normal?</div><div><div>• Turn starting switch OFF.</div><div>• Disconnect C11.</div><div>• 290±29 Ω</div></div><div>YES</div><div>NO</div></div>		<div>Defective moment limiter controller</div> <div>Defective contact or disconnection in wiring harness between C11 (female) (10) - C23 (8) - C40 (2)(1) - C37 (female) (1)</div> <div>Defective contact or disconnection in wiring harness between C37 (female) (2) - C23 (12) - chassis ground</div> <div>Defective jib rotation permission relay</div>	<div>Replace</div> <div>Repair or replace</div> <div>Repair or replace</div> <div>Replace</div>

EM-113 Related electric circuit diagram

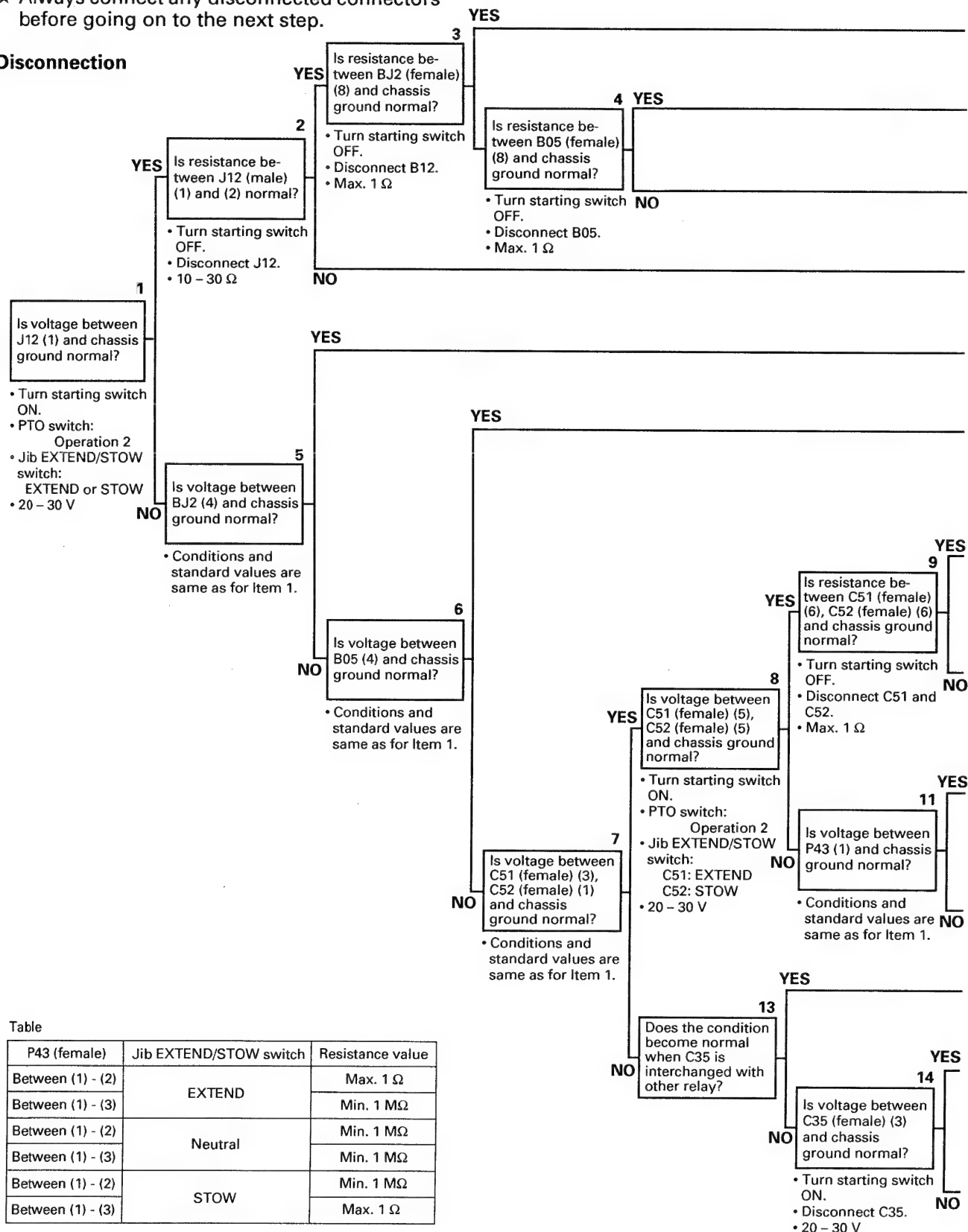


TKL00519

EM-114 Abnormality in jib selector solenoid system

- ★ When no error code is displayed.
 - ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for “Short circuit with chassis ground”.)
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- YES
☐

Disconnection



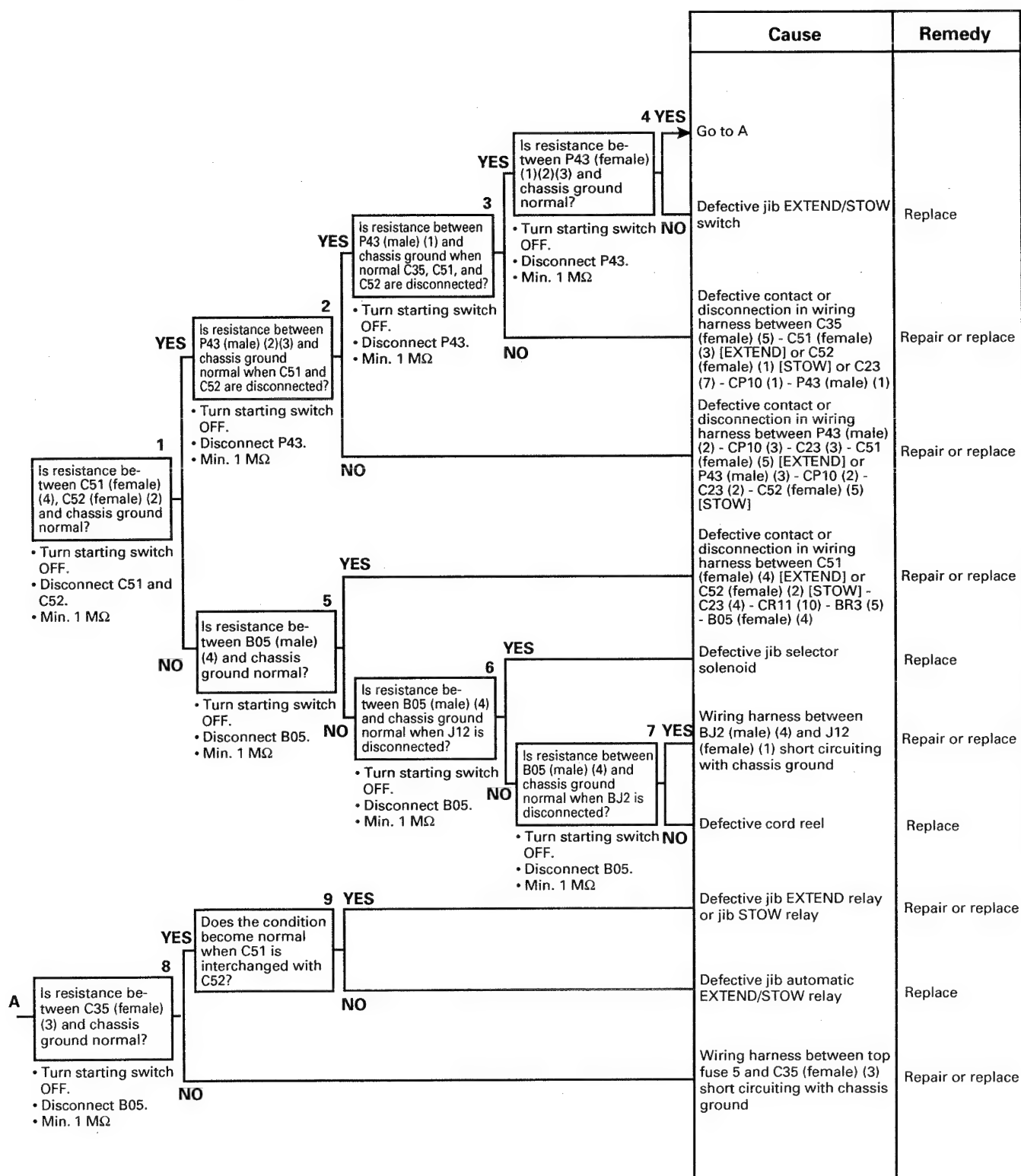
Table

P43 (female)	Jib EXTEND/STOW switch	Resistance value
Between (1) - (2)	EXTEND	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Neutral	Min. 1 MΩ
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	STOW	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

023S02

		Cause	Remedy
		Defective contact or disconnection in wiring harness between J12 (female) (2) and BJ2 (male) (8)	Repair or replace
		Defective cord reel	Replace
		Defective contact or disconnection in wiring harness between B05 (female) (8) - BR3 (12) - chassis ground	Repair or replace
		Defective jib selector solenoid	Replace
		Defective contact or disconnection in wiring harness between BJ2 (male) (4) and J12 (female) (1)	Repair or replace
		Defective cord reel	Replace
Does the condition become normal when C51 is interchanged with C52?	10 YES	Defective jib EXTEND relay or jib STOW relay	Replace
	NO	Defective contact or disconnection in wiring harness between C51 (female) (4) [EXTEND] or C52 (female) (2) [STOW] - C23 (4) - CR11 (10) - BR3 (5) - B05 (female) (4)	Repair or replace
		Defective contact or disconnection in wiring harness between C51 (female) (6) [EXTEND] or C52 (female) (6) [STOW] - C23 (12) - chassis ground	Repair or replace
Is resistance between pins of P43 (female) (1)(2)(3) as shown in Table 1?	12 YES	Defective contact or disconnection in wiring harness between P43 (male) (2) - CP10 (3) - C23 (3) - C51 (female) (5) [EXTEND] or between P43 (male) (3) - CP10 (2) - C23 (2) - C552 (female) (5) [STOW]	Repair or replace
	NO	Defective jib EXTEND/STOW switch	Replace
<ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect P43. 		Go to Troubleshooting No. 14	
		Defective jib automatic EXTEND/STOW relay	Replace
		Defective contact or disconnection in wiring harness between C35 (female) (5) and C51 (female) (3) [EXTEND] or C52 (female) (1) [STOW]	Repair or replace
Is voltage between top fuse 5 inlet and chassis ground normal?	15 YES	Defective contact or disconnection in wiring harness between top fuse 5 and C35 (female) (3)	Repair or replace
	NO	Defective power source system	Go to Troubleshooting of power source system (E-1)
<ul style="list-style-type: none"> • Turn starting switch ON. • 20 - 30 V 			

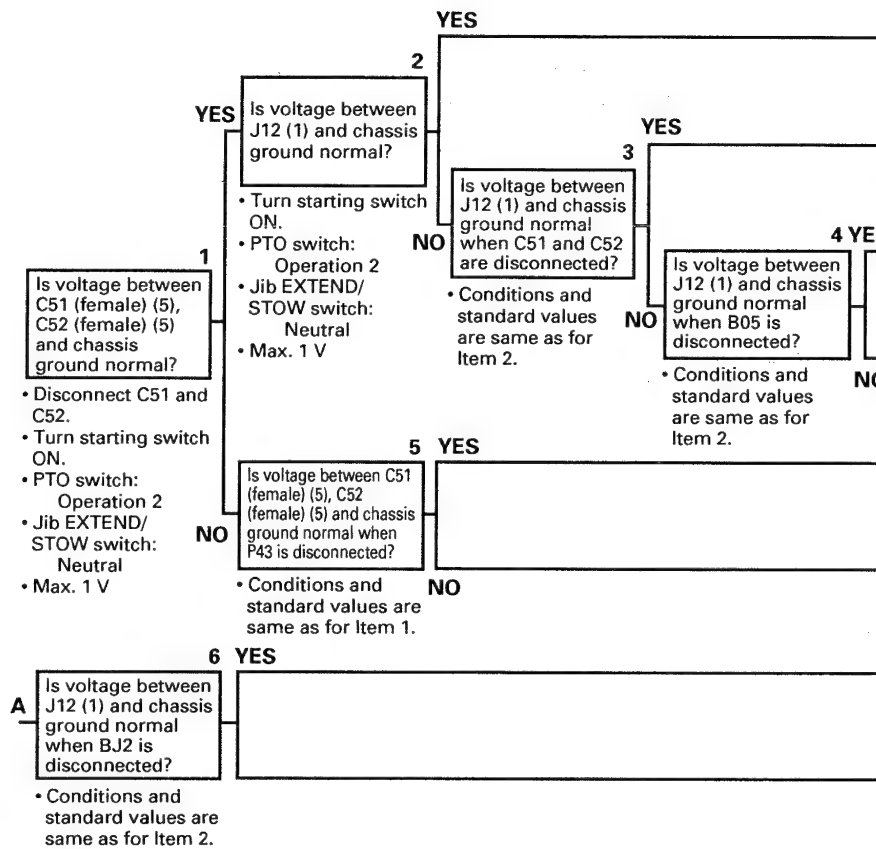
Short circuit with chassis ground



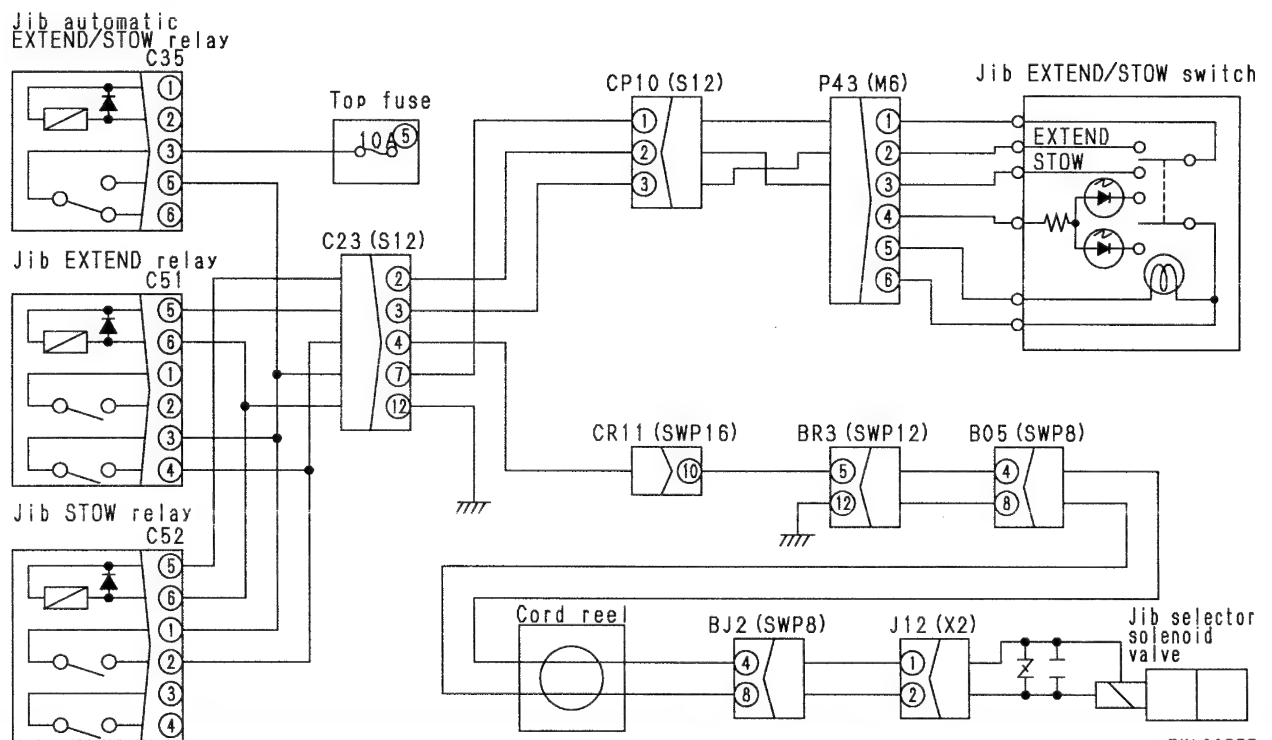
023S02

Short circuit with power source

Cause	Remedy
Defective jib selector solenoid	Replace
Defective jib EXTEND relay or jib STOW relay	Replace
Wiring harness between C51 (female) (4) [EXTEND] or C52 (female) (2) [STOW] - C23 (4) - CR11 (10) - BR3 (5) - B05 (female) (4) short circuiting with power source	Go to A
Defective jib EXTEND/STOW switch	Replace
Wiring harness between P43 (male) (2) - CP10 (3) - C23 (3) - C51 (female) (5) [EXTEND] or P43 (male) (3) - CP10 (2) - C23 (2) - C52 (female) (5) [STOW] short circuiting with power source	Repair or replace
Defective cord reel	Replace
Wiring harness between BJ2 (male) (4) and J12 (female) (1) short circuiting with power source	Repair or replace



EM-114 Related electric circuit diagram

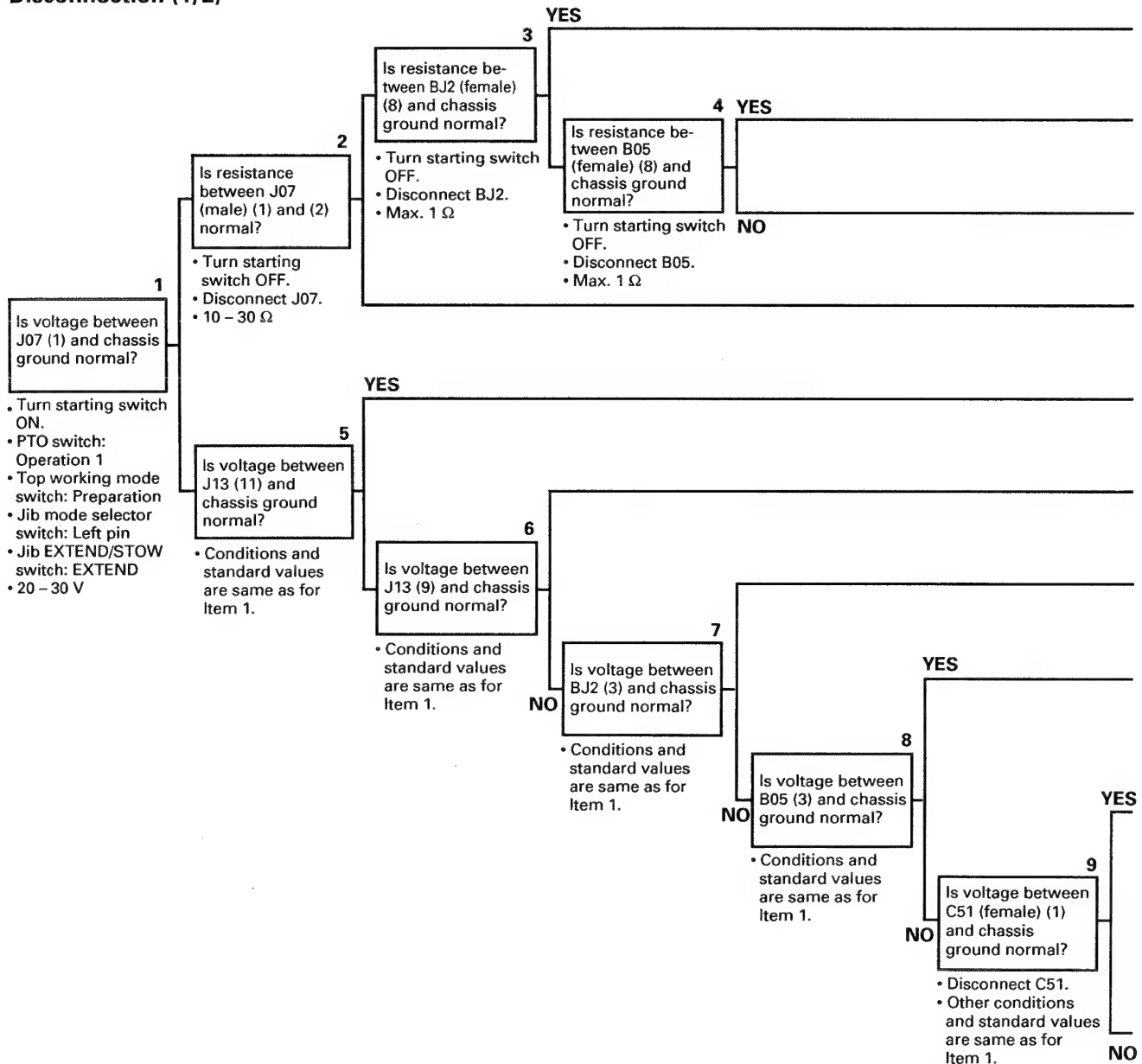


TKL00557

EM-115 Abnormality in jib left lock pin solenoid (EXTEND) system

- ★ When no error code is displayed.
- ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection (1/2)

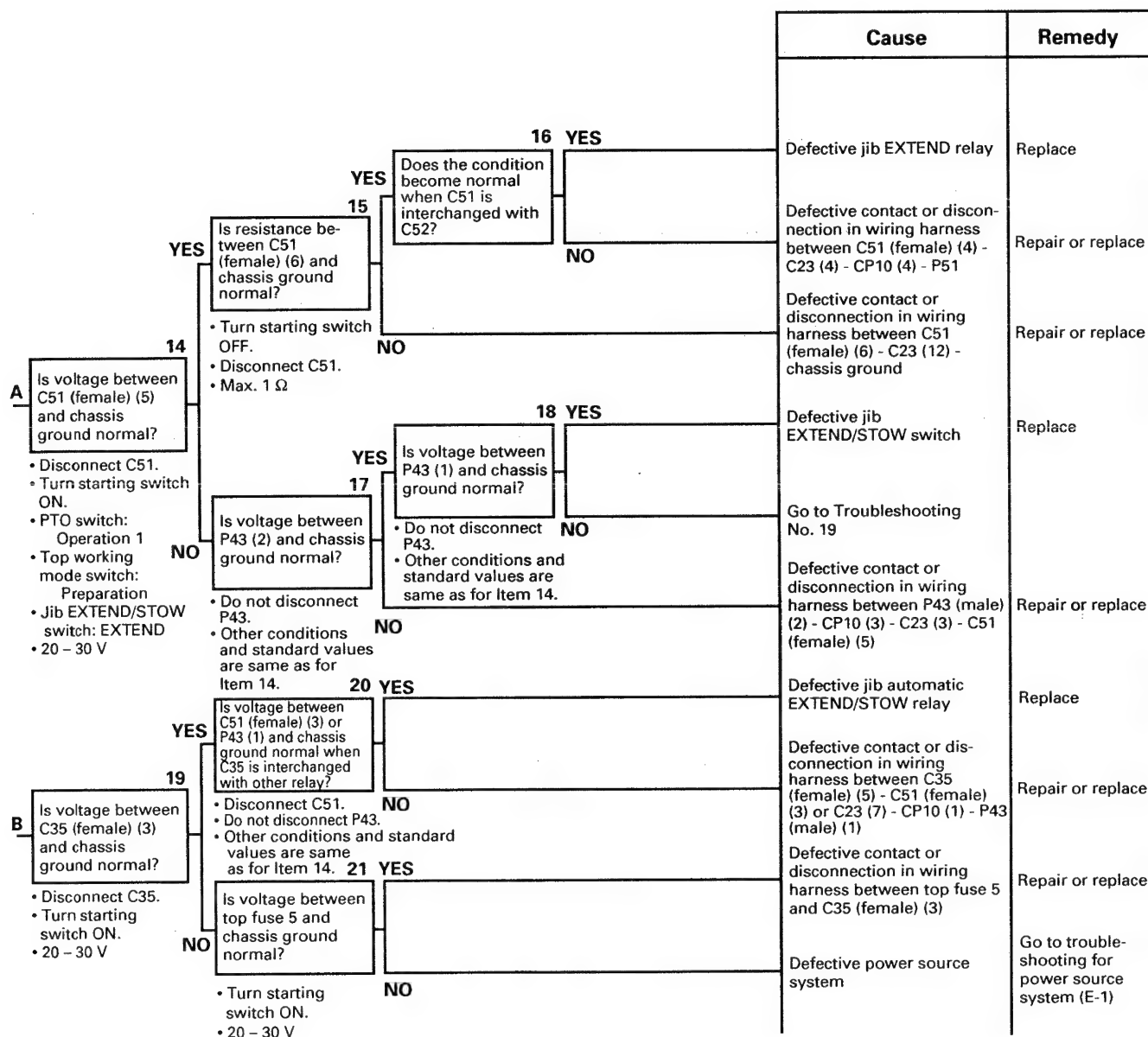


023S02

023S02

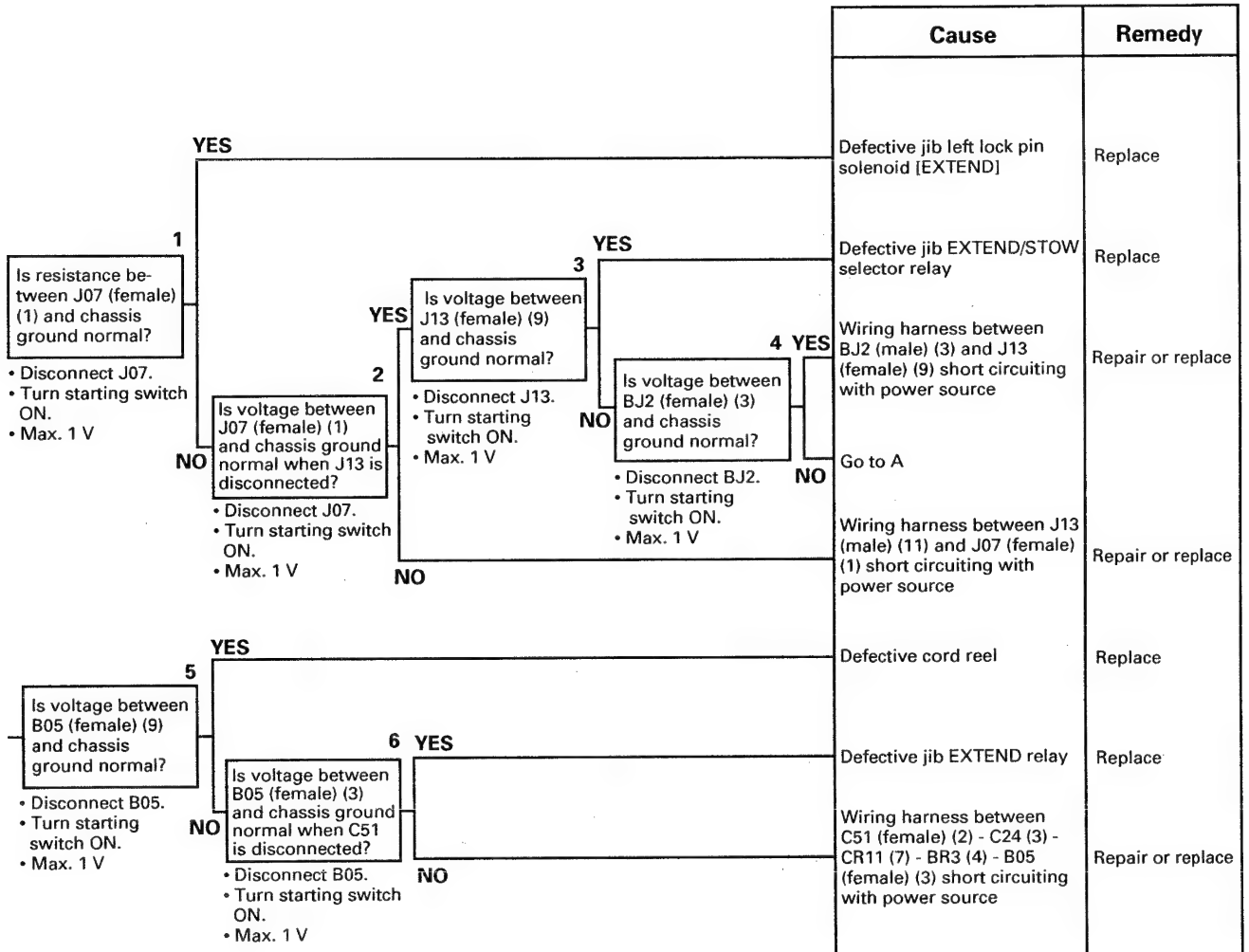
	Cause	Remedy
	Defective contact or disconnection in wiring harness between J07 (female) (2) and BJ2 (male) (8)	Repair or replace
	Defective cord reel	Replace
	Defective contact or disconnection in wiring harness between B05 (female) (8) - BR3 (12) - chassis ground	Repair or replace
	Defective jib left lock pin solenoid [Extend]	Replace
	Defective contact or disconnection in wiring harness between J13 (female) (11) and J07 (female) (1)	Repair or replace
	Defective jib EXTEND/STOW selector relay	Replace
	Defective contact or disconnection in wiring harness between BJ2 (male) (3) and J13 (female) (9)	Repair or replace
	Defective cord reel	Replace
<p>10 YES</p> <p>Is voltage between B05 (3) and chassis ground normal when C51 is interchanged with C52?</p> <p>• Conditions and standard values are same as for Item 1.</p>	Defective jib EXTEND relay	Replace
<p>NO</p> <p>11</p> <p>Is voltage between P50 and chassis ground normal?</p> <p>• Conditions and standard values are same as for Item 1.</p>	Defective contact or disconnection in wiring harness between C51 (female) (2) - C24 (3) - CR11 (7) - BR3 (4) - B05 (female) (3)	Repair or replace
<p>YES</p> <p>12</p> <p>Is voltage between P51 and chassis ground normal?</p> <p>• Conditions and standard values are same as for Item 1.</p>	Defective contact or disconnection in wiring harness between C51 (female) (1) - C24 (1) - CP10 (7) - P50	Repair or replace
<p>NO</p> <p>13</p> <p>Is voltage between C51 (female) (3) and chassis ground normal?</p> <p>• Disconnect C51. • Other conditions and standard values are same as for Item 1.</p>	Defective jib mode selector switch	Replace
<p>YES Go to A of 2/2</p> <p>NO Go to B of 2/2</p>		

Disconnection (2/2)

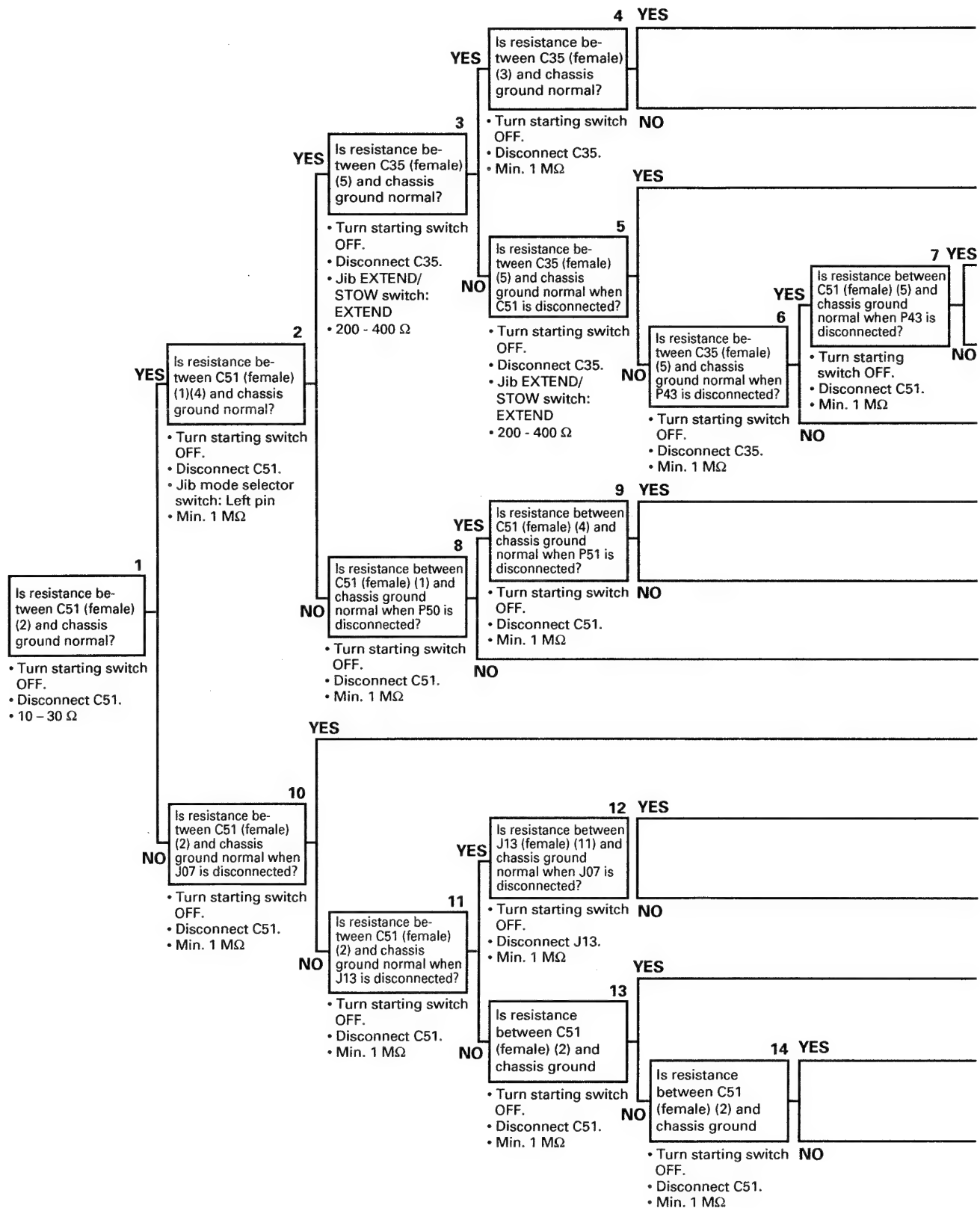


023S02

Short circuit with power source



Short circuit with chassis ground

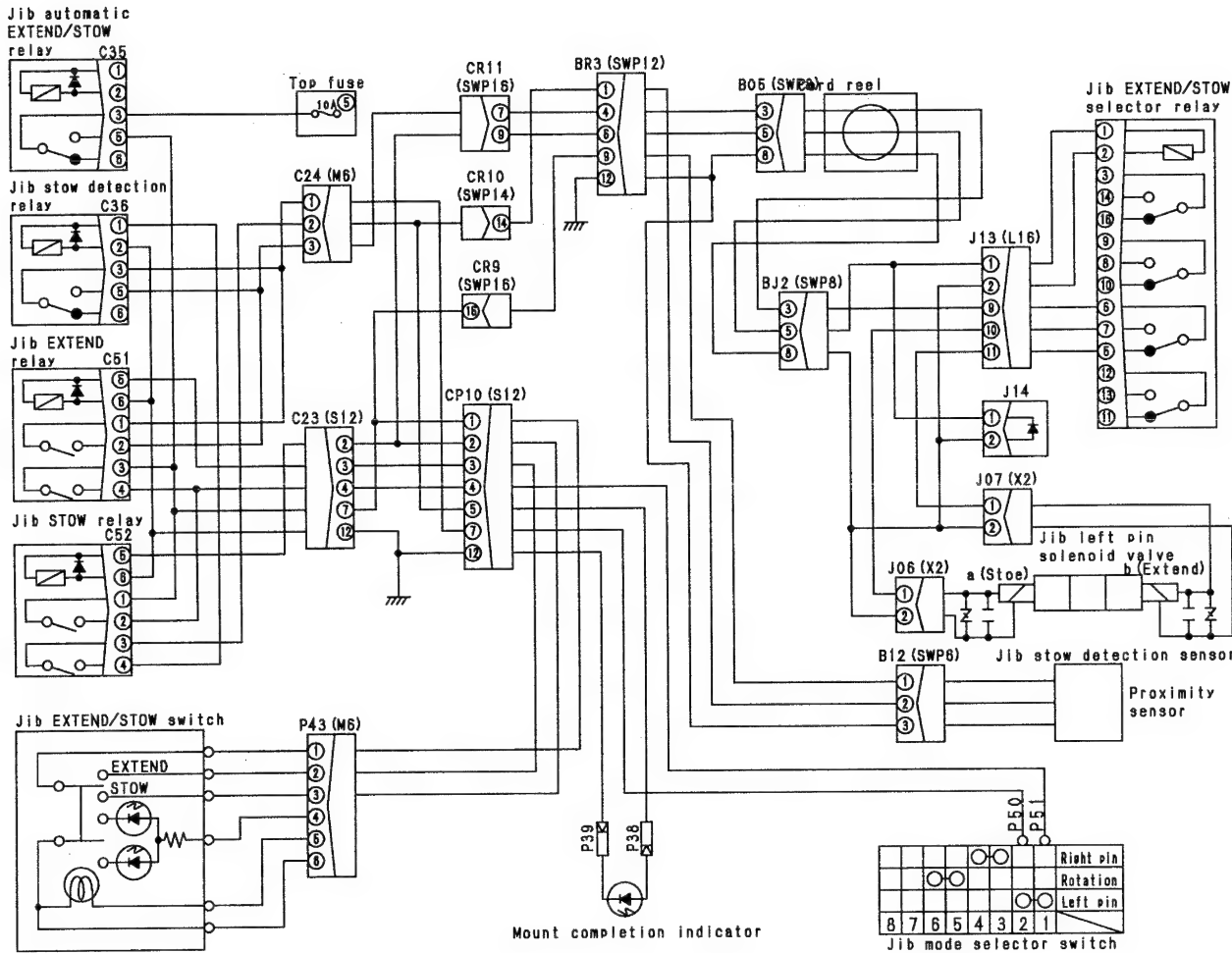


023S02

Cause	Remedy
Defective jib automatic EXTEND/STOW relay	Replace
Wiring harness between top fuse 5 and C35 (female) (3) short circuiting with chassis ground	Repair or replace
Defective jib EXTEND relay	Replace
Defective jib EXTEND/STOW switch	Replace
Wiring harness between C51 (female) (5) - C23 (3) - CP10 (3) - P43 (male) (2) short circuiting with chassis ground	Repair or replace
Wiring harness between C35 (female) (5) - C51 (female) (3) or C23 (7) - CP10 (1) - P43 (male) (3) short circuiting with chassis ground	Repair or replace
Defective jib mode selector switch	Replace
Wiring harness between C51 (female) (4) - C23 (4) - CP10 (4) - P51 short circuiting with chassis ground	Repair or replace
Wiring harness between C51 (female) (1) - C24 (1) - CP10 (7) - P50 short circuiting with chassis ground	Repair or replace
Defective jib left lock pin solenoid [EXTEND]	Replace
Defective jib EXTEND/STOW selector switch	Replace
Wiring harness between J13 (female) (11) and J07 (female) (1) short circuiting with chassis ground	Repair or replace
Wiring harness between BJ2 (male) (3) and J13 (female) (9) short circuiting with chassis ground	Repair or replace
Defective cord reel	Replace
Wiring harness between C51 (female) (2) - C24 (3) - CR11 (7) - BR3 (4) - B05 (female) (3) short circuiting with chassis ground	Repair or replace

023S02

EM-115 Related electric circuit diagram



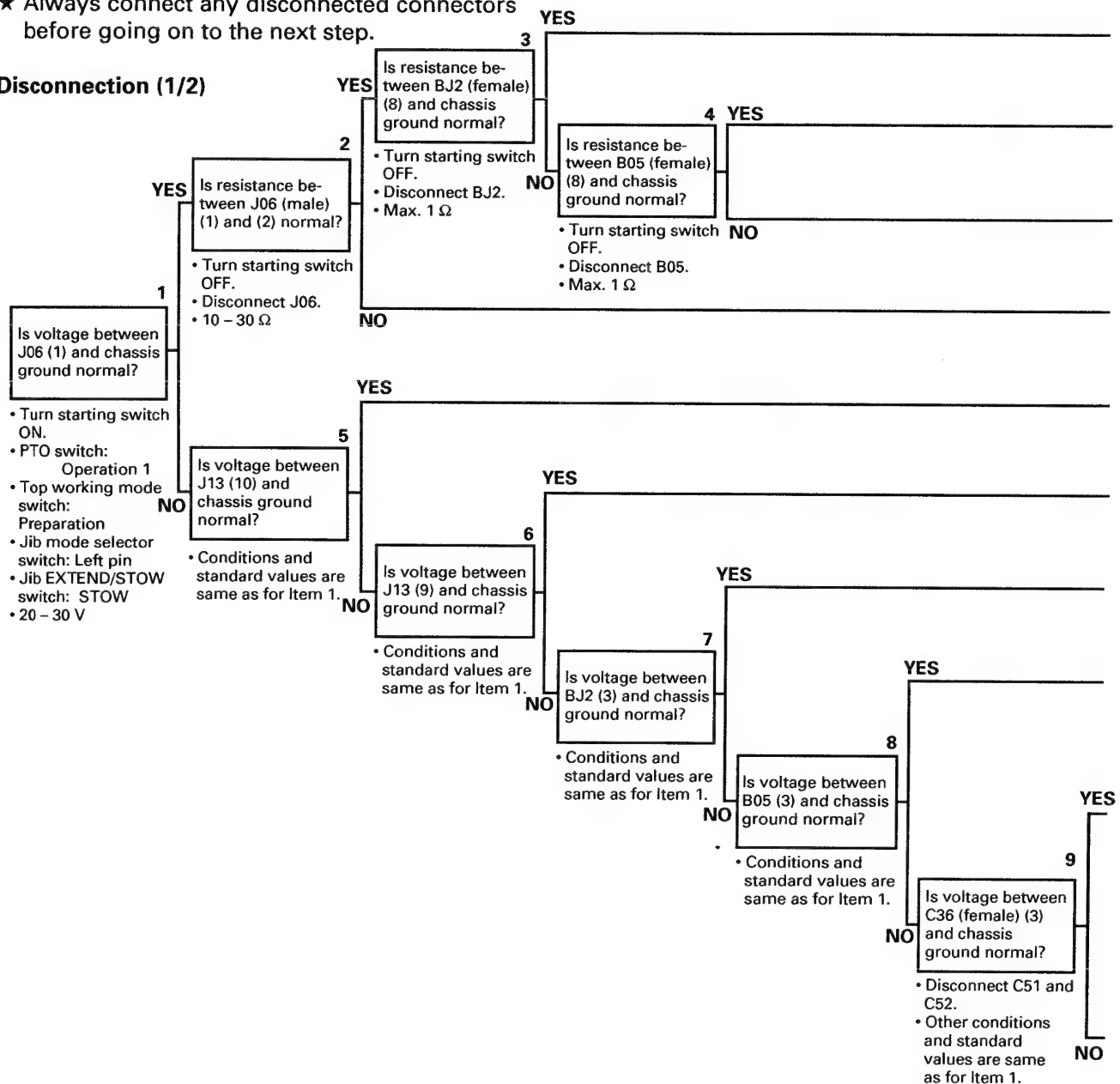
023S02

TKL00558

EM-116 Abnormality in jib left lock pin solenoid (STOW) system

- ★ When no error code is displayed.
- ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Check that there is no abnormality in jib stow detection sensor system. (If there is any abnormality, carry out Troubleshooting EM-50 first.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection (1/2)

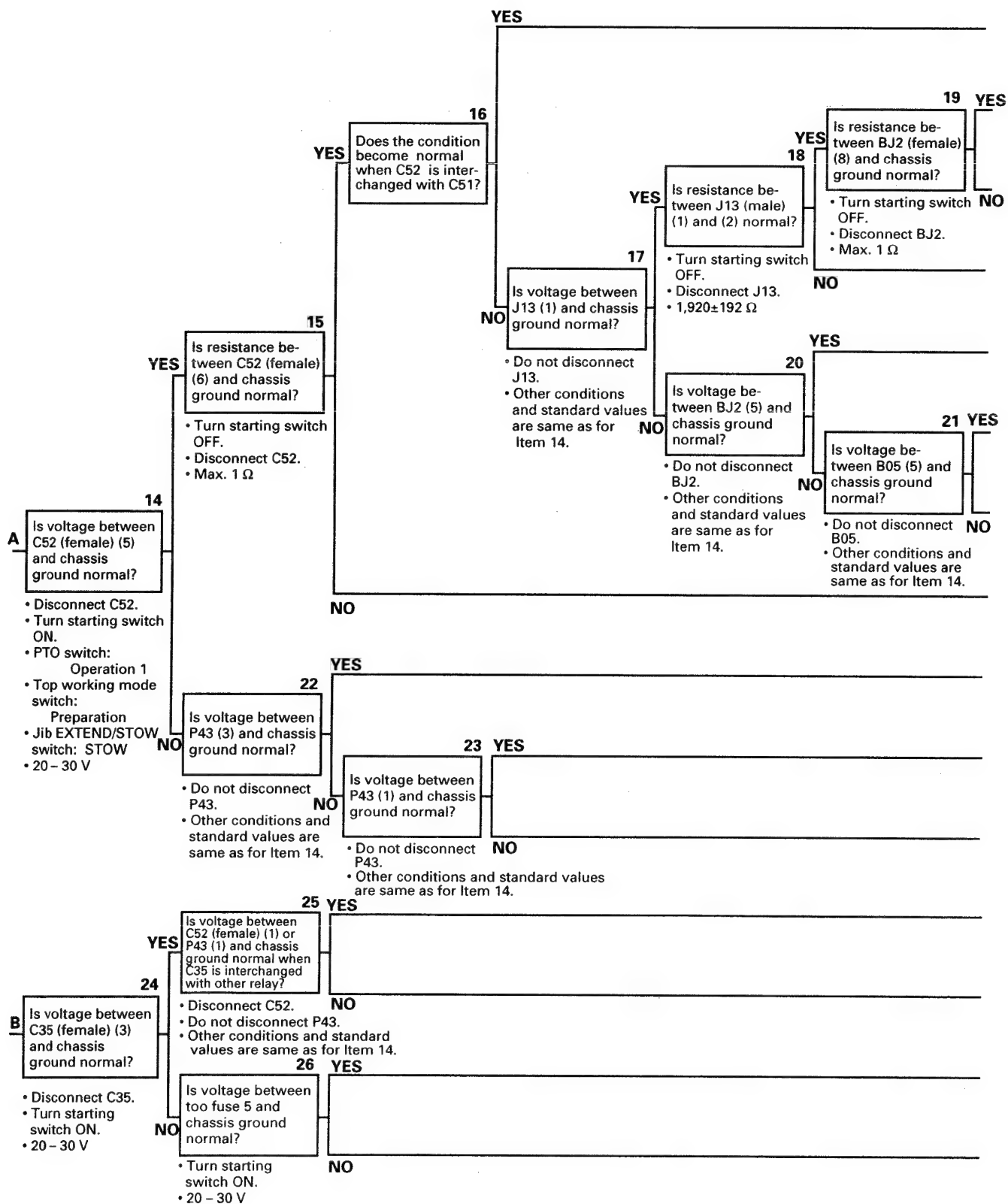


023S02

023S02

		Cause	Remedy
		Defective contact or disconnection in wiring harness between J06 (female) (2) and BJ2 (male) (8)	Repair or replace
		Defective cord reel	Replace
		Defective contact or disconnection in wiring harness between B05 (female) (8) - BR3 (12) - chassis ground	Repair or replace
		Defective jib left lock pin solenoid [STOW]	Replace
		Defective contact or disconnection in wiring harness between J13 (female) (10) and J06 (female) (1)	Repair or replace
		Defective jib EXTEND/STOW selector relay	Replace
		Defective contact or disconnection in wiring harness between BJ2 (male) (3) and J13 (female) (9)	Repair or replace
		Defective cord reel	Replace
<p>10 YES</p> <p>Is voltage between B05 (3) and chassis ground normal when C36 is inter-changed with other relay?</p> <p>• Conditions and standard values are same as for Item 1.</p>		Defective jib stow detection relay	Replace
<p>NO</p> <p>11 YES</p> <p>Is voltage between P50 and chassis ground normal?</p> <p>• Conditions and standard values are same as for Item 1.</p>		Defective contact or disconnection in wiring harness between C36 (female) (5) - C24 (3) - CR11 (7) - BR3 (4) - B05 (female) (3)	Repair or replace
<p>NO</p> <p>12 YES</p> <p>Is voltage between P51 and chassis ground normal?</p> <p>• Conditions and standard values are same as for Item 1.</p>		Defective contact or disconnection in wiring harness between C50 - CP10 (7) - C24 (1) - C36 (female) (2)	Repair or replace
<p>NO</p> <p>13 YES Go to A of 2/2</p> <p>Is voltage between C52 (female) (1) and chassis ground normal?</p> <p>• Disconnect C52. • Other conditions and standard values are same as for Item 1.</p>		Defective jib mode selector switch	Replace
<p>NO Go to B of 2/2</p>			

Disconnection (2/2)

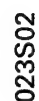


023S02

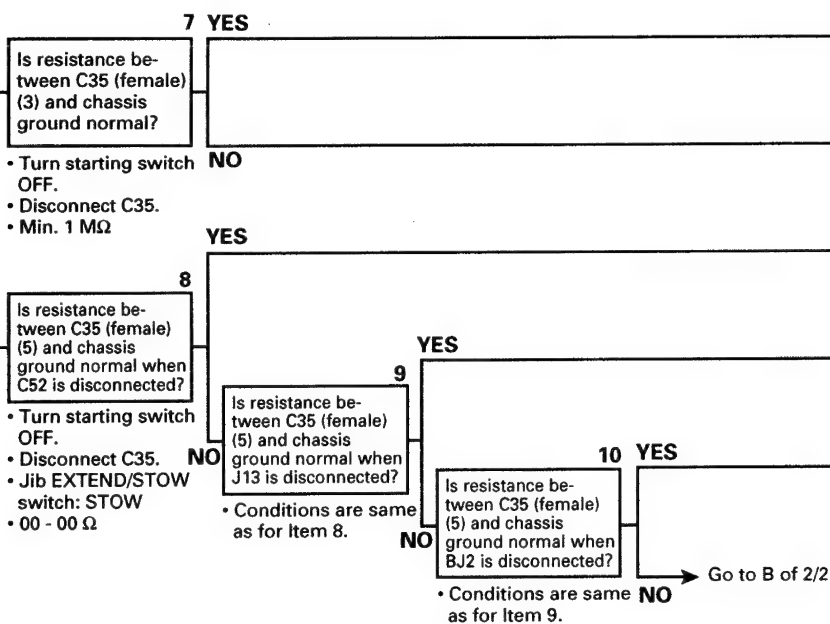
023S02

	Cause	Remedy
	Defective jib STOW relay	Replace
	Defective contact or disconnection in wiring harness between J13 (female) (2) - BJ2 (male) (8)	Repair or replace
	Go to Troubleshooting No. 4 (1/2)	
	Defective jib EXTEND/STOW selector relay	Replace
	Defective contact or disconnection in wiring harness between BJ2 (male) (5) and J13 (female) (1)	Repair or replace
	Defective cord reel	Replace
	Go to Troubleshooting No. 22	
	Defective contact or disconnection in wiring harness between C52 (female) (6) - C23 (12) - chassis ground	Repair or replace
	Defective contact or disconnection in wiring harness between P43 (male) (3) - CP10 (2) - C23 (2) - C52 (female) (5) or CR11 (9) - BR3 (6) - B05 (female) (5)	Repair or replace
	Defective jib EXTEND/STOW switch	Replace
	Go to Troubleshooting No. 24	
	Jib automatic EXTEND/STOW relay	Replace
	Defective contact or disconnection in wiring harness between C35 (female) (5) - C52 (female) (1) or C23 (7) - CP10 (1) - P43 (male) (1)	Repair or replace
	Defective contact or disconnection in wiring harness between top fuse 5 and C35 (female) (3)	Repair or replace
	Defective power source system	Go to Troubleshooting for power source system (E-1)

Short circuit with chassis ground (1/2)



		Cause	Remedy
		Defective jib stow detection relay	Replace
		Defective jib automatic EXTEND/STOW relay	Replace
		Wiring harness between top fuse 5 and C35 (female) (3) short circuiting with chassis ground	Repair or replace
		Defective jib STOW relay	Replace
		Defective jib EXTEND/STOW selector relay	Replace
		Wiring harness between BJ2 (male) (5) and J13 (female) (1) short circuiting with chassis ground, or J14 is short circuited	Repair or replace
		Defective jib mode selector switch	Replace
		Wiring harness between C52 (female) (2) - C23 (4) - CP10 (4) - P51 short circuiting with chassis ground	Repair or replace
		Wiring harness between C36 (female) (3) - C24 (1) - CP10 (7) - P50 short circuiting with chassis ground	Repair or replace
		Wiring harness between C36 (female) (5) - C24 (3) - CR11 (7) - BR3 (4) - B05 (female) (3) short circuiting with chassis ground	Repair or replace
		Defective cord reel	Replace
		Wiring harness between BJ2 (female) (3) and J13 (female) (9) short circuiting with chassis ground	Repair or replace
		Defective jib EXTEND/STOW selector relay	Replace



023S02

Short circuit with chassis ground (2/2)

Short circuit with chassis ground (2/2)			Cause	Remedy
A	15 YES	Is resistance between J13 (female) (10) and chassis ground normal when J16 is disconnected?	Defective jib left lock pin solenoid [STOW]	Replace
	NO	<ul style="list-style-type: none">• Turn starting switch OFF.• Disconnect J13.• Min. 1 MΩ	Wiring harness between J13 (female) (10) and J06 (female) (1) short circuiting with chassis ground	Repair or replace
B	16 YES	Is resistance between C35 (female) (5) and chassis ground normal when B05 is disconnected?	Defective cord reel	Replace
	NO	17 YES	Defective jib EXTEND/STOW switch	Replace
	NO	<ul style="list-style-type: none">• Turn starting switch OFF.• Disconnect C35.• Jib EXTEND/STOW switch: STOW• 290±29 Ω	Wiring harness between C35 (female) (5) - C52 (female) (1) or C23 (7) - CP10 (1) - P43 (male) (1) short circuiting with chassis ground	Repair or replace
		<ul style="list-style-type: none">• Turn starting switch OFF.• Disconnect C35.• Min. 1 MΩ		

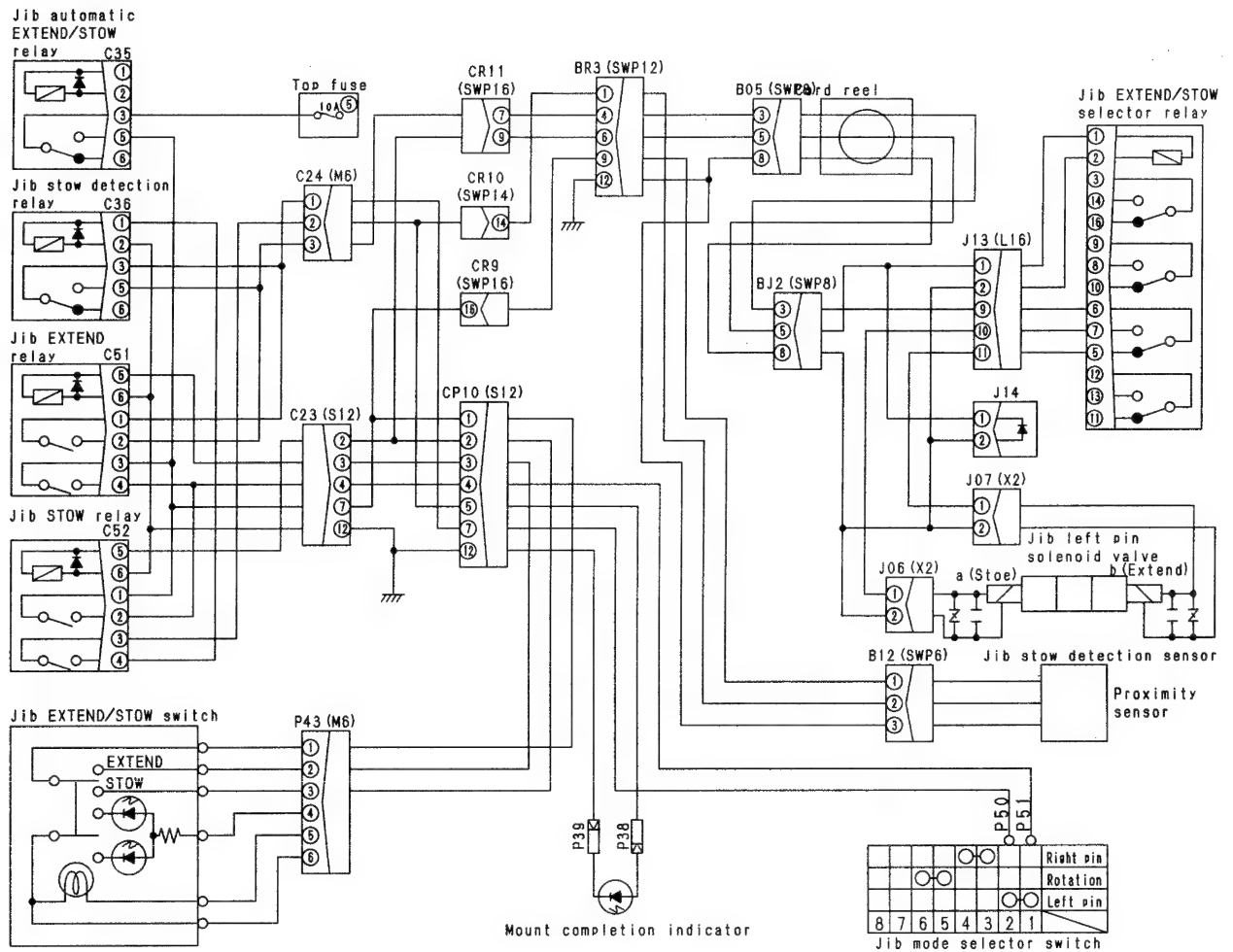
023S02

Short circuit with power source

		Cause	Remedy
<div>1</div> <div>Is voltage between J06 (female) (1) and chassis ground normal?</div> <div><div>• Disconnect J06.</div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div>	YES	Defective jib left lock solenoid [STOW]	Replace
	<div>2 YES</div> <div>Is resistance between J06 (female) (1) and chassis ground normal when J13 is disconnected?</div> <div><div>• Disconnect J06.</div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div>	Defective jib EXTEND/STOW selector relay	Replace
	NO	Wiring harness between J13 (female) (10) and J06 (female) (1) short circuiting with power source	

EM-116 Related electric circuit diagram

023S02

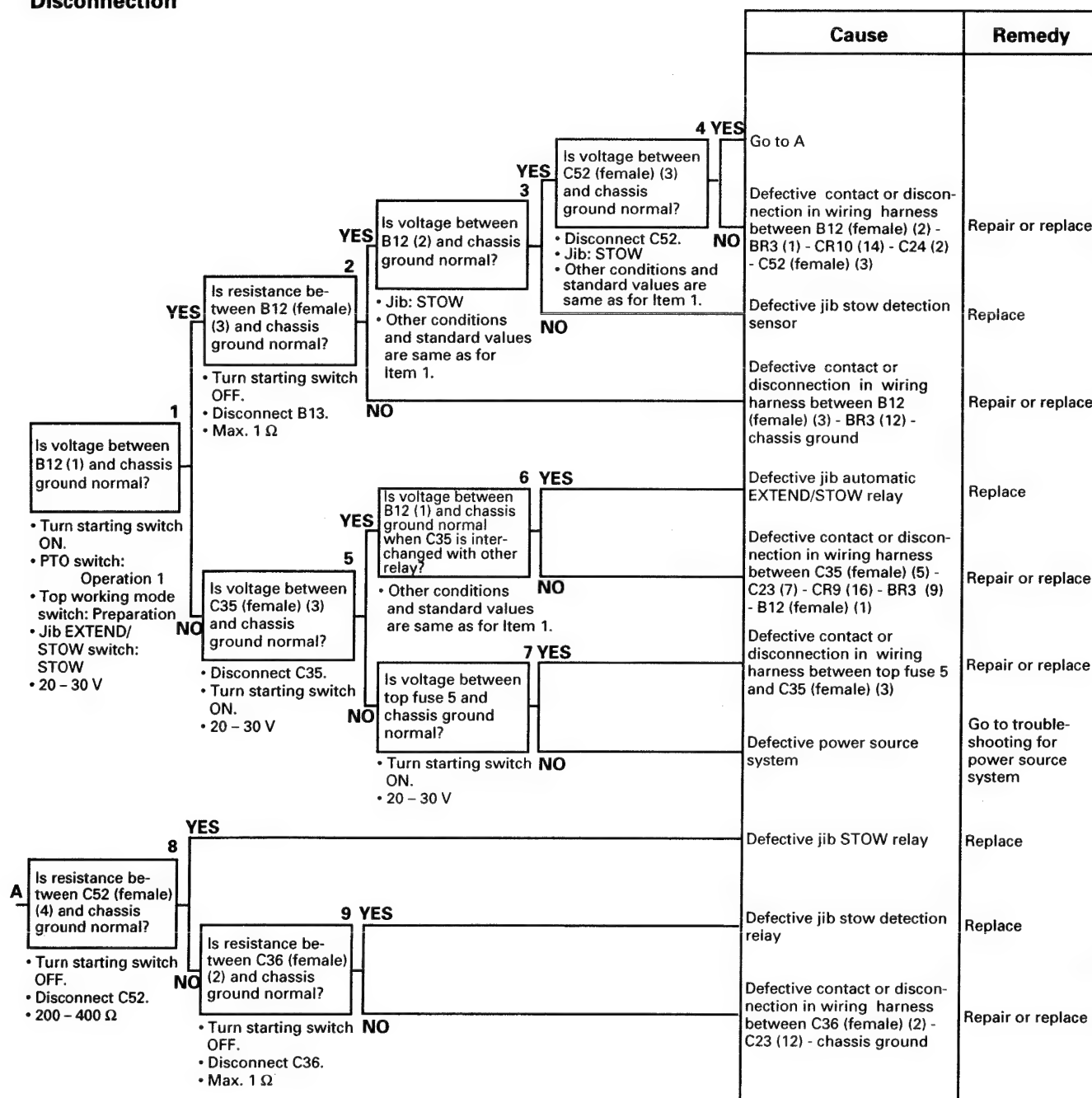


TKL00558

EM-117 Abnormality in jib stow detection sensor system

- ★ When no error code is displayed.
- ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

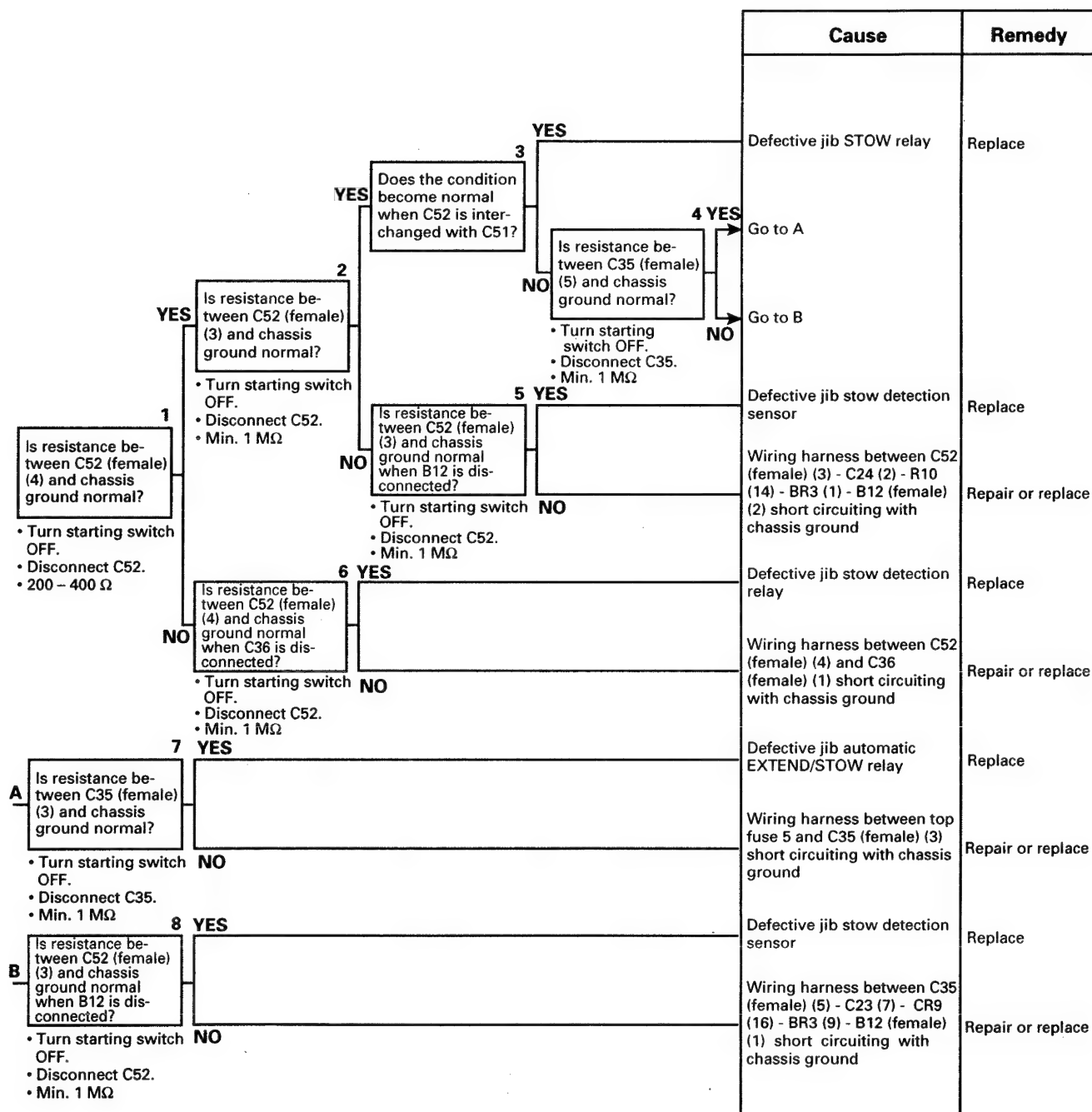
Disconnection



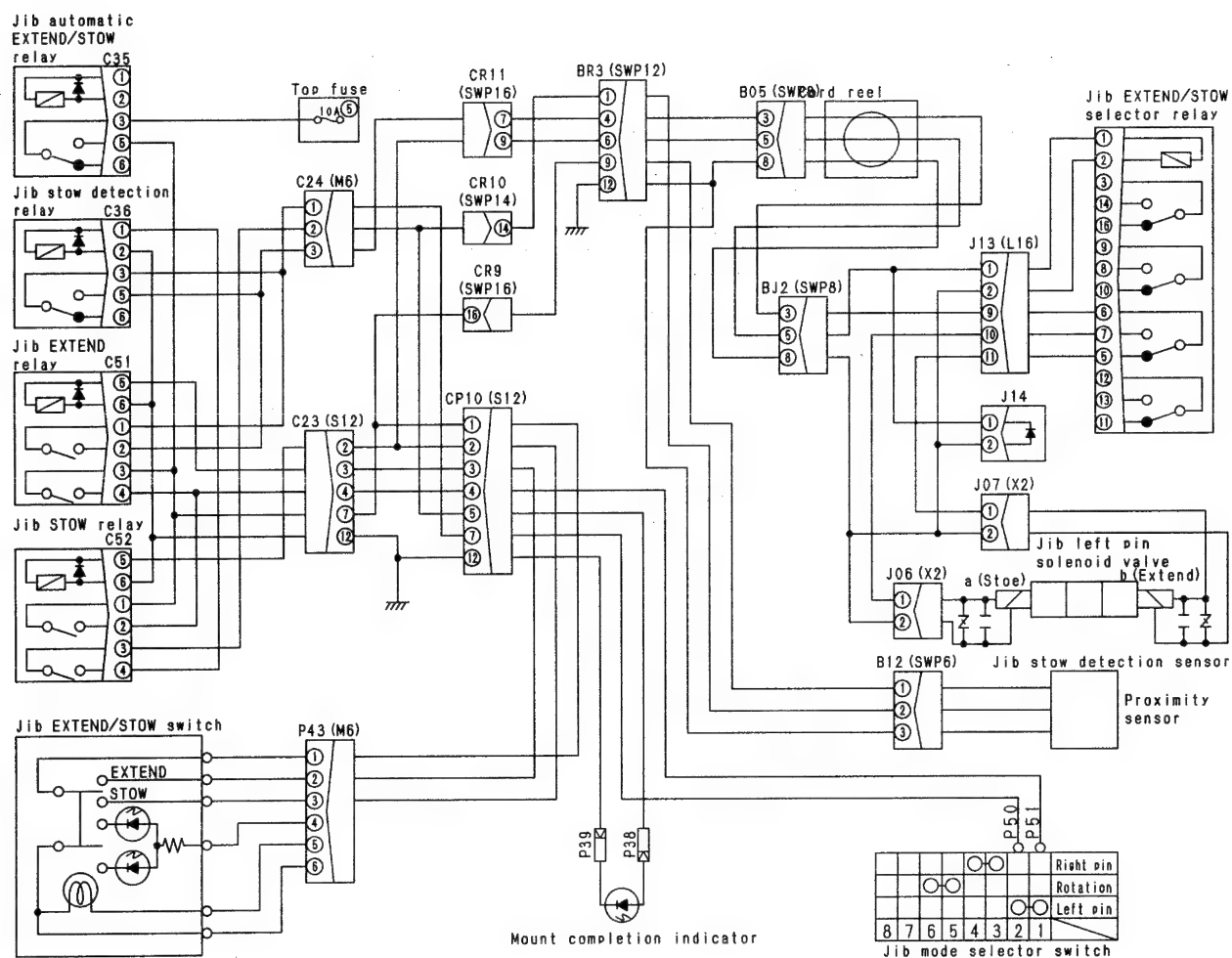
023S02

Short circuit with chassis ground

023S02



EM-117 Related electric circuit diagram



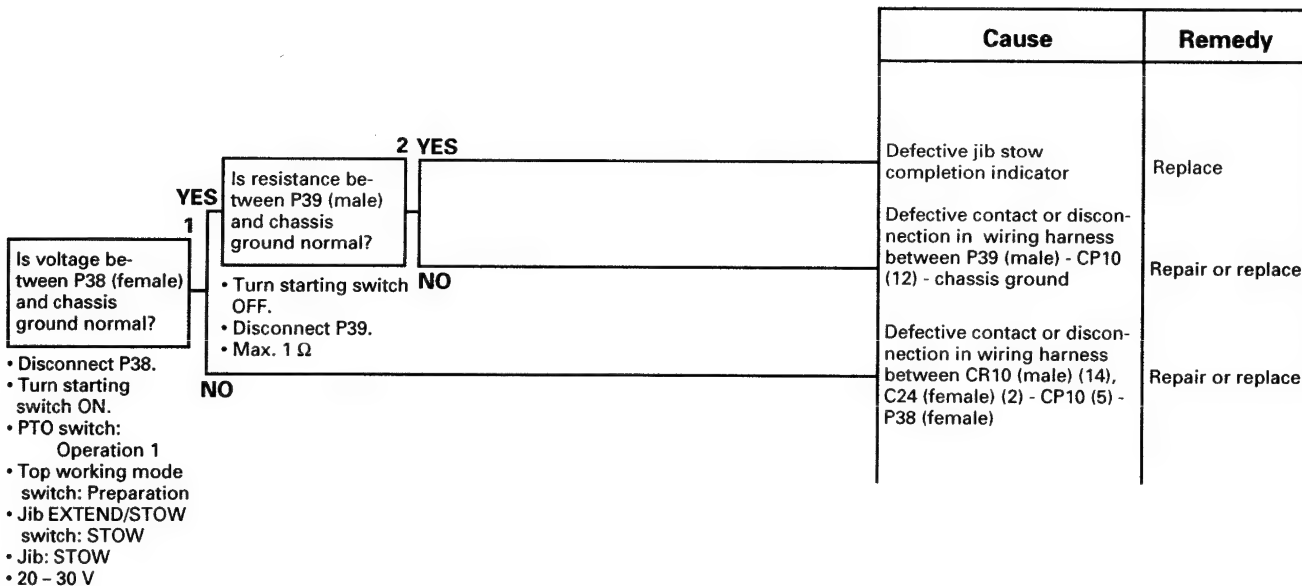
023S02

TKL00558

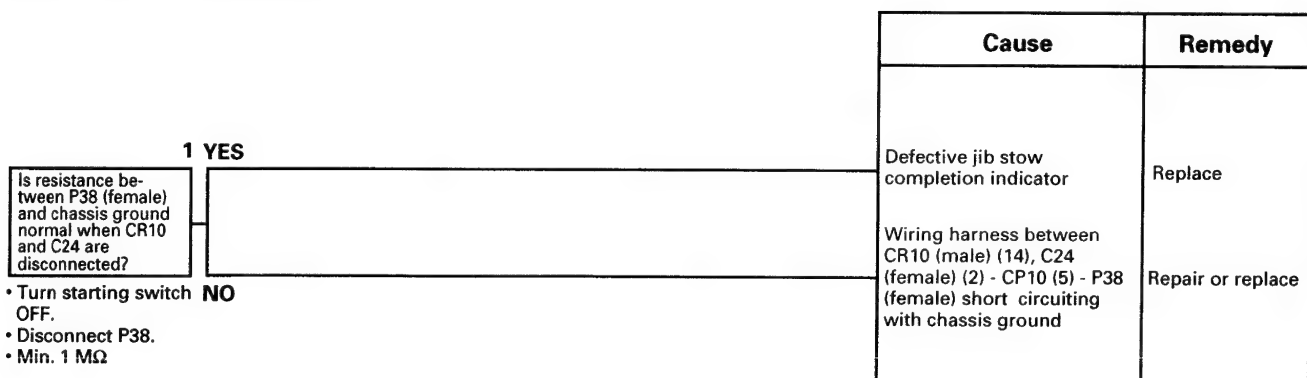
EM-118 Abnormality in jib stow completion indicator system

- ★ When no error code is displayed.
- ★ Check that jib stow detection sensor system is normal. (If there is any abnormality, carry out Troubleshooting for that problem first.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

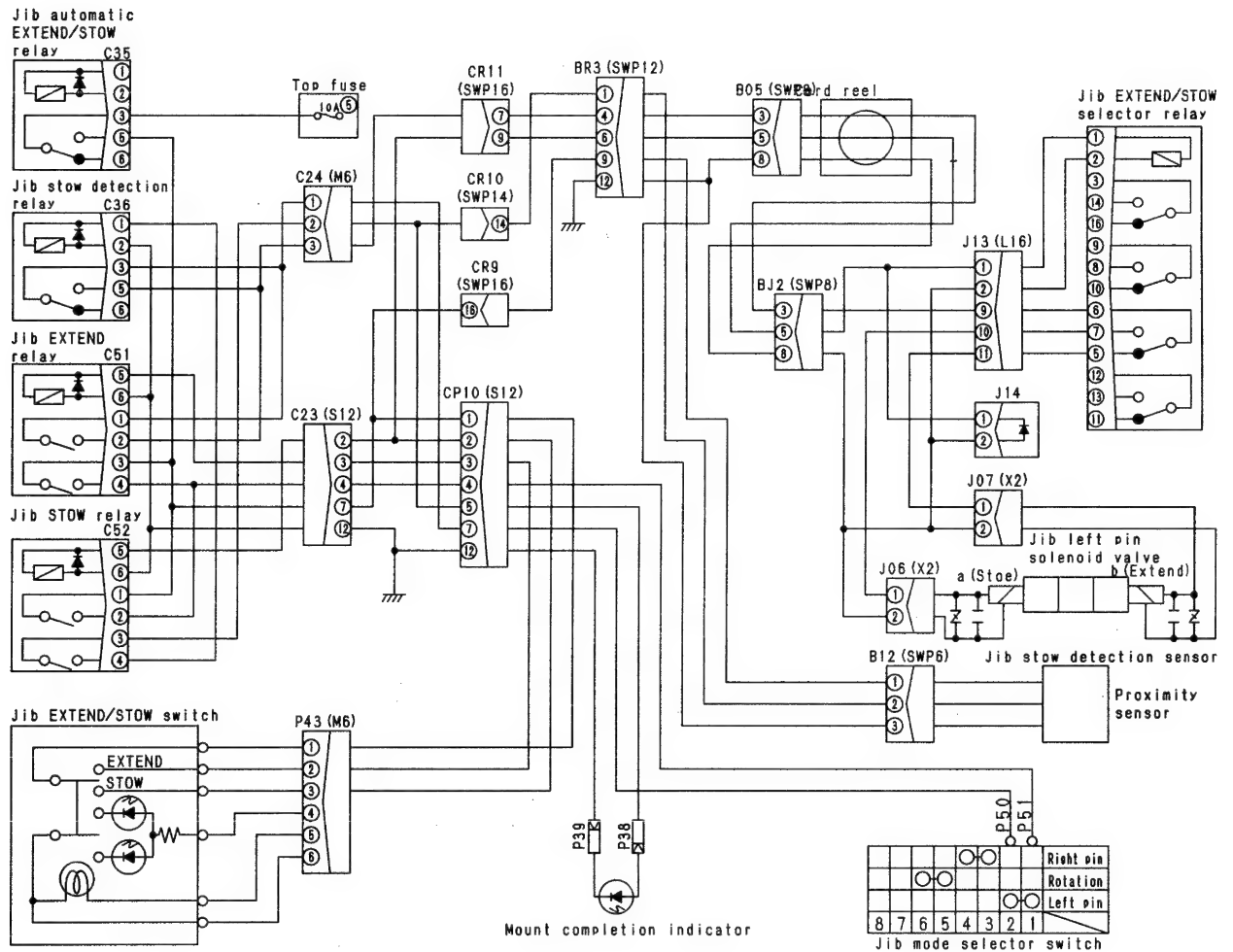


Short circuit with chassis ground



EM-118 Related electric circuit diagram

023S02

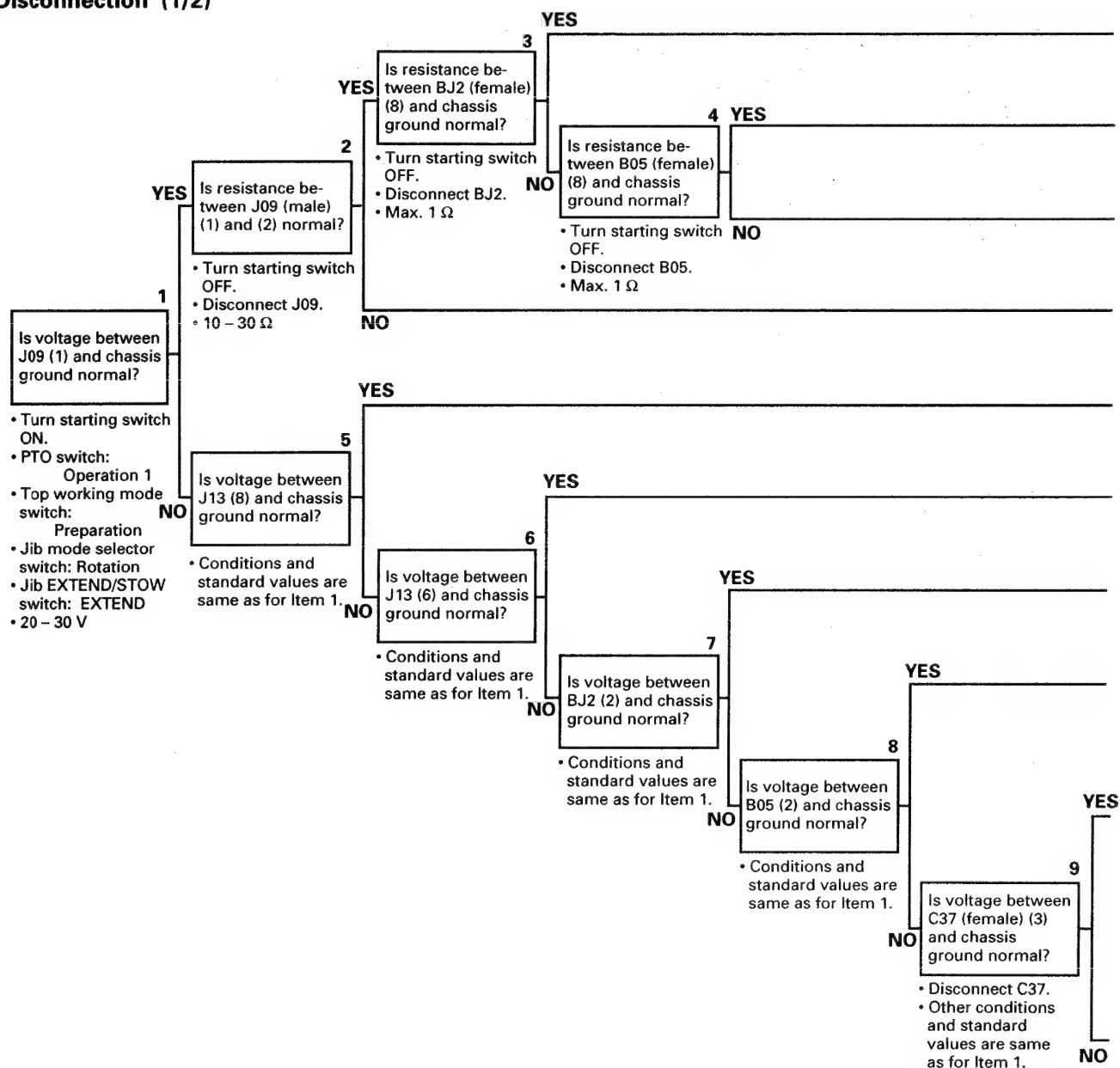


TKL00558

EM-119 Abnormality in jib rotation solenoid (EXTEND) system

- ★ When no error code is displayed.
- ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection (1/2)



023S02

023S02

		Cause	Remedy
		Defective contact or disconnection in wiring harness between J09 (female) (2) - BJ2 (male) (8)	Repair or replace
		Defective cord reel	Replace
		Defective contact or disconnection in wiring harness between B05 (female) (8) - BR3 (12) - chassis ground	Repair or replace
		Defective jib rotation solenoid [EXTEND]	Replace
		Defective contact or disconnection in wiring harness between J13 (female) (8) - J09 (female) (1)	Repair or replace
		Defective jib EXTEND/STOW selector relay	Replace
		Defective contact or disconnection in wiring harness between BJ2 (male) (2) - J13 (female) (6)	Repair or replace
		Defective cord reel	Replace
		Defective jib rotation permission relay	Replace
		Defective contact or disconnection in wiring harness between C37 (female) (5) - C23 (6) - CR11 (9) - BR3 (3) - B05 (female) (2)	Repair or replace
		Defective contact or disconnection in wiring harness between P46 - CP10 (9) - C23 (5) - C37 (female) (3)	Repair or replace
		Defective jib mode selector switch	Replace

10 YES

Is voltage between B05 (2) and chassis ground normal when C37 is interchanged with other relay?

• Conditions and standard values are same as for Item 1.

NO

11

Is voltage between P46 - chassis ground normal?

• Conditions and standard values are same as for Item 1.

YES

12

Is voltage between P47 - chassis ground normal?

• Conditions and standard values are same as for Item 1.

NO

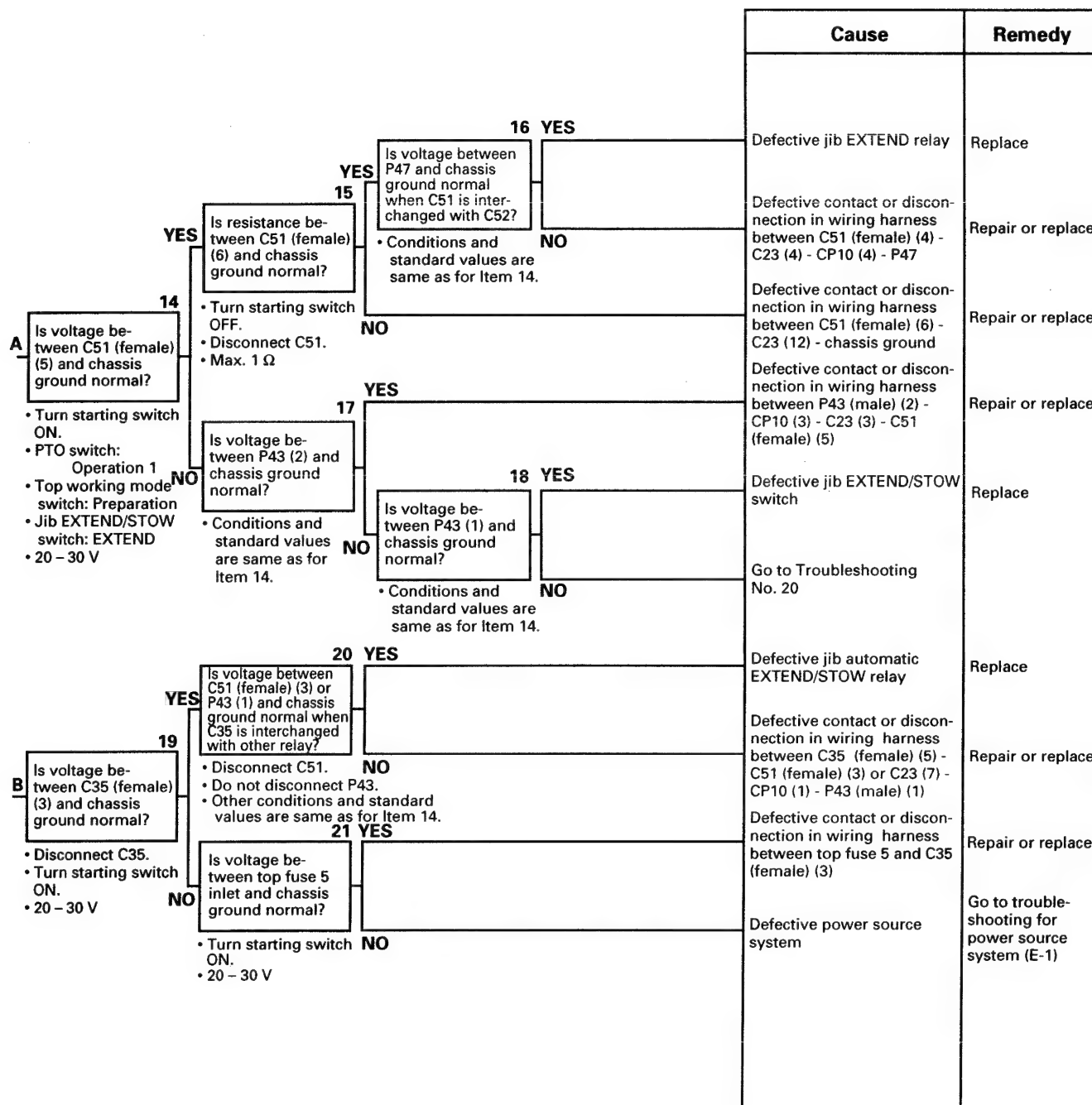
13 YES [Go to A of 2/2]

Is voltage between C51 (female) (3) and chassis ground normal?

• Disconnect C51.
• Other conditions and standard values are same as for Item 1.

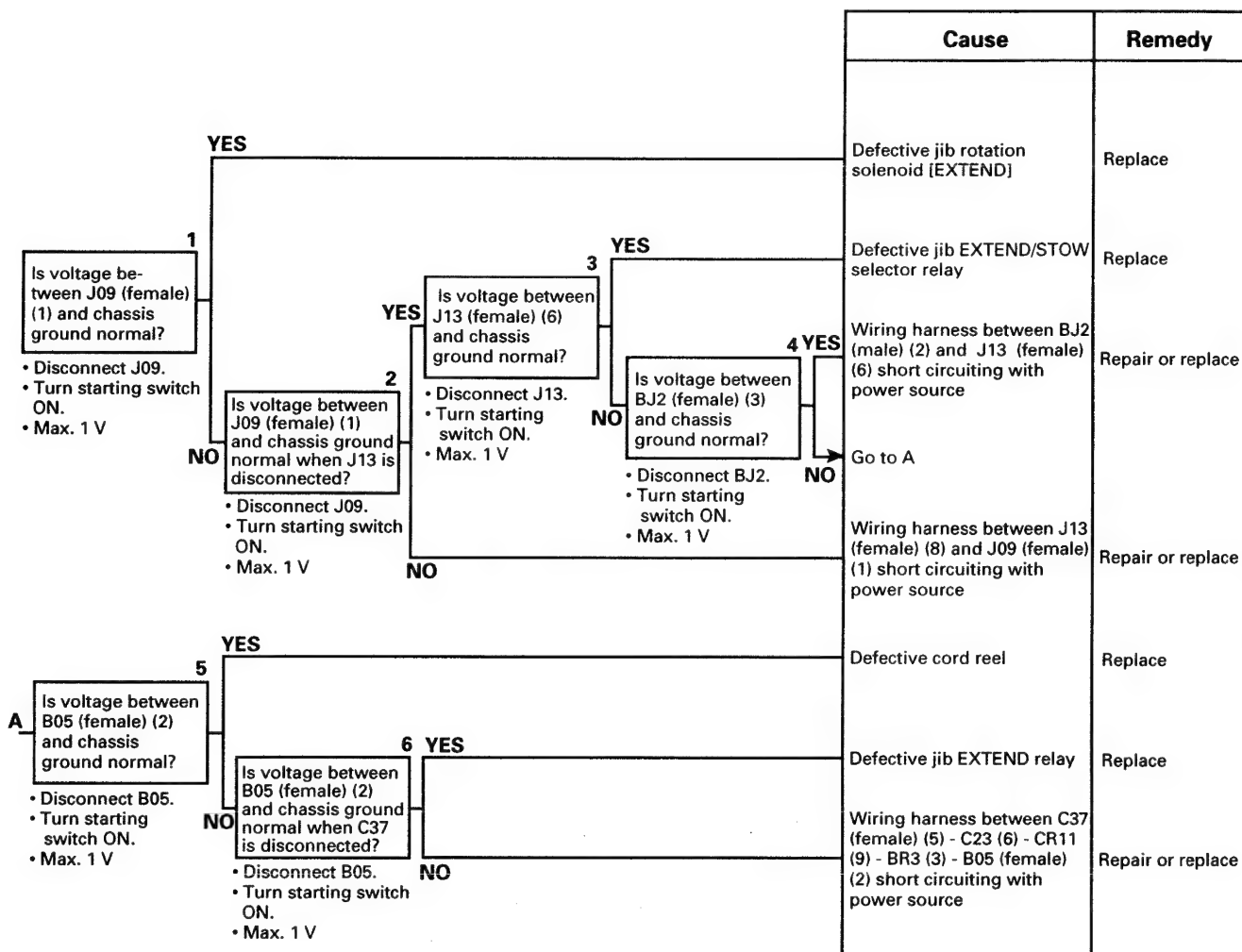
NO [Go to B of 2/2]

Disconnection (2/2)

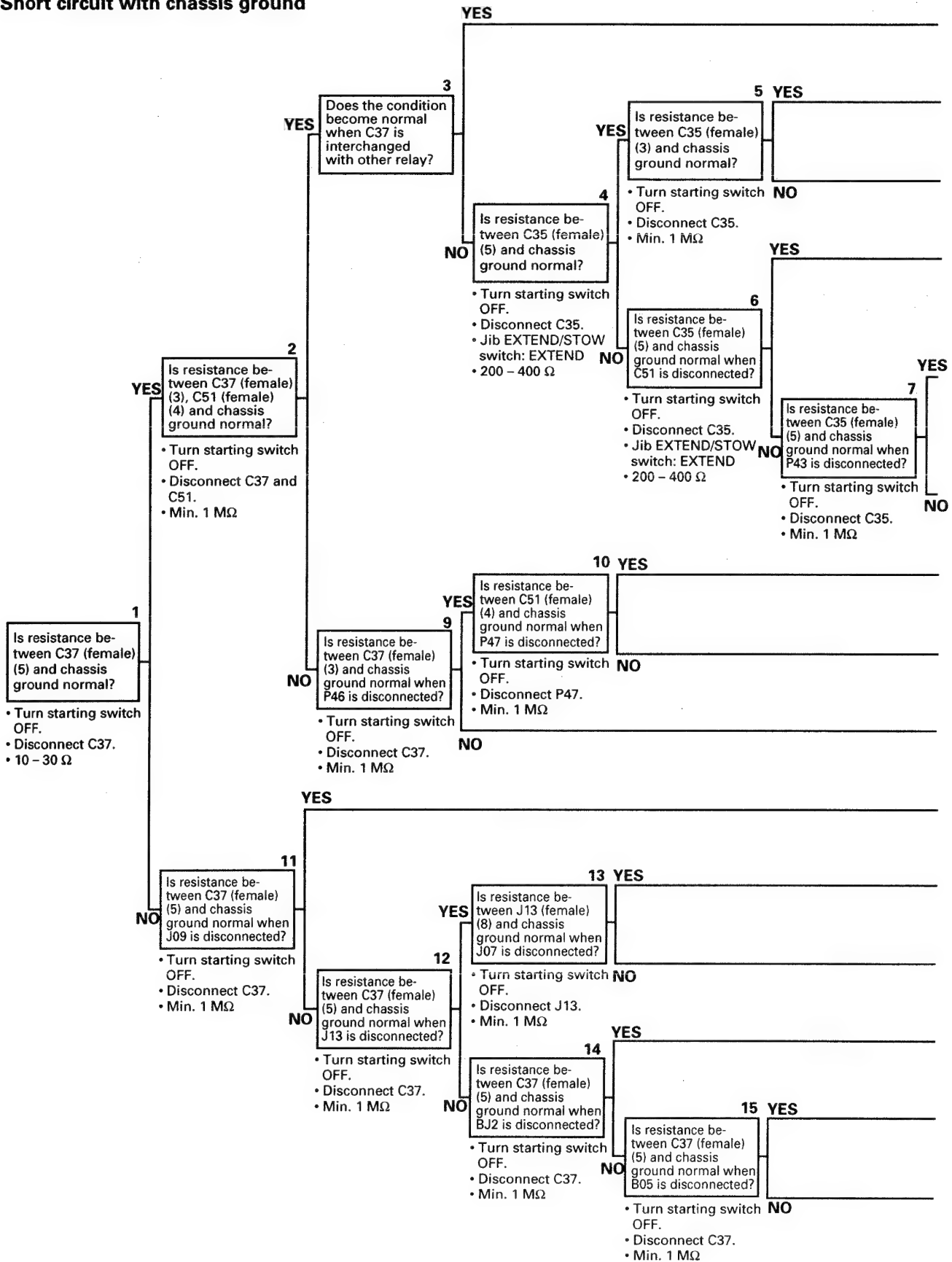


023S02

Short circuit with power source



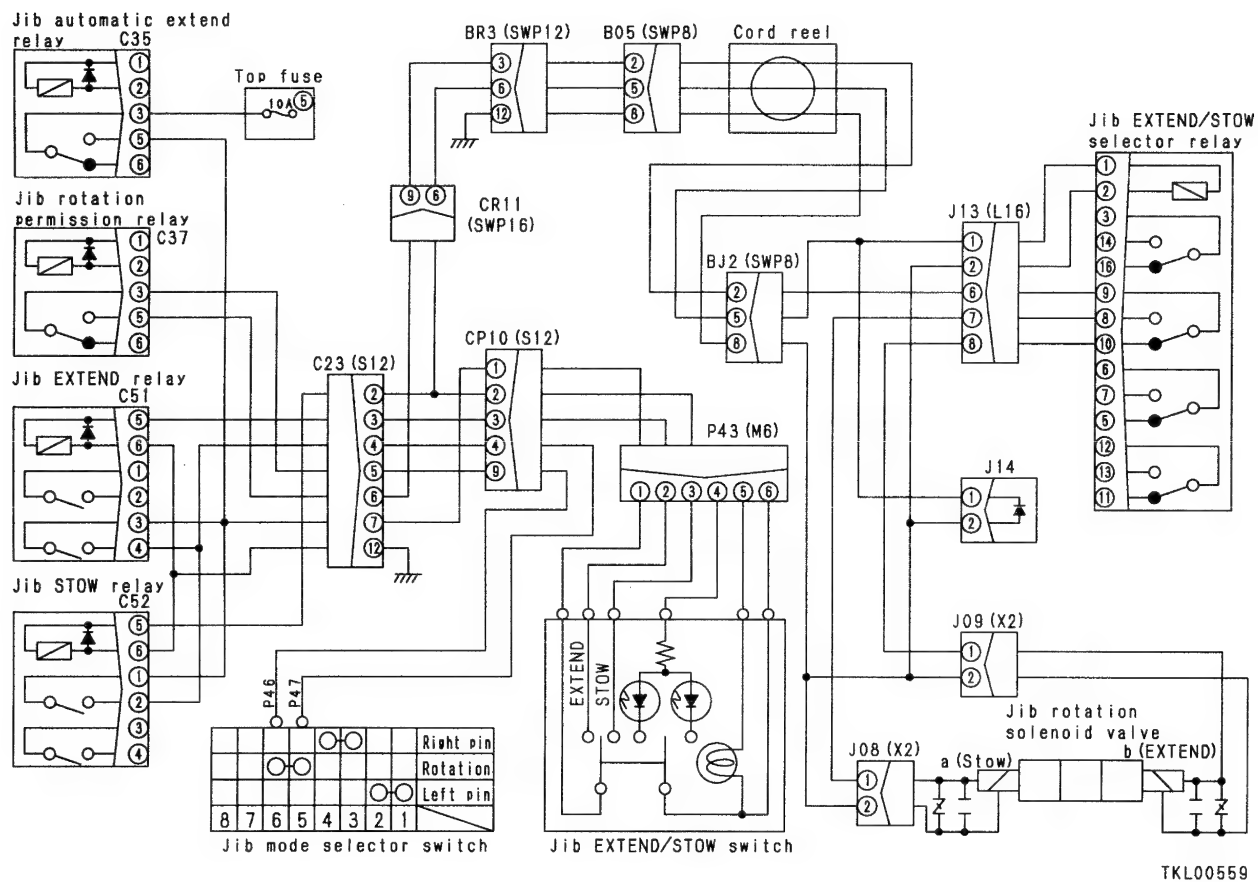
Short circuit with chassis ground



023S02

		Cause	Remedy
		Defective jib rotation permission relay	Replace
		Defective jib automatic EXTEND/STOW relay	Replace
		Wiring harness between top fuse 5 and C35 (female) (3) short circuiting with chassis ground	Repair or replace
		Defective jib EXTEND relay	Replace
8 YES		Defective jib EXTEND/STOW switch	Replace
Is resistance between C51(female) (5) and chassis ground normal when P43 is disconnected?		Wiring harness between C51 (female) (5) - C23 (3) - CP10 (3) - P43 (male) (2) short circuiting with chassis ground	Repair or replace
• Turn starting switch NO OFF.		Wiring harness between C35 (female) (5) - C51 (female) (3) or C23 (7) - CP10 (1) - P43 (male) (1) short circuiting with chassis ground	Repair or replace
• Disconnect C51.		Defective jib mode selector switch	Replace
• Min. 1 MΩ		Wiring harness between C51 (female) (4) - C23 (4) - CP10 (4) - P47 short circuiting with chassis ground	Repair or replace
		Wiring harness between C37 (female) (3) - C23 (5) - CP10 (9) - P46 short circuiting with chassis ground	Repair or replace
		Defective jib rotation solenoid [EXTEND]	Replace
		Defective jib EXTEND/STOW selector switch	Repair or replace
		Wiring harness between J13 (female) (8) and J09 (female) (1) short circuiting with chassis ground	Repair or replace
		Wiring harness between BJ2 (male) (2) and J13 (female) (6) short circuiting with chassis ground	Repair or replace
		Defective cord reel	Replace
		Wiring harness between C37 (female) (5) - C23 (6) - CR11 (9) - BR3 (3) - B05 (female) (2) short circuiting with chassis ground	Repair or replace

EM-119 Related electric circuit diagram

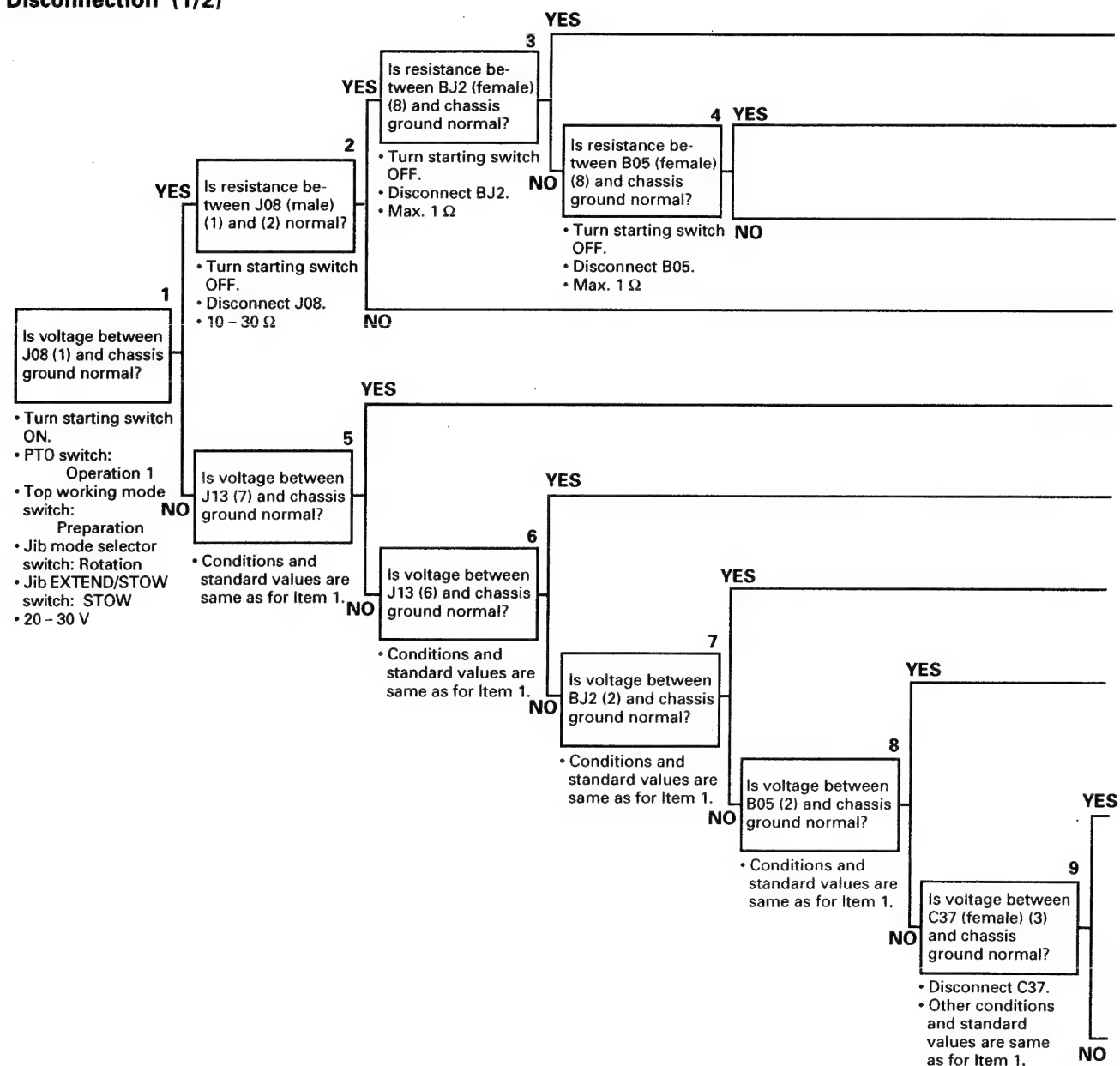


023S02

EM-120 Abnormality in jib rotation solenoid (STOW) system

- ★ When no error code is displayed.
- ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection (1/2)

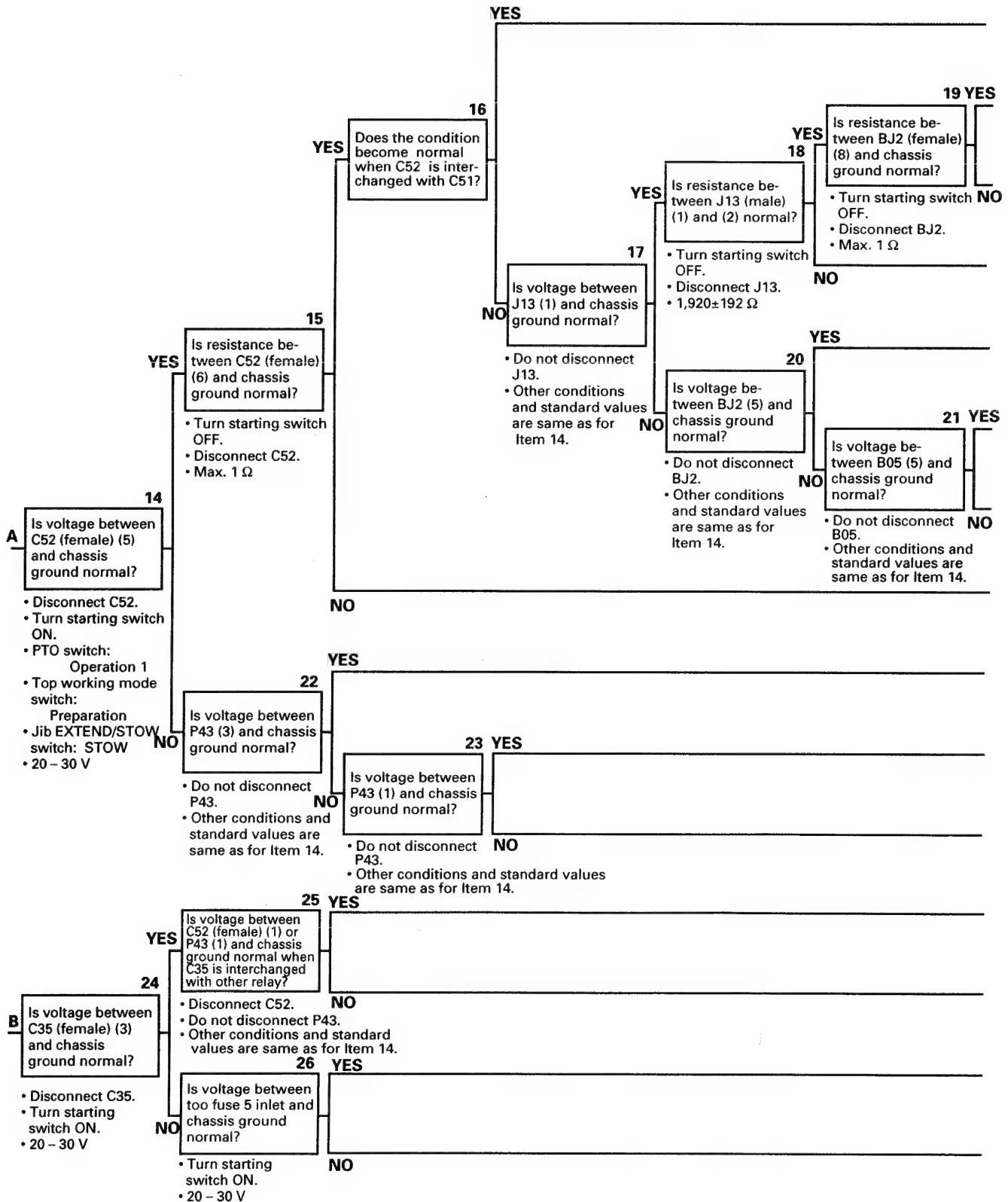


023S02

023S02

	Cause	Remedy
	Defective contact or disconnection in wiring harness between J08 (female) (2) and BJ2 (male) (8)	Repair or replace
	Defective cord reel	Replace
	Defective contact or disconnection in wiring harness between B05 (female) (8) - BR3 (12) - chassis ground	Repair or replace
	Defective jib rotation solenoid [STOW]	Replace
	Defective contact or disconnection in wiring harness between J13 (female) (7) and J08 (female) (1)	Repair or replace
	Defective jib EXTEND/STOW selector relay	Replace
	Defective contact or disconnection in wiring harness between BJ2 (male) (2) and J13 (female) (6)	Repair or replace
	Defective cord reel	Replace
<div>10 YES</div> <div>Is voltage between B05 (3) and chassis ground normal when C37 is interchanged with other relay?</div> <div>• Conditions and standard values are same as for Item 1.</div>	Defective jib rotation permission relay	Replace
<div>NO</div> <div>YES</div> <div>11</div> <div>Is voltage between P46 and chassis ground normal?</div> <div>• Conditions and standard values are same as for Item 1.</div>	Defective contact or disconnection in wiring harness between C37 (female) (5) - C23 (6) - CR11 (9) - BR3 (3) - B05 (female) (2)	Repair or replace
<div>NO</div> <div>12</div> <div>Is voltage between P47 and chassis ground normal?</div> <div>• Conditions and standard values are same as for Item 1.</div>	Defective contact or disconnection in wiring harness between P46 - CP10 (9) - C23 (5) - C37 (female) (3)	Repair or replace
<div>YES</div> <div>13 YES</div> <div>Is voltage between C52 (female) (1) and chassis ground normal?</div> <div>• Disconnect C52.</div> <div>• Other conditions and standard values are same as for Item 1.</div> <div>NO</div> <div>Go to A of 2/2</div> <div>Go to B of 2/2</div>	Defective jib mode selector switch	Replace

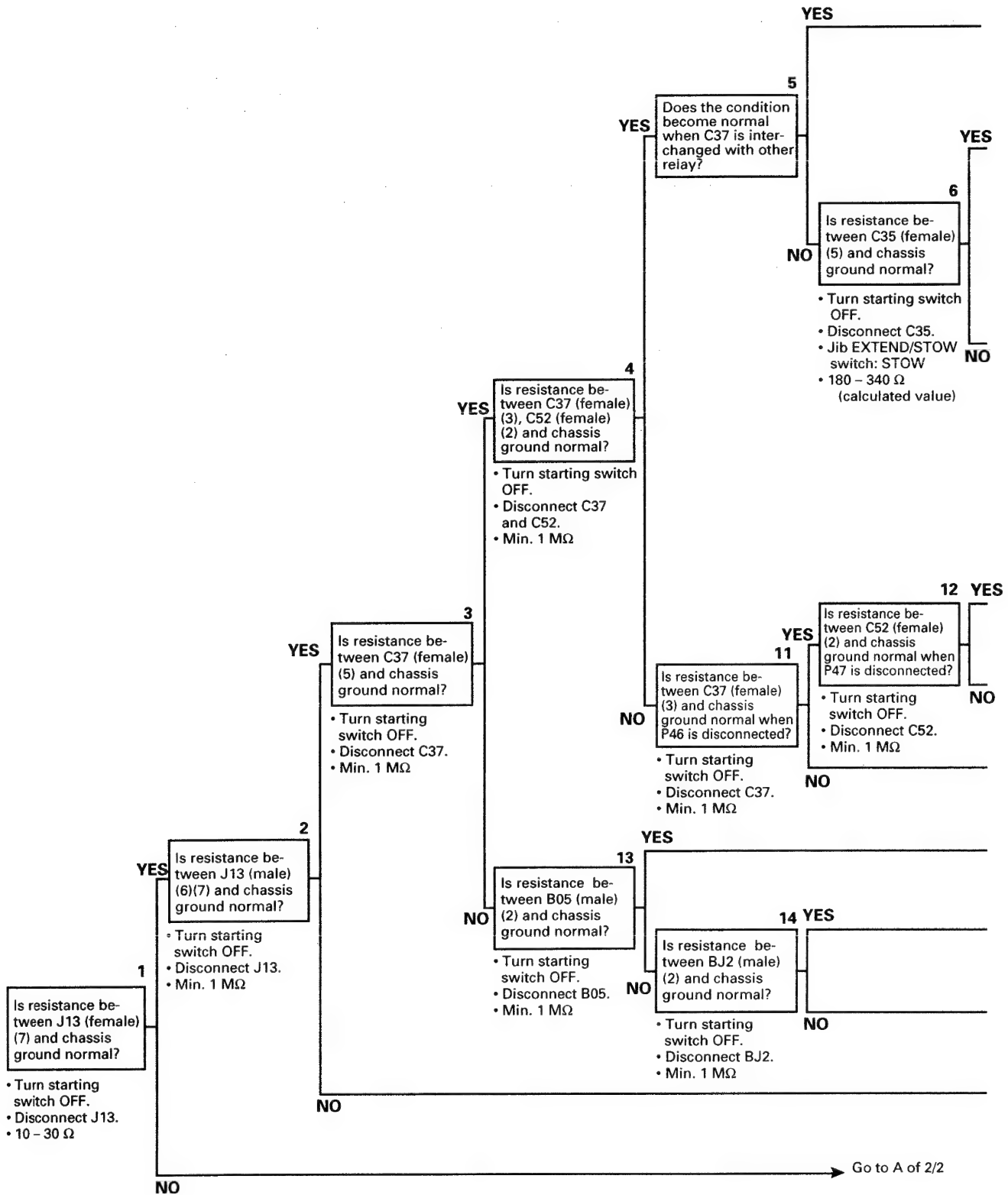
Disconnection (2/2)



023S02

	Cause	Remedy
	Defective jib EXTEND relay	Replace
	Defective contact or disconnection in wiring harness between J13 (female) (2) - BJ2 (male) (8)	Repair or replace
	Go to Troubleshooting No. 4 (1/2)	
	Defective jib EXTEND/STOW selector relay	Replace
	Defective contact or disconnection in wiring harness between BJ2 (male) (5) and J13 (female) (1)	Repair or replace
	Defective cord reel	Replace
	Go to Troubleshooting No. 22	
	Defective contact or disconnection in wiring harness between C52 (female) (6) - C23 (12) - chassis ground	Repair or replace
	Defective contact or disconnection in wiring harness between P43 (male) (3) - CP10 (2) - C23 (2) - C52 (female) (5) or CR11 (6) - BR3 (6) - B05 (female) (5)	Repair or replace
	Defective jib EXTEND/STOW switch	Replace
	Go to Troubleshooting No. 24	
	Jib automatic EXTEND/STOW relay	Replace
	Defective contact or disconnection in wiring harness between C35 (female) (5) - C52 (female) (1) or C23 (7) - CP10 (1) - P43 (male) (1)	Repair or replace
	Defective contact or disconnection in wiring harness between top fuse 5 and C35 (female) (3)	Repair or replace
	Defective power source system	Go to Troubleshooting for power source system (E-1)

Short circuit with chassis ground (1/2)



023S02

	Cause	Remedy
	Defective rotation permission relay	Replace
	Defective jib automatic EXTEND/STOW relay	Replace
<p>7 YES</p> <p>Is resistance between C35 (female) (3) and chassis ground normal?</p> <p>NO</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C35. • Min. 1 MΩ 	Wiring harness between top fuse 5 and C35 (female) (3) short circuiting with chassis ground	Repair or replace
	Defective jib STOW relay	Replace
<p>8</p> <p>Is resistance between C35 (female) (5) and chassis ground normal when C52 is disconnected?</p> <p>NO</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C35. • Min. 1 MΩ • Jib EXTEND/STOW switch: STOW • 1,800 – 2,200 Ω 	Defective jib EXTEND/STOW selector relay	Replace
<p>9 YES</p> <p>Is resistance between C35 (female) (5) and chassis ground normal when J13 is disconnected?</p> <p>NO</p> <ul style="list-style-type: none"> • Conditions are same as for Item 8. • 200 – 400 Ω 	Wiring harness between BJ2 (male) (5) and J13 (female) (1) short circuiting with chassis ground, or J14 is short circuited	Repair or replace
<p>10 YES</p> <p>Is resistance between C35 (female) (5) and chassis ground normal when BJ2 is disconnected?</p> <p>NO</p> <ul style="list-style-type: none"> • Conditions and standard values are same as for Item 9. <p>Go to B of 2/2</p>		
	Defective jib mode selector switch	Replace
	Wiring harness between C52 (female) (2) - C23 (4) - CP10 (4) - P47 short circuiting with chassis ground	Repair or replace
	Wiring harness between C36 (female) (3) - C23 (4) - CP10 (9) - P47 short circuiting with chassis ground	Repair or replace
	Wiring harness between C37 (female) (5) - C23 (6) - CR11 (9) - BR3 (3) - B05 (female) (2) short circuiting with chassis ground	Repair or replace
	Defective cord reel	Replace
	Wiring harness between BJ2 (male) (2) and J13 (female) (6) short circuiting with chassis ground	Repair or replace
	Defective jib EXTEND/STOW selector relay	Replace

023S02

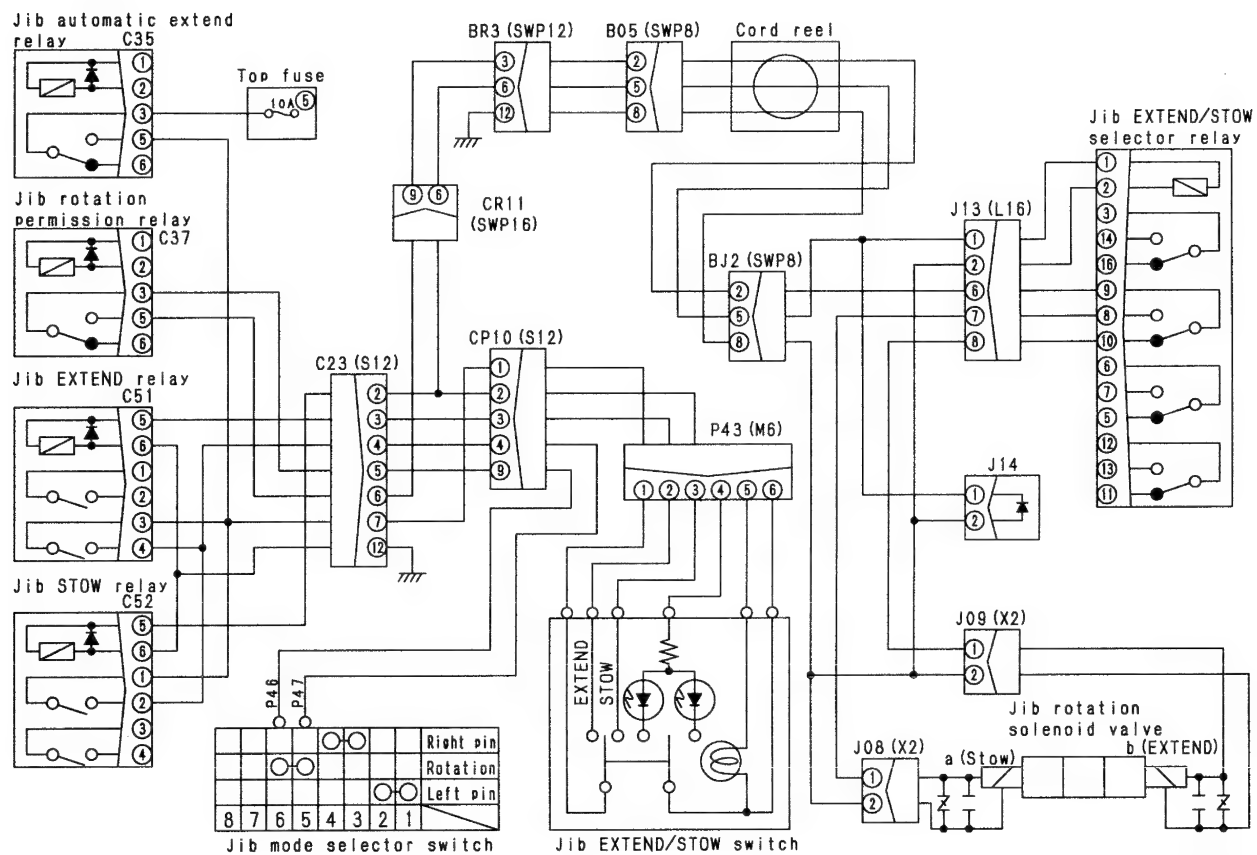
Short circuit with chassis ground (2/2)

		Cause	Remedy
<div> <div> <div>15 YES</div> <div> <div>A</div> <div>Is resistance between J13 (female) (7) and chassis ground normal when J08 is disconnected?</div> <div> <div>• Turn starting switch OFF.</div> <div>• Disconnect J13.</div> <div>• Min. 1 MΩ</div> </div> </div> <div>NO</div> </div> </div>		Defective jib rotation solenoid [STOW]	Replace
		Wiring harness between J13 (female) (7) and J08 (female) (1) short circuiting with chassis ground	Repair or replace
<div> <div> <div>16 YES</div> <div> <div>B</div> <div>Is resistance between C35 (female) (5) and chassis ground normal when B05 is disconnected?</div> <div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C35.</div> <div>• Jib EXTEND/STOW switch: STOW</div> <div>• 200 – 400 Ω</div> </div> </div> <div>NO</div> </div> </div>	<div> <div>17 YES</div> <div>Is resistance between C35 (female) (5) and chassis ground normal when P43 is disconnected?</div> <div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C35.</div> <div>• Min. 1 MΩ</div> </div> </div> <div>NO</div>	Defective cord reel	Replace
		Defective jib EXTEND/STOW switch	Replace
		Wiring harness between C35 (female) (5) - C52 (female) (1) or C23 (7) - CP10 (1) - P43 (male) (1) short circuiting with chassis ground	Repair or replace

Short circuit with power source

		Cause	Remedy
<div> <div> <div>1 YES</div> <div> <div>1</div> <div>Is voltage between J08 (female) (1) and chassis ground normal?</div> <div> <div>• Disconnect J08.</div> <div>• Turn starting switch ON.</div> <div>• Max. 1 V</div> </div> </div> <div>NO</div> </div> </div>	<div> <div>2 YES</div> <div>Is voltage between J08 (female) (1) and chassis ground normal when J13 is disconnected?</div> <div> <div>• Disconnect J08.</div> <div>• Turn starting switch ON.</div> <div>• Max. 1 V</div> </div> </div> <div>NO</div>	Defective jib rotation solenoid [STOW]	Replace
		Defective jib EXTEND/STOW selector relay	Replace
		Wiring harness between J13 (female) (7) and J08 (female) (1) short circuiting with power source	

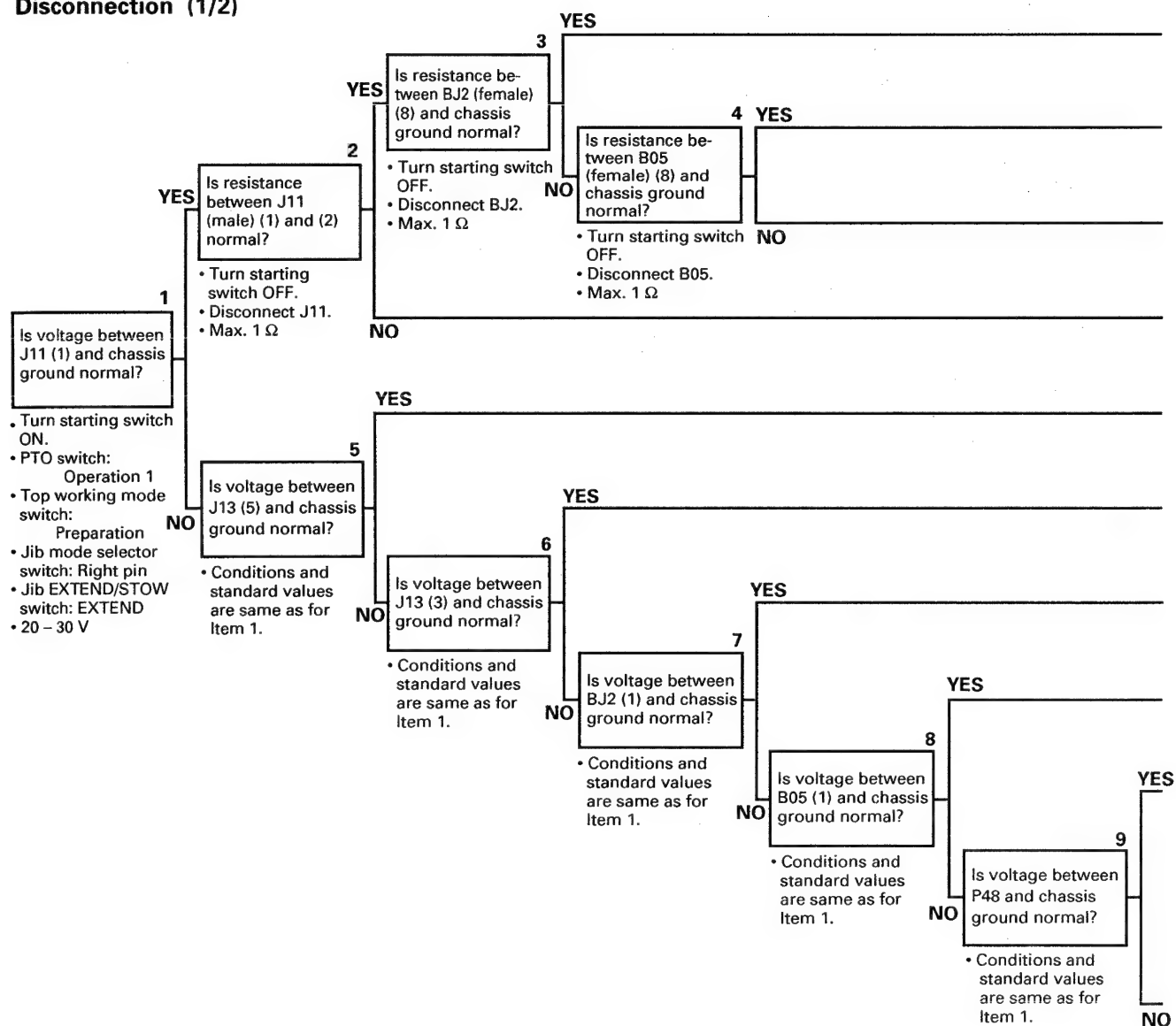
EM-120 Related electric circuit diagram



EM-121 Abnormality in jib right lock pin solenoid (EXTEND) system

- ★ When no error code is displayed.
- ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection (1/2)



023S02

023S02

	Cause	Remedy
	Defective contact or disconnection in wiring harness between J11 (female) (2) and BJ2 (male) (8)	Repair or replace
	Defective cord reel	Replace
	Defective contact or disconnection in wiring harness between B05 (female) (8) - BR3 (12) - chassis ground	Repair or replace
	Defective jib right lock pin solenoid [EXTEND]	Replace
	Defective contact or disconnection in wiring harness between J13 (female) (5) and J11 (female) (1)	Repair or replace
	Defective jib EXTEND/STOW selector relay	Replace
	Defective contact or disconnection in wiring harness between BJ2 (male) (1) and J13 (female) (3)	Repair or replace
	Defective cord reel	Replace
	Defective contact or disconnection in wiring harness between P48 - CP10 (8) - CR11 (8) - BR3 (2) - B05 (female) (1)	Repair or replace
	Defective jib mode selector switch	Repair or replace

10

Is voltage between P49 and chassis ground normal?

• Conditions and standard values are same as for Item 1.

YES

NO

11

Is voltage between C51 (female) (3) and chassis ground normal?

• Disconnect C51.
• Other conditions and standard values are same as for Item 1.

YES

NO

12

Is voltage between C51 (female) (5) and chassis ground normal?

• Disconnect C51.
• Other conditions and standard values are same as for Item 1.

YES Go to A of 2/2

NO Go to B of 2/2

13

Is voltage between C35 (female) (3) and chassis ground normal?

• Disconnect C35.
• Turn starting switch ON.
• 20 – 30 V

YES Go to C of 2/2

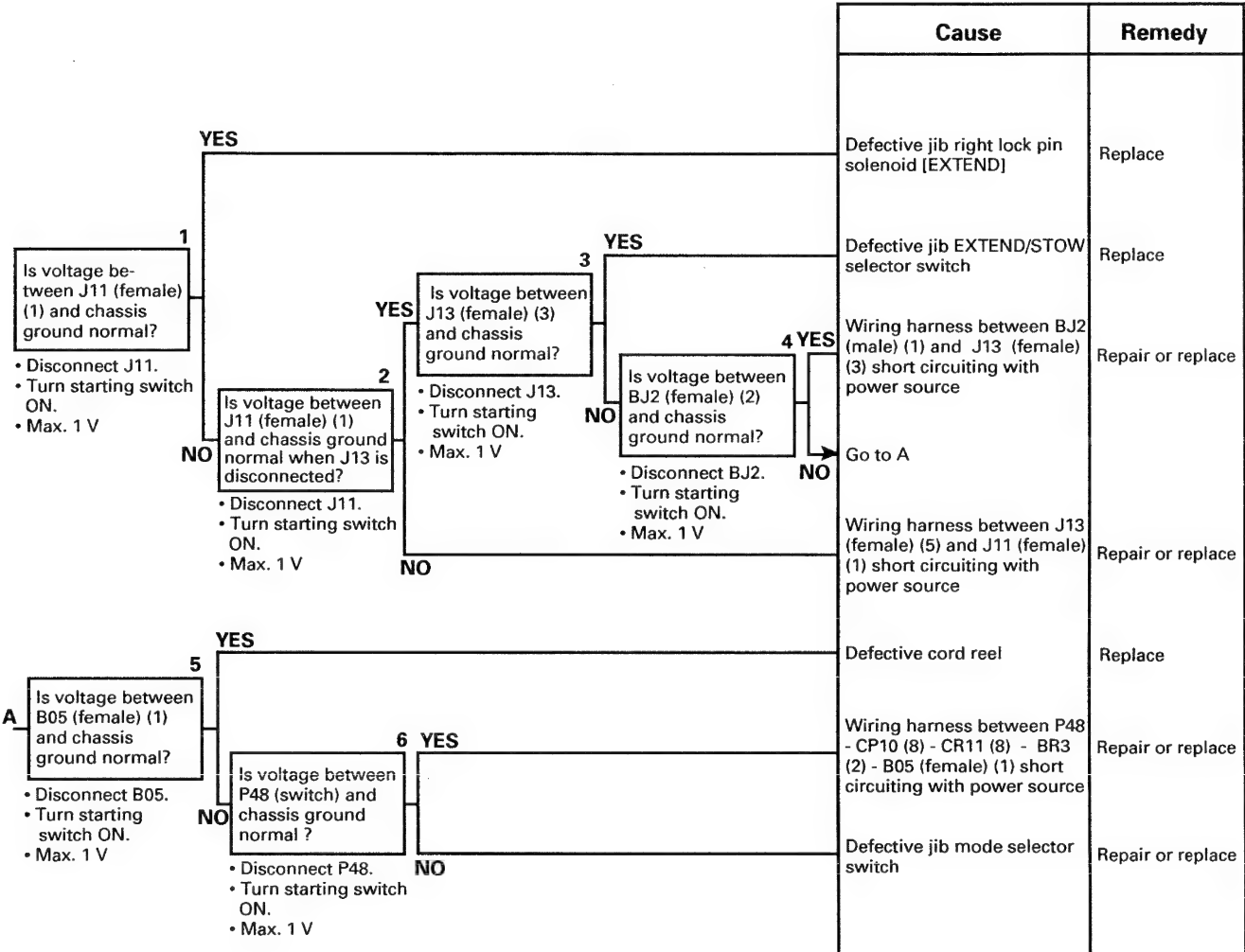
NO Go to D of 2/2

Disconnection (2/2)

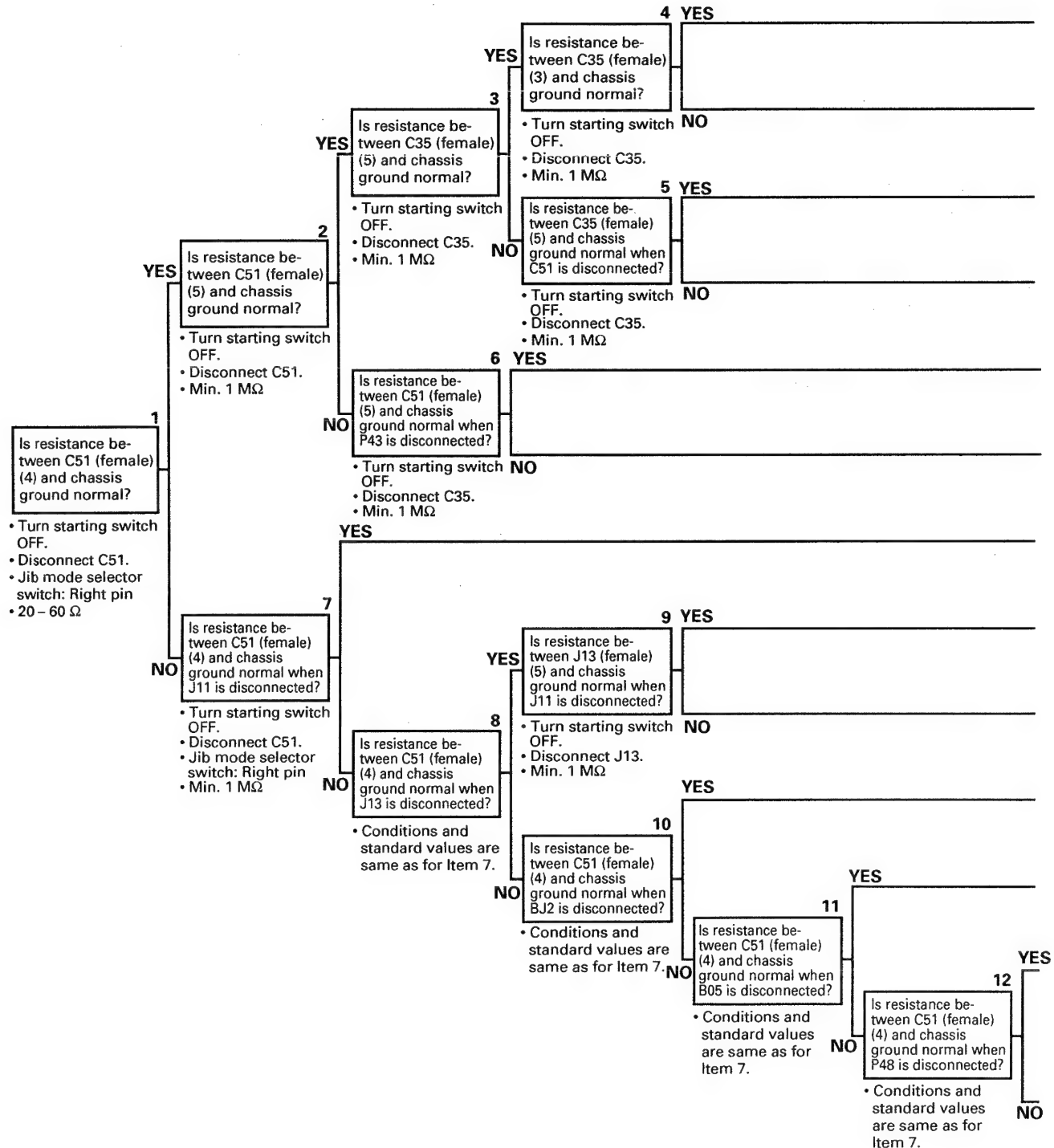
		Cause	Remedy
A	Is voltage between C51 (female) (6) and chassis ground normal? • Turn starting switch OFF.	14 YES Is resistance between P49 and chassis ground normal when P51 and C52 are disconnected? • Turn starting switch OFF. • PTO switch: Operation 1 • Top working mode switch: Preparation • Jib EXTEND/STOW switch: EXTEND • 20 – 30 V	15 YES Defective jib EXTEND relay Replace
		NO Defective contact or disconnection in wiring harness between C51 (female) (6) - C23 (4) - CP10 (4) - P49 Repair or replace	
		NO Defective contact or disconnection in wiring harness between C51 (female) (6) - C23 (12) - chassis ground Repair or replace	
		NO Defective contact or disconnection in wiring harness between C51 (female) (5) - C23 (3) - CP10 (3) - P43 (male) (2) Repair or replace	
B	Is voltage between P43 (2) and chassis ground normal? • Turn starting switch OFF. • PTO switch: Operation 1 • Top working mode switch: Preparation • Jib mode selector switch: Right pin • Jib EXTEND/STOW switch: EXTEND • 20 – 30 V	16 YES Is voltage between P43 (1) and chassis ground normal? • Conditions and standard values are same as for Item 15.	17 YES Defective jib EXTEND/STOW switch Replace
		NO Go to Troubleshooting No. 18	
C	Is voltage between C51 (female) (3), P43 (1) and chassis ground normal when C35 is interchanged with other relay? • Conditions and standard values are same as for Item 15.	18 YES Defective jib automatic EXTEND/STOW relay Replace	
		NO Defective contact or disconnection in wiring harness between C35 (female) (5) - C51 (female) (3) or C23 (7) - CP10 (1) - P43 (male) (1) Repair or replace	
D	Is voltage between top fuse 5 and chassis ground normal? • Turn starting switch ON. • 20 – 30 V	19 YES Defective contact or disconnection in wiring harness between top fuse 5 and C35 (female) (3) Repair or replace	
		NO Defective power source system Go to troubleshooting for power source system (E-1)	

023S02

Short circuit with power source



Short circuit with chassis ground



023S02

023S02

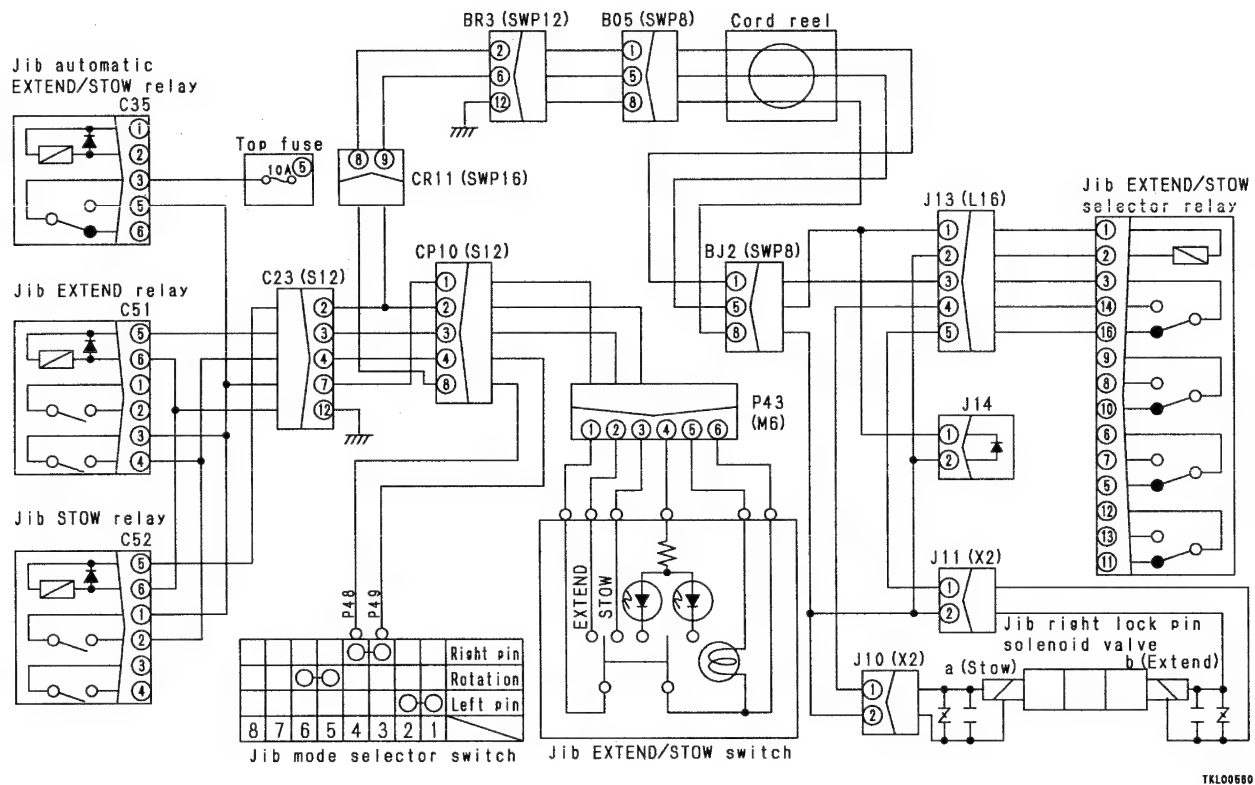
		Cause	Remedy
023S02		Defective jib automatic EXTEND/STOW relay	Replace
		Wiring harness between fuse 5 and C35 (female) (3) short circuiting with chassis ground	Repair or replace
		Defective jib EXTEND relay	Replace
		Wiring harness between C35 (female) (5) - C51 (female) (3) or C23 (7) - CP10 (1) - P43 (male) (1) short circuiting with chassis ground	Repair or replace
		Defective jib EXTEND/STOW switch	Replace
		Wiring harness between C51 (female) (5) - C23 (3) - CP10 (3) - P43 (male) (2) short circuiting with chassis ground	Repair or replace
		Defective jib right lock pin solenoid [EXTEND]	Replace
		Jib EXTEND/STOW selector relay	Repair or replace
		Wiring harness between J13 (female) (5) and J11 (female) (1) short circuiting with chassis ground	Repair or replace
		Wiring harness between BJ2 (male) (1) and J13 (female) (3) short circuiting with chassis ground	Repair or replace
		Defective cord reel	Replace
		Wiring harness between P48 - CP10 (8) - CR11 (8) - BR3 (2) - B05 (female) (1) short circuiting with chassis ground	Repair or replace
		Defective jib mode selector switch	Replace
		Wiring harness between C51 (female) (4) - C23 (4) - CP10 (4) - P49 short circuiting with chassis ground	Repair or replace

13 YES

Is resistance between C51(female) (4) and chassis ground normal when P49 is disconnected?

- Turn starting switch OFF.
- Disconnect C51.
- Min. 1 MΩ

EM-121 Related electric circuit diagram

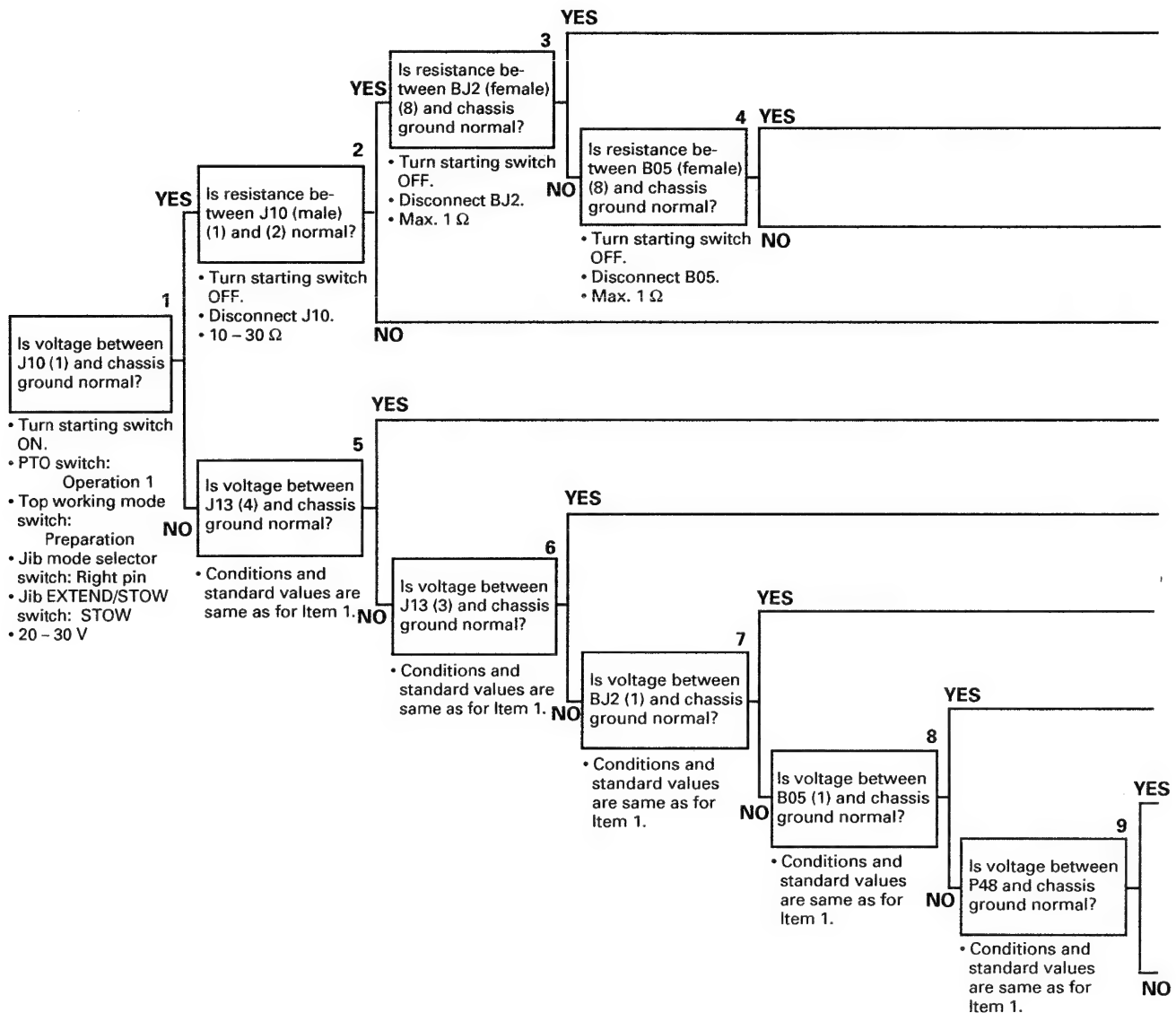


023S02

EM-122 Abnormality in jib right lock pin solenoid (STOW) system

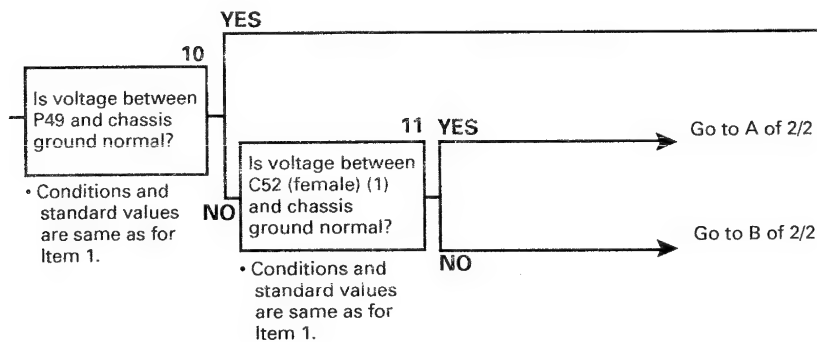
- ★ Check that top fuse 5 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection (1/2)



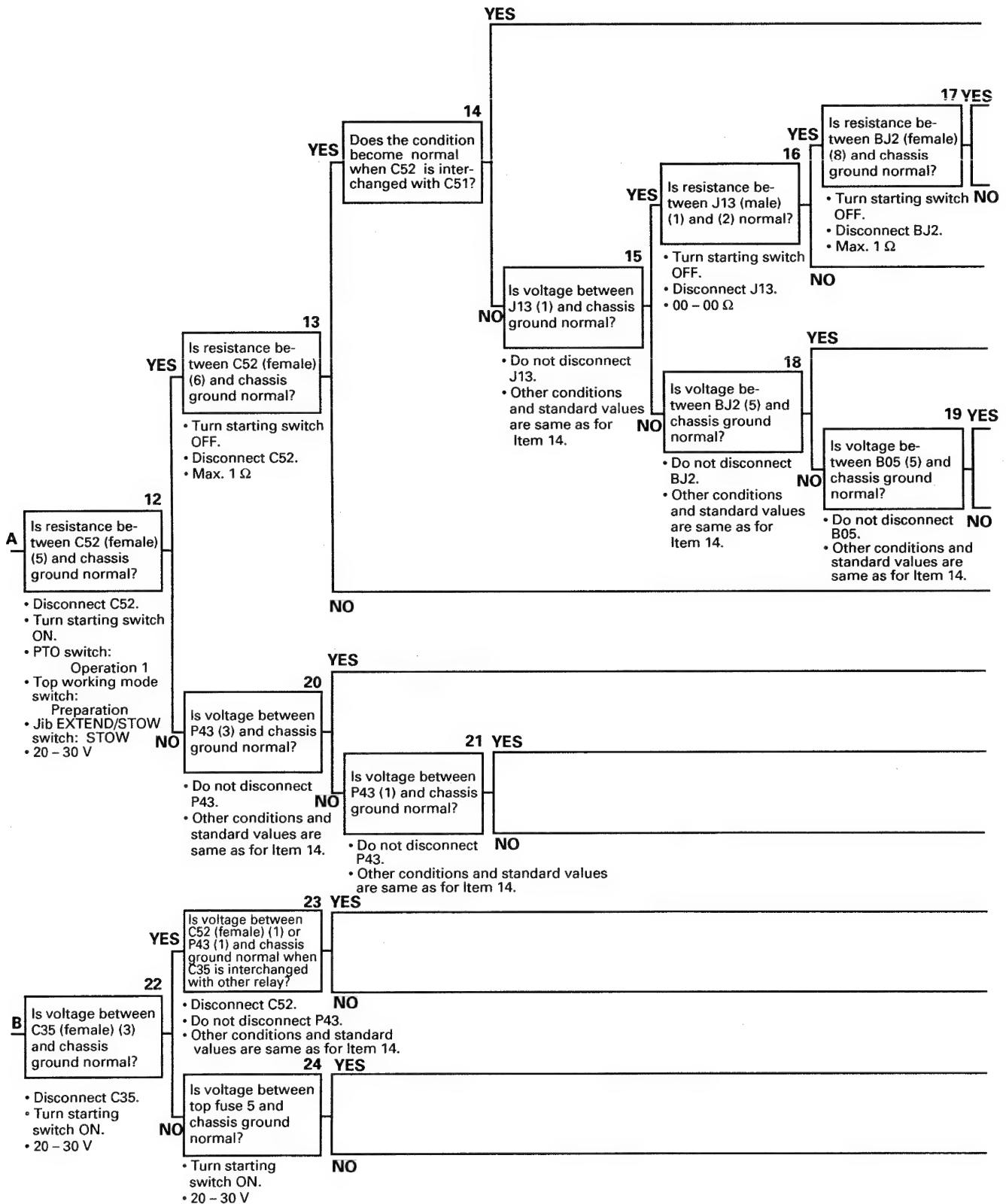
023S02

Cause	Remedy
Defective contact or disconnection in wiring harness between J10 (female) (2) and BJ2 (male) (8)	Repair or replace
Defective cord reel	Replace
Defective contact or disconnection in wiring harness between B05 (female) (8) - BR3 (12) - chassis ground	Repair or replace
Defective jib right lock pin solenoid [STOW]	Replace
Defective contact or disconnection in wiring harness between J13 (female) (4) and J10 (female) (1)	Repair or replace
Defective jib EXTEND/STOW selector relay	Replace
Defective contact or disconnection in wiring harness between BJ2 (male) (1) and J13 (female) (3)	Repair or replace
Defective cord reel	Replace
Defective contact or disconnection in wiring harness between P48 - CP10 (8) - CR11 (8) - BR3 (2) - B05 (female) (1)	Repair or replace
Defective jib mode selector switch	Repair or replace



023S02

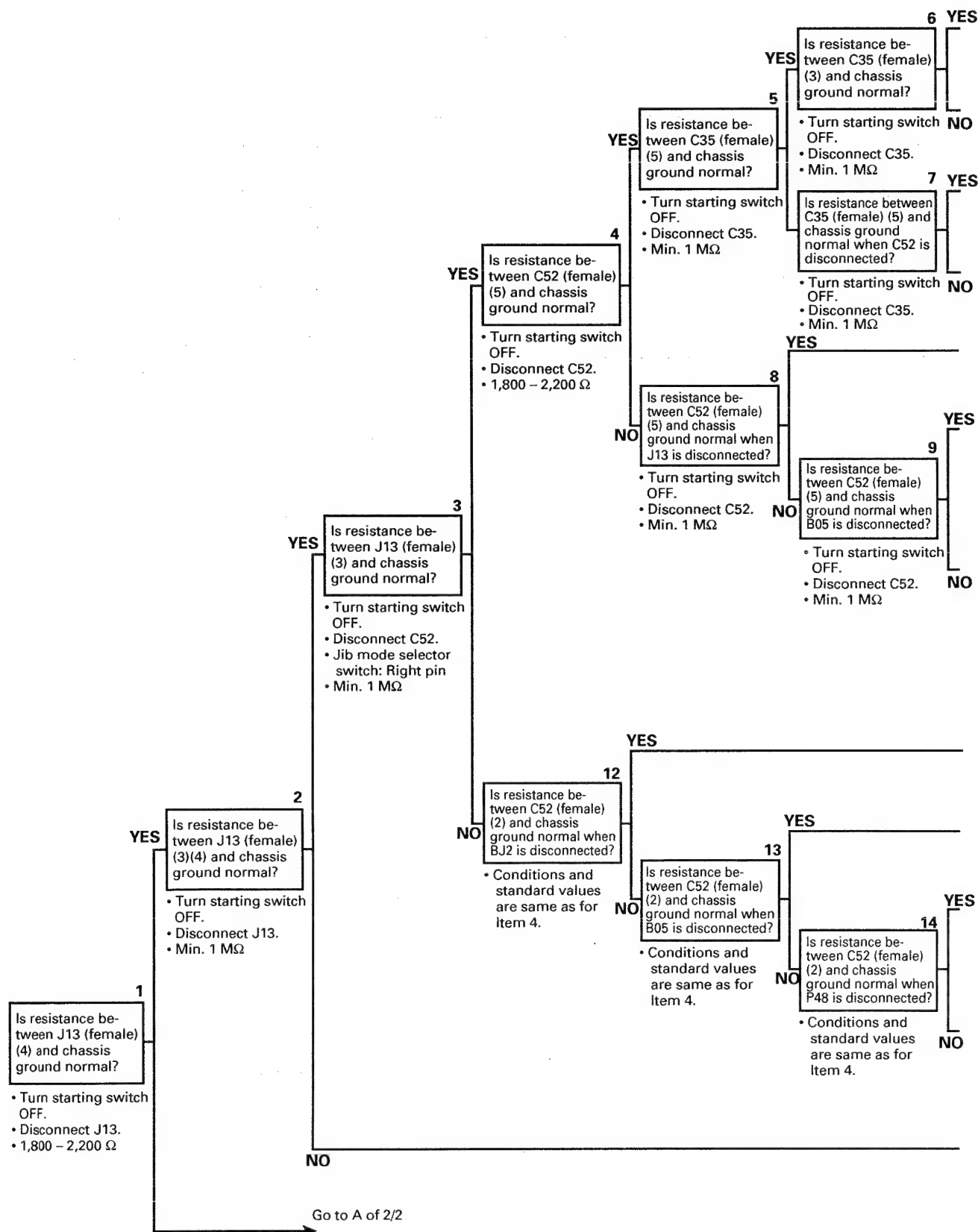
Disconnection (2/2)



023S02

	Cause	Remedy
	Defective jib STOW relay	Replace
	Defective contact or disconnection in wiring harness between J13 (female) (2) - BJ2 (male) (8)	Repair or replace
	Go to Troubleshooting No. 4 (1/2)	
	Defective jib EXTEND/STOW relay	Replace
	Defective contact or disconnection in wiring harness between BJ2 (male) (5) and J13 (female) (1)	Repair or replace
	Defective cord reel	Replace
	Go to Troubleshooting No. 20	
	Defective contact or disconnection in wiring harness between C52 (female) (6) - C23 (12) - chassis ground normal	Repair or replace
	Defective contact or disconnection in wiring harness between P43 (male) (3) - CP10 (2) - C23 (2) - C52 (female) (5) or CR11 (6) - BR3 (6) - B05 (female) (5)	Repair or replace
	Defective jib EXTEND/STOW switch	Replace
	Go to Troubleshooting No. 22	
	Defective jib automatic EXTEND/STOW relay	Replace
	Defective contact or disconnection in wiring harness between C35 (female) (5) - C52 (female) (1) or C23 (7) - CP10 (1) - P43 (male) (1)	Repair or replace
	Defective contact or disconnection in wiring harness between top fuse 5 and C35 (female) (3)	Repair or replace
	Defective power source system	Go to Troubleshooting for power source system (E-00)

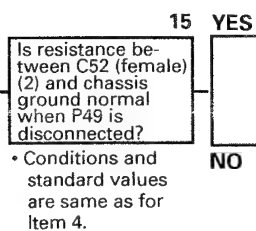
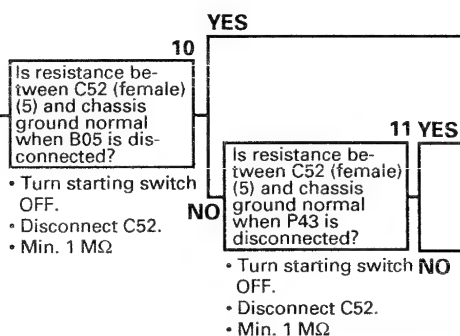
Short circuit with chassis ground (1/2)



023S02

023S02

		Cause	Remedy
		Defective jib automatic EXTEND/STOW relay	Repair or replace
		Wiring harness between top fuse 5 and C35 (female) (3) short circuiting with chassis ground	Repair or replace
		Defective jib STOW relay	Replace
		Wiring harness between C35 (female) (5) - C52 (female) (1) or C23 (7) - CP10 (1) - P43 (male) short circuiting with chassis ground	Repair or replace
		Defective jib EXTEND/STOW selector relay	Replace
		Wiring harness between BJ2 (male) (5) - J13 (female) (1) short circuiting with chassis ground, or J14 is short circuited.	Repair or replace
		Defective cord reel	Repair or replace
		Defective jib EXTEND/STOW relay	Replace
		Wiring harness between C52 (female) (5) - C23 (2) - CP10 (2) - P43 (male) (3) or CR11 (9) - BR3 (6) - B05 (female) (5) short circuiting with chassis ground	Repair or replace
		Wiring harness between BJ2 (male) (1) and J13 (female) (3) short circuiting with chassis ground	Repair or replace
		Defective cord reel	Replace
		Wiring harness between P48 - CP10 (8) - CR11 (8) - BR3 (2) - B05 (female) (1) short circuiting with chassis ground	Repair or replace
		Defective jib EXTEND/STOW selector relay	Replace
		Wiring harness between C52 (female) (2) - C23 (4) - CP10 (4) - P49 short circuiting with chassis ground	Repair or replace
		Defective jib EXTEND/STOW selector relay	Repair or replace



Short circuit with chassis ground (2/2)

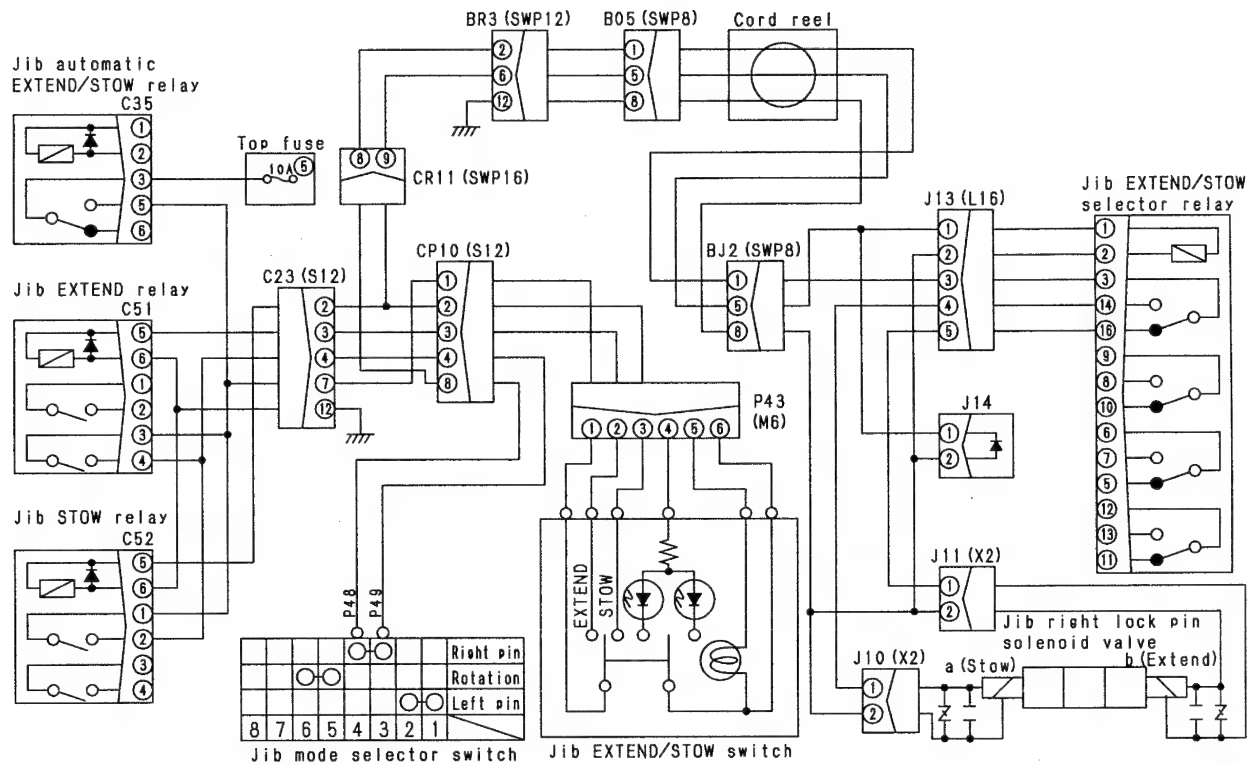
		Cause	Remedy
<div><div><div>16 YES</div><div><div><div>A</div><div>Is resistance between J13 (female) (4) and chassis ground normal when J10 is disconnected?</div><div><div><div>• Turn starting switch OFF.</div><div>• Disconnect J13.</div><div>• Min. 1 MΩ</div></div><div>NO</div></div></div></div></div></div>		Defective jib right lock pin solenoid [STOW]	Replace
		Wiring harness between J13 (female) (4) and J10 (female) (1) short circuiting with chassis ground	Repair or replace

Short circuit with power source

		Cause	Remedy
<div><div><div>1</div><div>Is voltage between J10 (female) (1) and chassis ground normal?</div><div><div>• Disconnect J10.</div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div></div><div><div>YES</div></div></div> <div><div>Defective jib right lock pin solenoid [STOW]</div><div>Replace</div></div> <tr><td><div><div>2 YES</div><div>Is voltage between J10 (female) (1) and chassis ground normal when J13 is disconnected?</div><div><div>• Disconnect J10.</div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div></div><div><div>Defective jib EXTEND/STOW selector relay</div><div>Replace</div></div><tr><td><div><div>NO</div></div><div><div>Wiring harness between J13 (female) (4) and J10 (female) (1) short circuiting with power source</div><div>Repair or replace</div></div></td></tr></td></tr>	<div><div>2 YES</div><div>Is voltage between J10 (female) (1) and chassis ground normal when J13 is disconnected?</div><div><div>• Disconnect J10.</div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div></div> <div><div>Defective jib EXTEND/STOW selector relay</div><div>Replace</div></div> <tr><td><div><div>NO</div></div><div><div>Wiring harness between J13 (female) (4) and J10 (female) (1) short circuiting with power source</div><div>Repair or replace</div></div></td></tr>	<div><div>NO</div></div> <div><div>Wiring harness between J13 (female) (4) and J10 (female) (1) short circuiting with power source</div><div>Repair or replace</div></div>	
	<div><div>2 YES</div><div>Is voltage between J10 (female) (1) and chassis ground normal when J13 is disconnected?</div><div><div>• Disconnect J10.</div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div></div> <div><div>Defective jib EXTEND/STOW selector relay</div><div>Replace</div></div> <tr><td><div><div>NO</div></div><div><div>Wiring harness between J13 (female) (4) and J10 (female) (1) short circuiting with power source</div><div>Repair or replace</div></div></td></tr>	<div><div>NO</div></div> <div><div>Wiring harness between J13 (female) (4) and J10 (female) (1) short circuiting with power source</div><div>Repair or replace</div></div>	
	<div><div>NO</div></div> <div><div>Wiring harness between J13 (female) (4) and J10 (female) (1) short circuiting with power source</div><div>Repair or replace</div></div>		

023S02

EM-122 Related electric circuit diagram



TKL50580

023S02

EM-123 Abnormality in swing brake solenoid system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

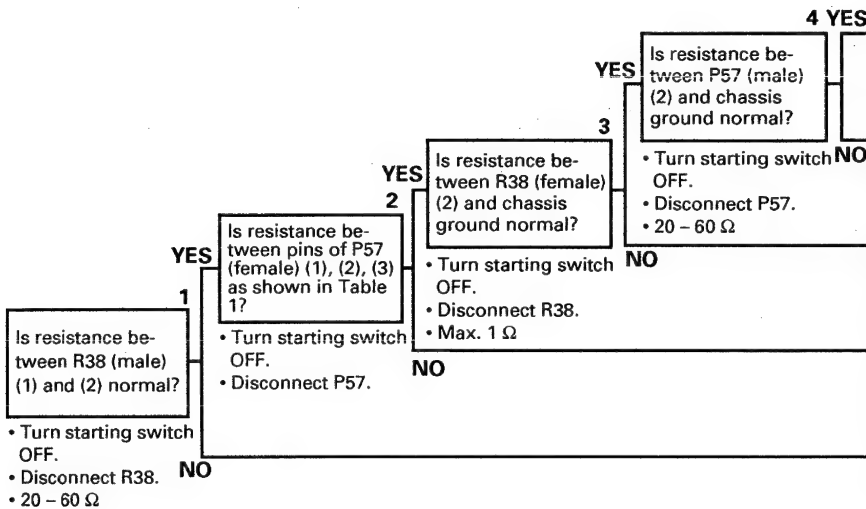


Table 1

P57 (female)	Swing brake switch	Resistance value
Between (1) - (2)	OFF	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	ON	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

Cause	Remedy
Defective contact or disconnection in wiring harness between C34 (female) (5) - C22 (11) - CP11 (10) - P57 (male) (1)	Repair or replace
Defective contact or disconnection in wiring harness between P57 (male) (2) - CP11 (9) - CR7 (6) - R38 (female) (1)	Repair or replace
Defective contact or disconnection in wiring harness between R38 (female) (2) and chassis ground	Repair or replace
Defective swing brake switch	Replace
Defective swing brake solenoid	Replace

Short circuit with chassis ground

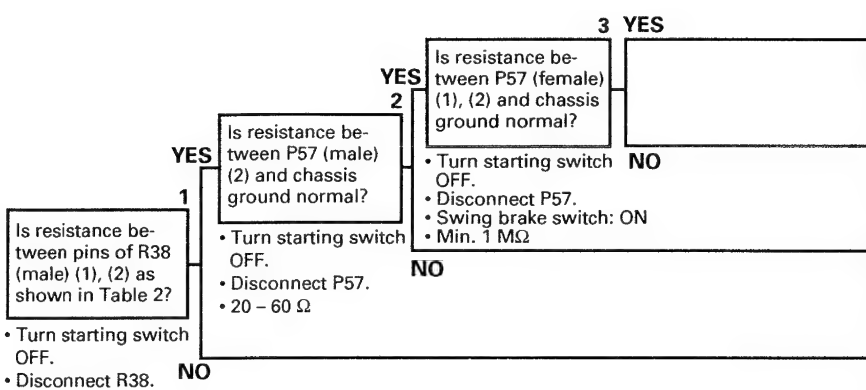


Table 2

R38 (male)	Resistance value
Between (1) - (2)	20 – 60 Ω
Between (1) - chassis ground	Min. 1 MΩ

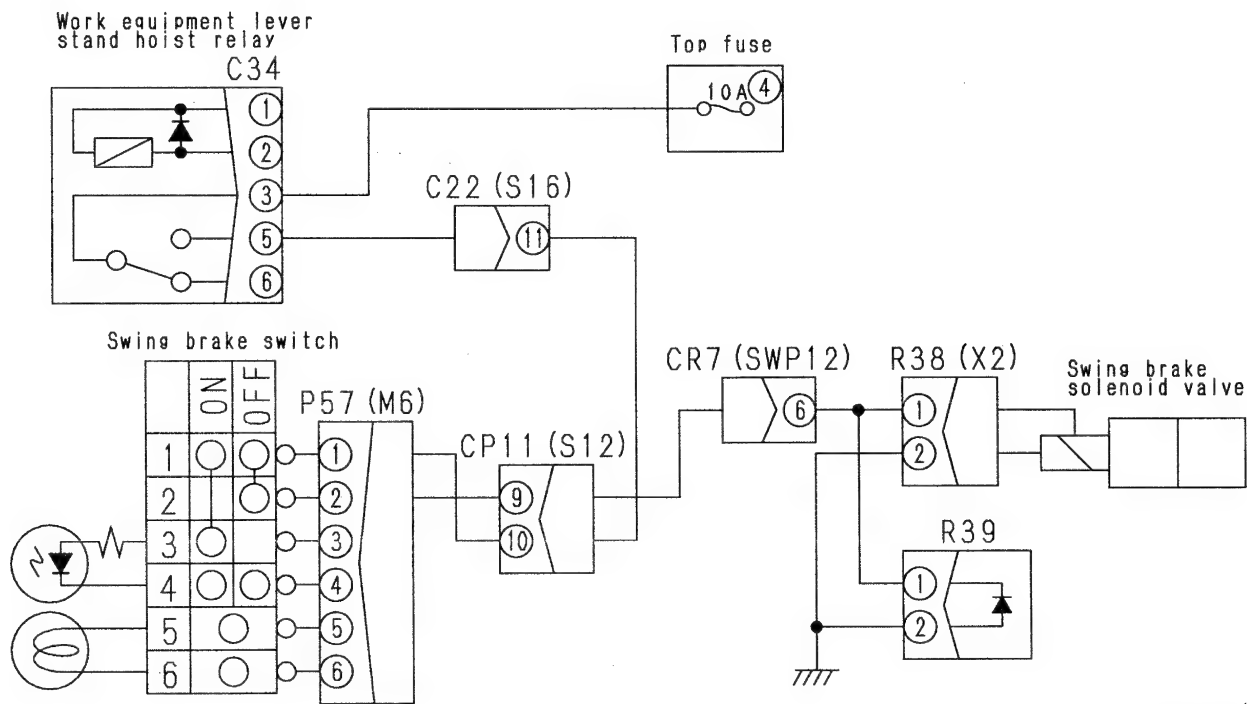
Cause	Remedy
Wiring harness between C34 (female) (5) - C22 (11) - CP11 (10) - P57 (female) (1) short circuiting with chassis ground	Repair or replace
Defective swing brake switch	Replace
Wiring harness between P57 (male) (2) - CP11 (9) - CR7 (6) - R38 (female) (1) short circuiting with chassis ground	Repair or replace
Defective swing brake solenoid	Replace

023502

Short circuit with power source

		Cause	Remedy
<div><div><div>Is voltage between P57 (2) and chassis ground normal?</div><div><div>YES</div><div>1</div></div></div><div><div>Is voltage between R38 (1) and chassis ground normal?</div><div><div>2 YES</div><div>NO</div></div><div><div>• Conditions and standard values are same as for Item 1.</div></div></div><div><div>• Turn starting switch ON.</div><div>• PTO switch: Operation 2</div><div>• Work equipment lever stand: Raised</div><div>• Swing brake switch: ON</div><div>• Max. 1 V</div></div></div>	<div><div>Defective swing brake solenoid</div><div>Defective contact or disconnection in wiring harness between P57 (male) (2) - CP11 (9) - CR7 (6) - R38 (female) (1)</div><div>Defective swing brake switch</div></div>	<div>Replace</div> <div>Repair or replace</div> <div>Replace</div>	

EM-123 Related electric circuit diagram



TKL00561

EM-124 Abnormality in swing FREE solenoid system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

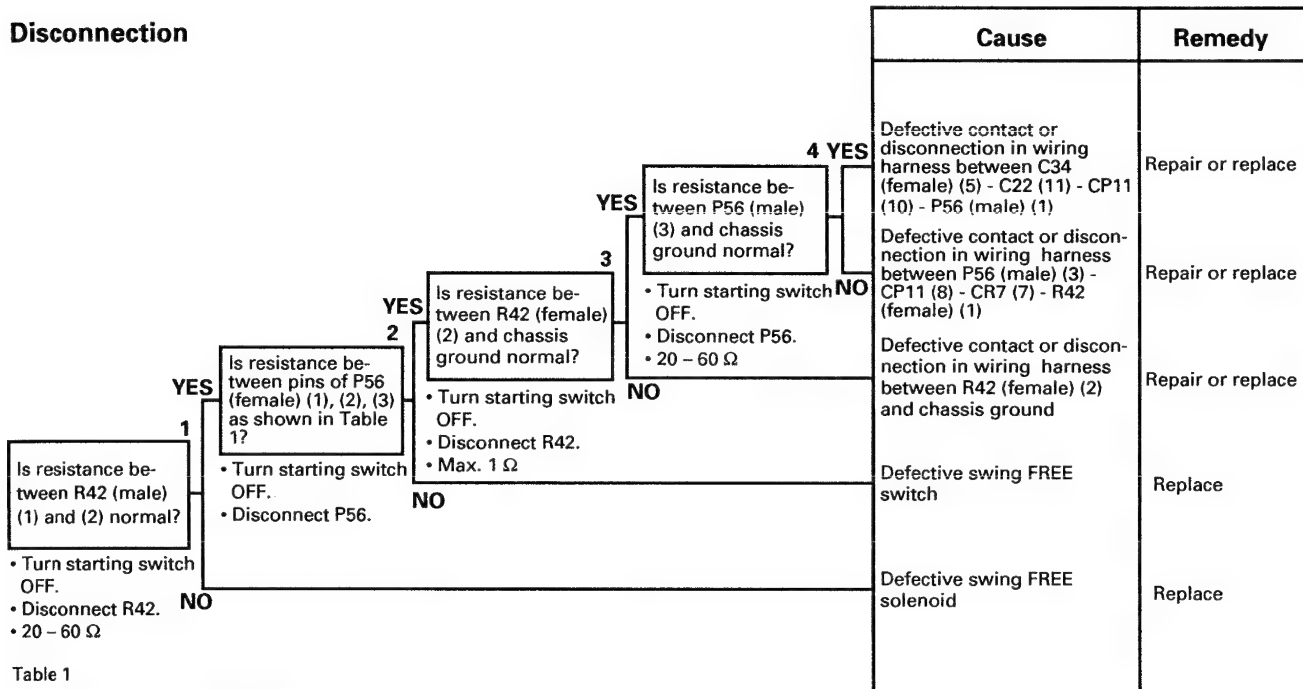


Table 1

P56 (female)	Swing FREE switch	Resistance value
Between (1) - (2)	LOCK	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	FREE	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω

Short circuit with chassis ground

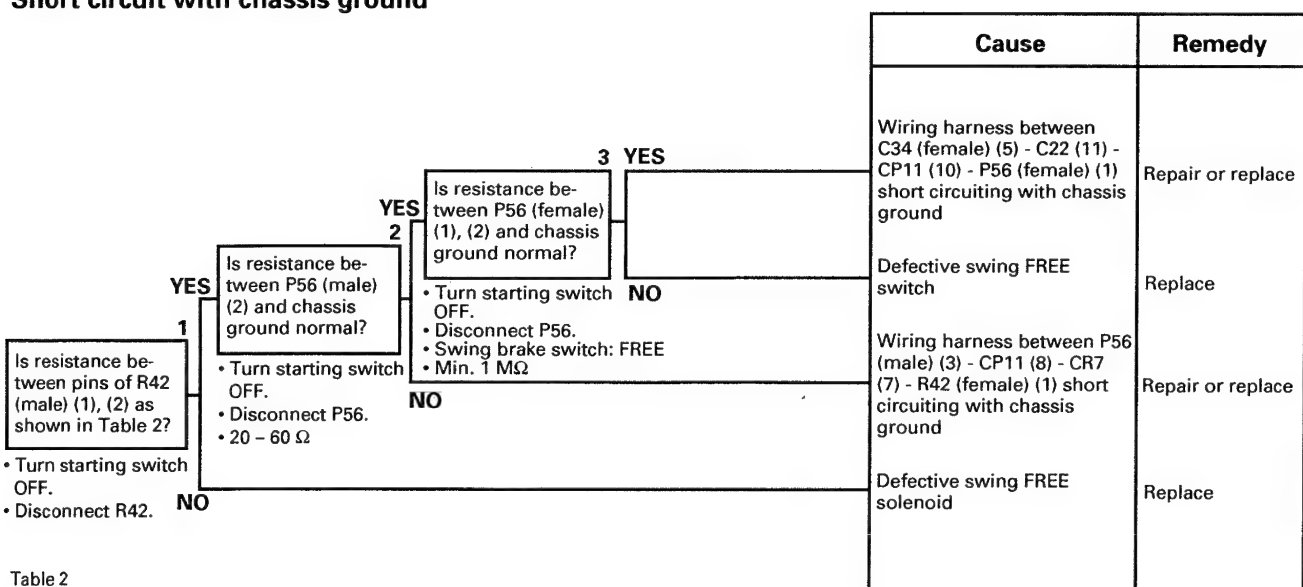
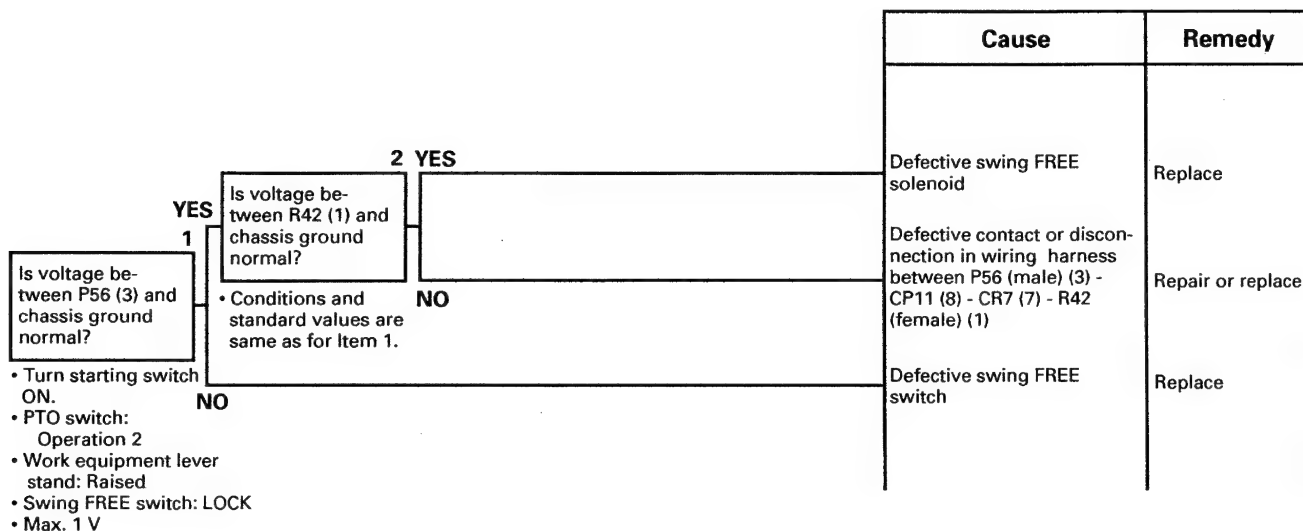


Table 2

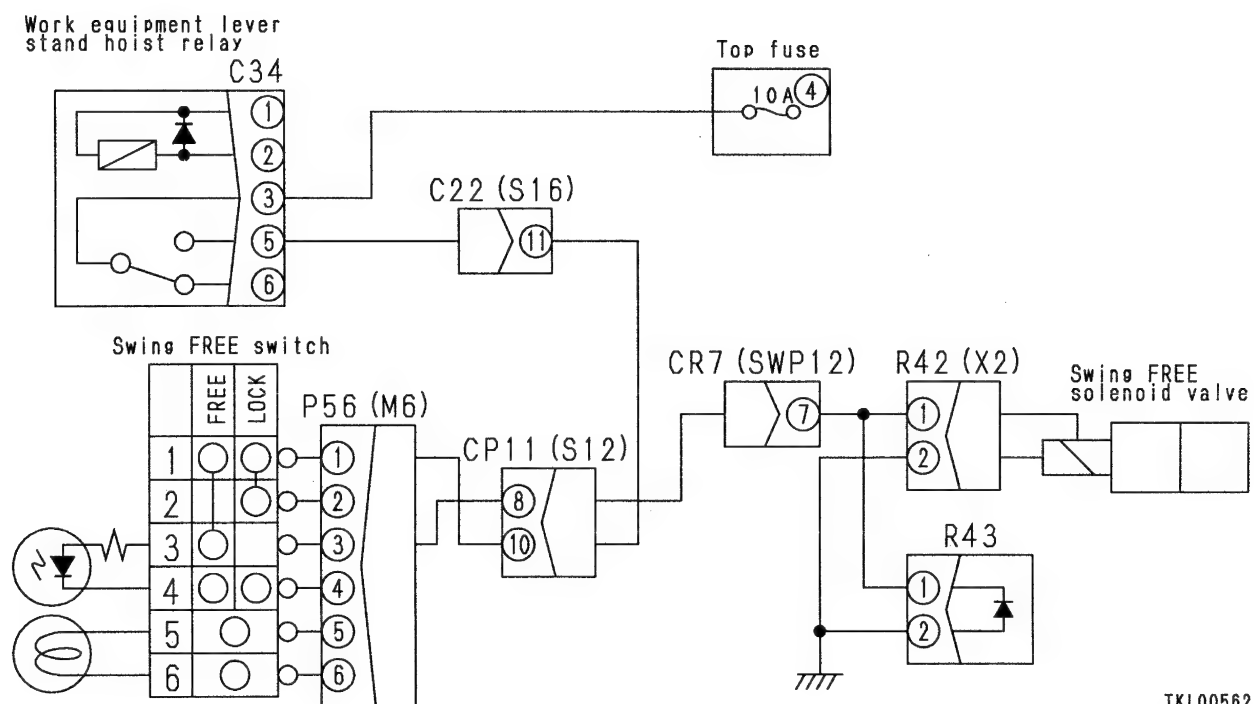
R42 (male)	Resistance value
Between (1) - (2)	20 – 60 Ω
Between (1) - chassis ground	Min. 1 MΩ

Short circuit with power source



023S02

EM-123 Related electric circuit diagram



TKL00562

EM-125 Abnormality in main winch drum speed signal (abnormality in main winch drum speed sensor system)

- ★ When no error code is displayed.
- ★ Check that top fuse 10 is not blown. (If it is blown, carry out troubleshooting from the Item 2 NO line.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

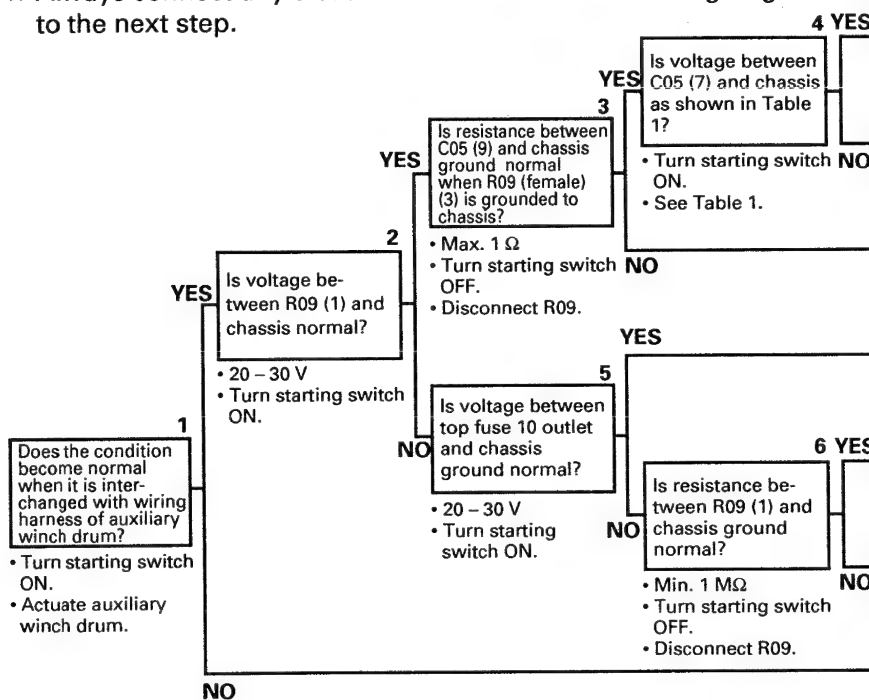


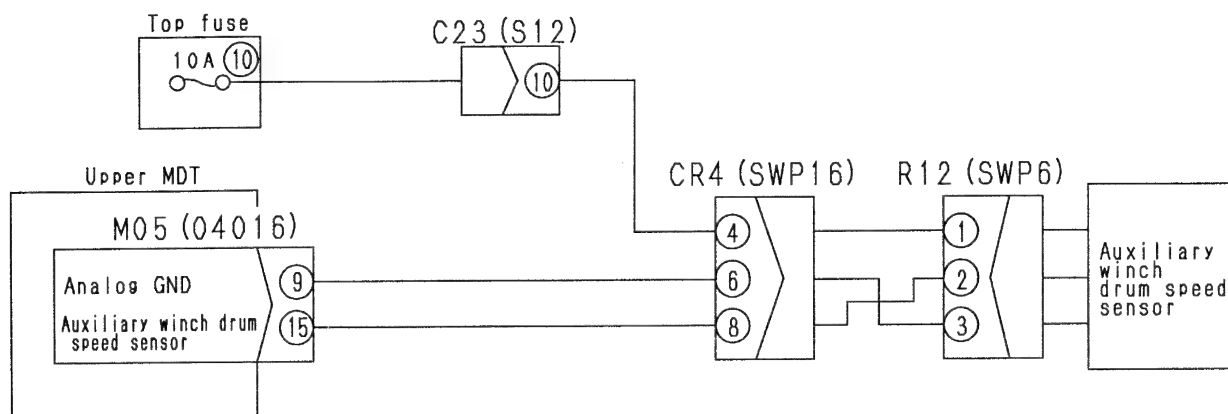
Table 1

Speed sensor ON (sensor pilot LED ON)	Between C05 (7) - chassis ground	Max. 1 V
Speed sensor OFF (sensor pilot LED OFF)		3 – 4 V

	Cause	Remedy
S	If only buzzer is defective, go to troubleshooting for abnormality in buzzer (EM-127) If buzzer and display indicator are both defective, upper MDT is defective	Repair or replace
D	Defective contact, disconnection, short circuit with ground, or short circuit with power source in wiring harness between C05 (female) (7) - CR4 (5) - R09 (female) (2)	Repair or replace
	Defective contact or disconnection in wiring harness between C05 (female) (9) - CR4 (6) - R09 (female) (3)	Repair or replace
S	Defective contact or disconnection in wiring harness between top fuse 10 - C23 (10) - CR4 (4) - R09 (female) (1)	Repair or replace
S	Defective power source system	Go to troubleshooting for power source system (E-1)
D	Wiring harness between top fuse 10 - C23 (10) - CR4 (4) - R09 (female) (1) short circuiting with chassis ground	Repair or replace
	Defective main winch drum speed sensor or defective sensor mount	Repair or replace

023S02

EM-125 Related electric circuit diagram



TKL00563

EM-126 Abnormality in auxiliary winch drum speed display or abnormality in auxiliary winch speed buzzer

- ★ When no error code is displayed.
- ★ Check that top fuse 10 is not blown. (If it is blown, carry out troubleshooting from the Item 2 NO line.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

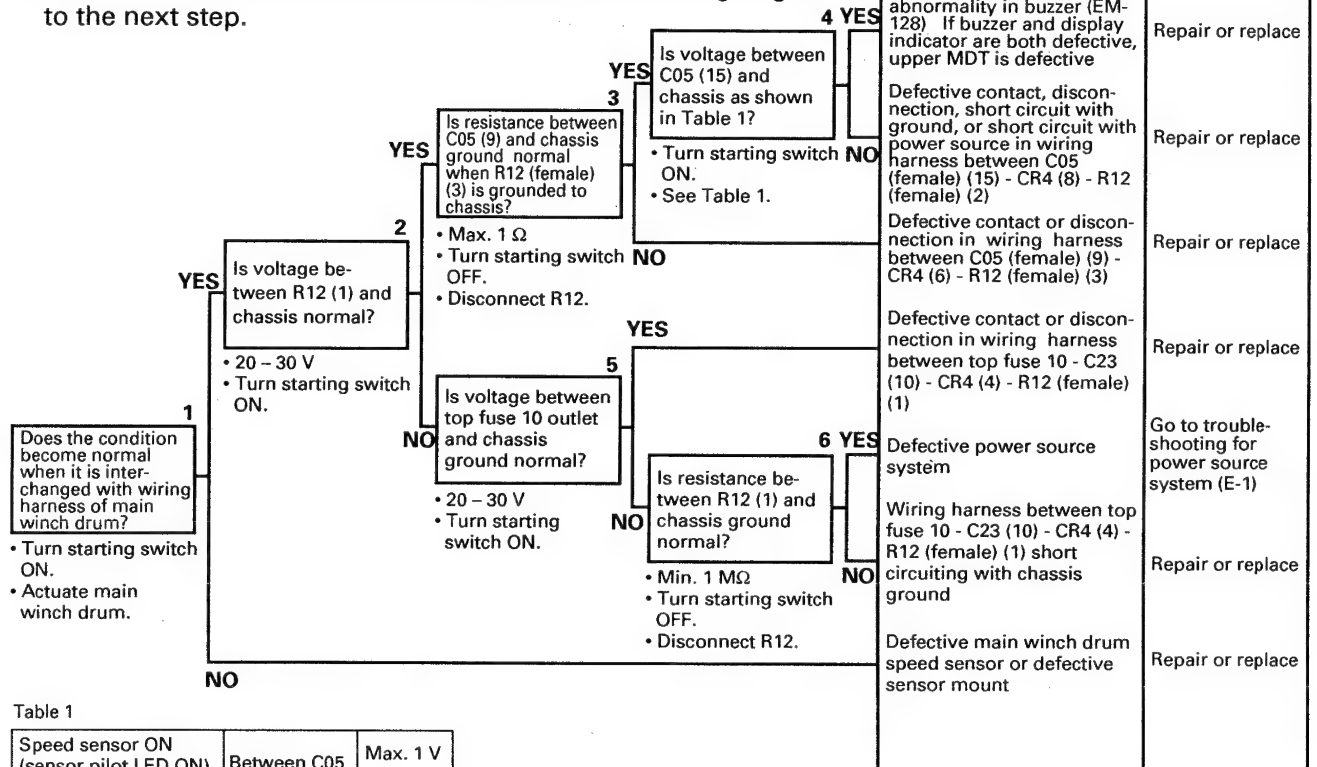
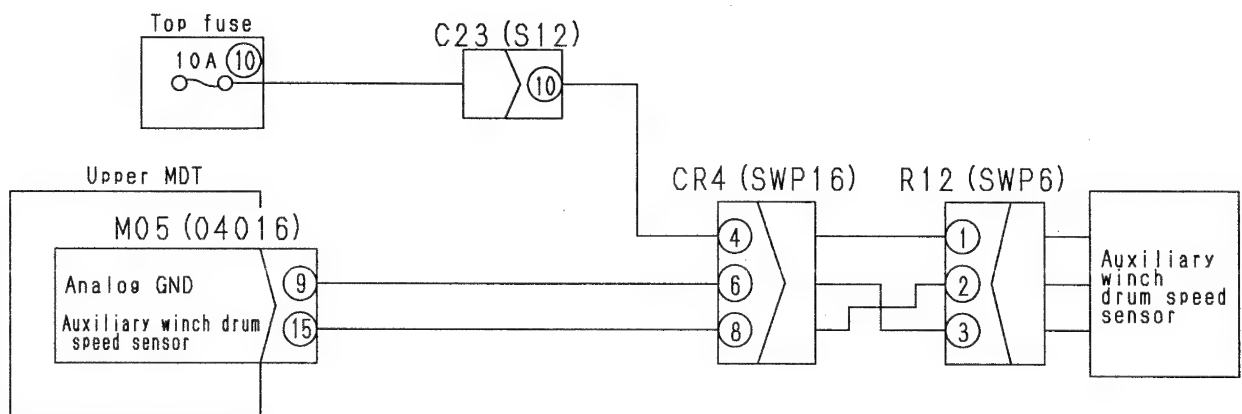


Table 1

Speed sensor ON (sensor pilot LED ON)	Between C05 (15) - chassis ground	Max. 1 V
Speed sensor OFF (sensor pilot LED OFF)		3 – 4 V

EM-126 Related electric circuit diagram



TKL00563

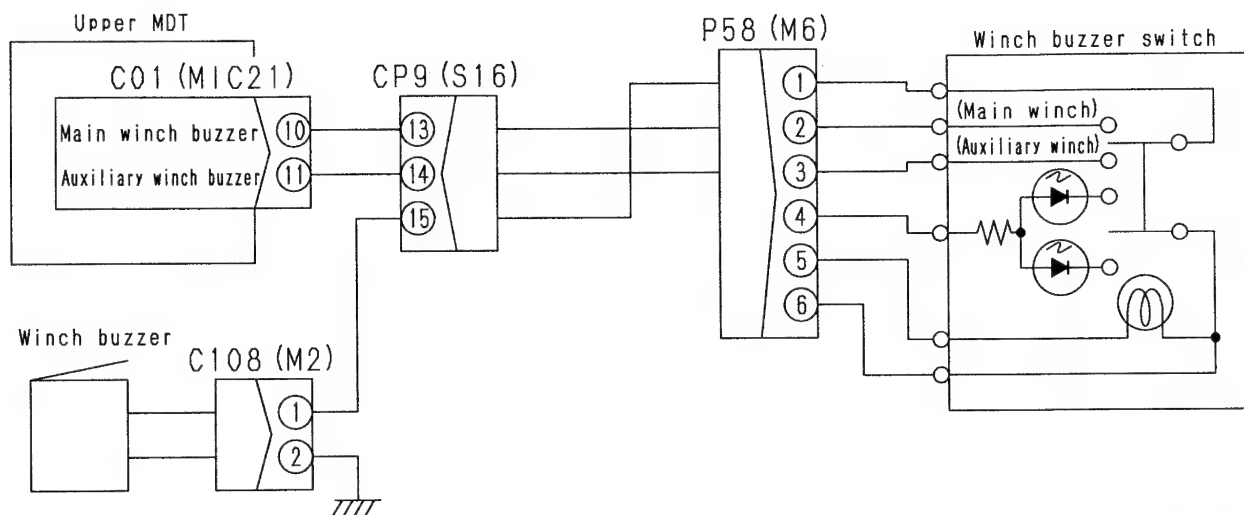
- ★ When no error code is displayed.
- ★ Check that the main winch drum speed sensor system is normal (see EM-125) before starting troubleshooting.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

YES Is auxiliary winch



P58 (female)	Winch buzzer switch	Resistance value
Between (1) - (2)	Main winch	Max. 1 Ω
Between (1) - (3)		Min. 1 M Ω
Between (1) - (2)	Neutral	Min. 1 M Ω
Between (1) - (3)		Min. 1 M Ω
Between (1) - (2)	Auxiliary winch	Min. 1 M Ω
Between (1) - (3)		Max. 1 Ω

EM-127 Related electric circuit diagram



TKL00564

023S02

EM-128 Abnormality in auxiliary winch buzzer system

- ★ When no error code is displayed.
- ★ Check that the auxiliary winch drum speed sensor system is normal (see EM-126) before starting troubleshooting.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

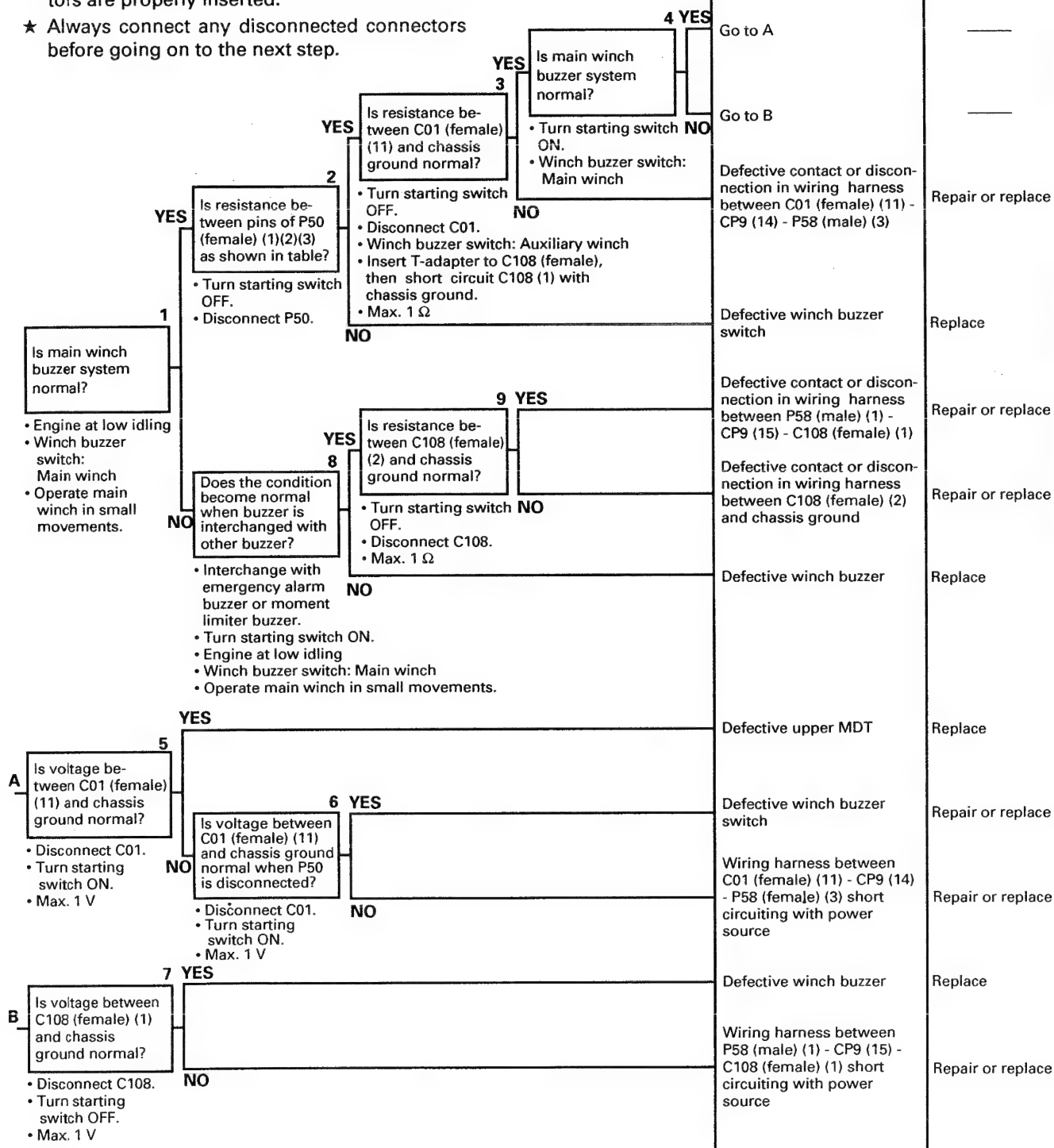
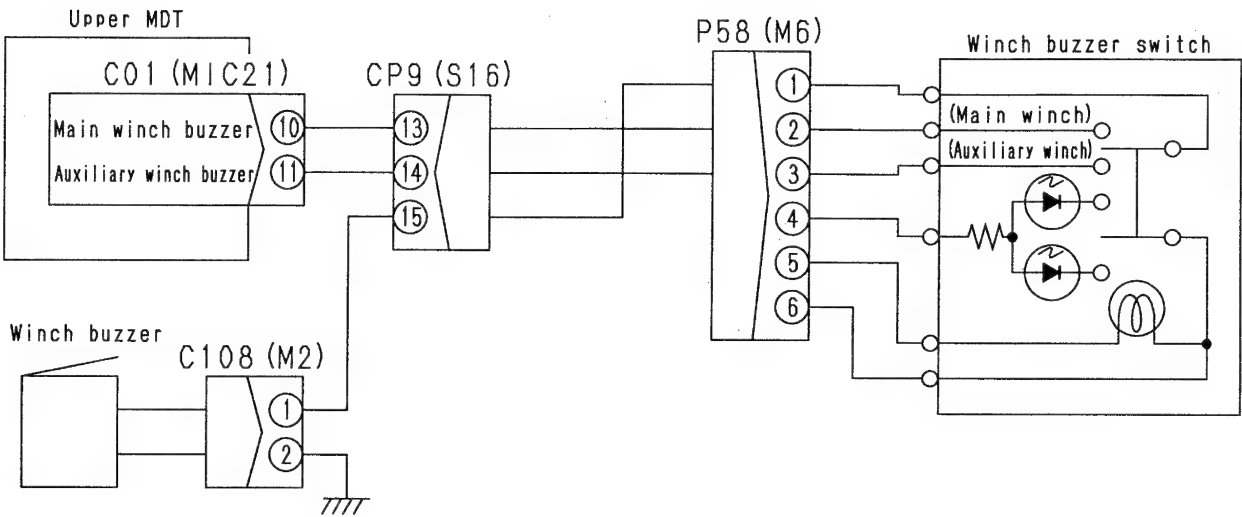


Table 1

P58 (female)	Winch buzzer switch	Resistance value
Between (1) - (2)	Main winch	Max. 1 Ω
Between (1) - (3)		Min. 1 M Ω
Between (1) - (2)	Neutral	Min. 1 M Ω
Between (1) - (3)		Min. 1 M Ω
Between (1) - (2)	Auxiliary winch	Min. 1 M Ω
Between (1) - (3)		Max. 1 Ω

EM-128 Related electric circuit diagram



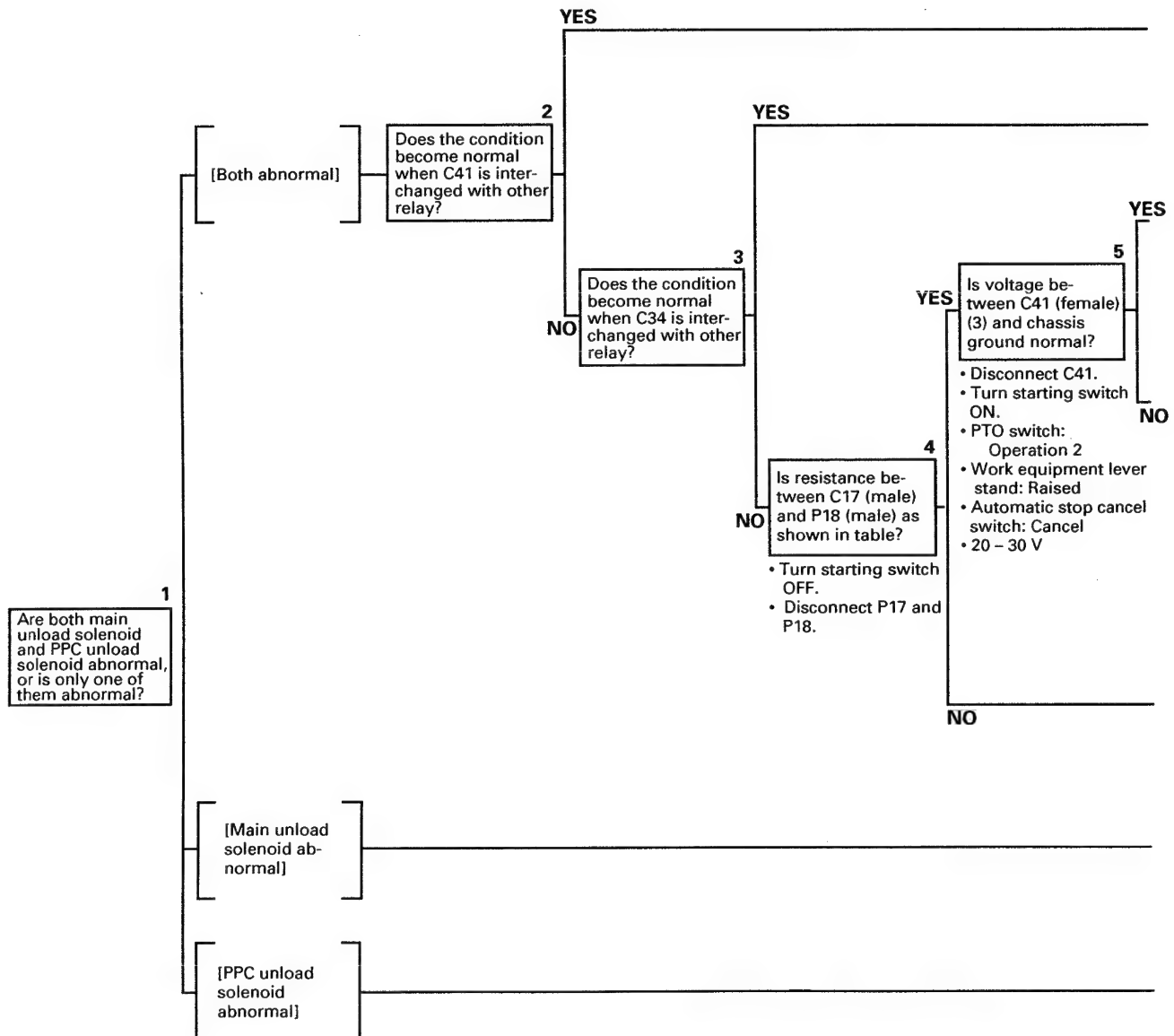
TKL00564

023S02

EM-129 Abnormality in automatic stop cancel prohibition relay system

- ★ When no error code is displayed.
- ★ Check that top fuse 4 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection



023S02

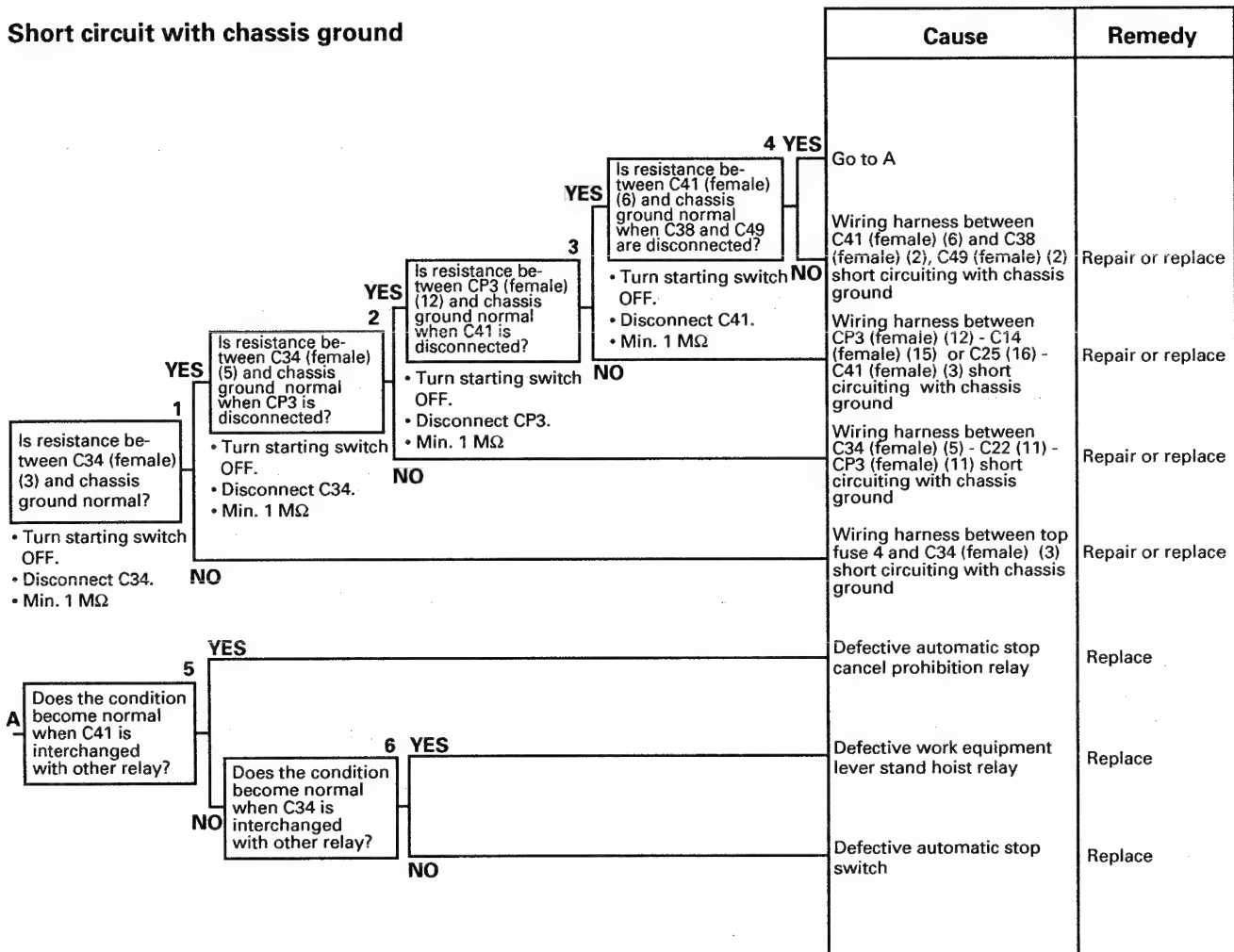
Table

	Automatic stop cancel switch	Resistance value
Between P17 (male) – P18 (male)	Automatic	Min. 1 M Ω
	Cancel	Max. 1 Ω

023S02

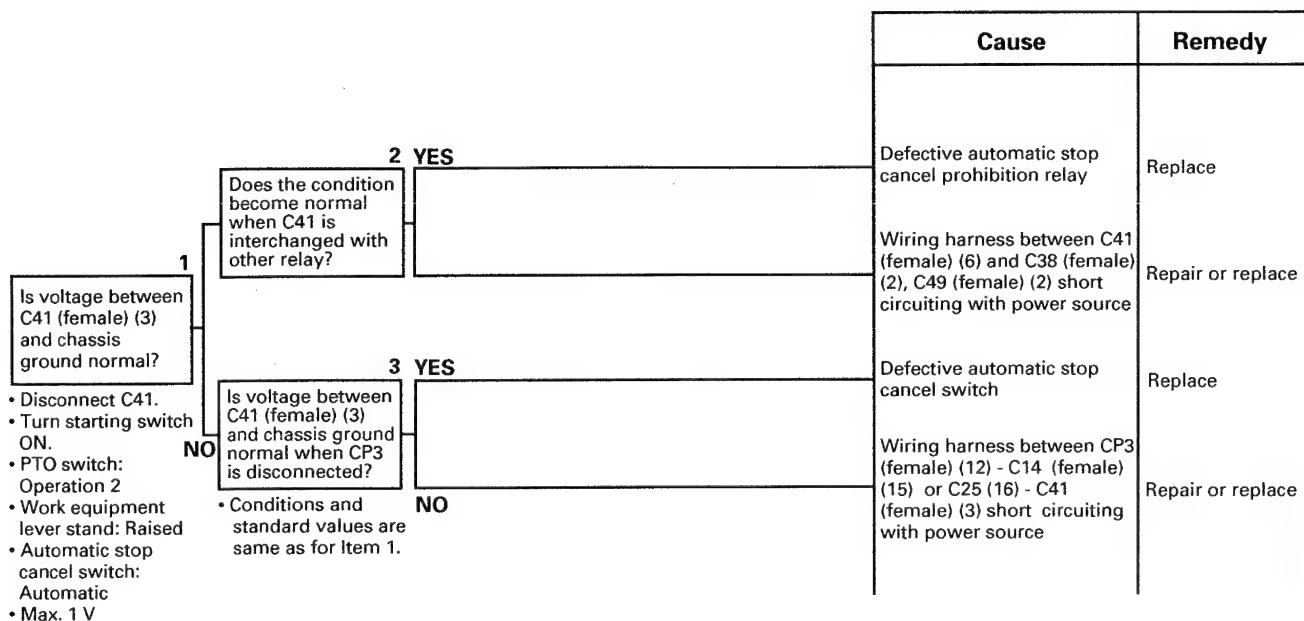
		Cause	Remedy
<div> <div>6</div> <div>Is voltage between CP3 (13) and chassis ground normal?</div> <div> <div>YES</div> <div>NO</div> </div> <div> <div>• Turn starting switch ON.</div> <div>• PTO switch: Operation 2</div> <div>• Work equipment lever stand: Raised</div> <div>• 20 – 30 V</div> </div> </div> <div> <div>7</div> <div>Is voltage between C34 (female) (3) and chassis ground normal?</div> <div> <div>YES</div> <div>NO</div> </div> <div> <div>• Disconnect C34.</div> <div>• Turn starting switch ON.</div> <div>• 20 – 30 V</div> </div> </div> <div> <div>8</div> <div>Is voltage between top fuse 4 inlet and chassis ground normal?</div> <div> <div>YES</div> <div>NO</div> </div> <div> <div>• Turn starting switch ON.</div> <div>• 20 – 30 V</div> </div> </div>		Defective automatic stop cancel prohibition relay	Replace
		Defective work equipment lever stand hoist relay	Replace
		Defective contact or disconnection in wiring harness between C41 (female) (6) - C38 (2), C49 (female) (2)	Repair or replace
		Defective contact or disconnection in wiring harness between CP3 (female) (12) - C25 (16) - C41 (female) (3)	Repair or replace
		Defective contact or disconnection in wiring harness between CP3 (female) (13) - C22 (11) - C34 (female) (5)	Repair or replace
		Defective contact or disconnection in wiring harness between top fuse 4 and C34 (female) (3)	Repair or replace
		Defective power source system	Go to trouble-shooting for power source system (E-1)
		Defective automatic stop cancel switch	Replace
		Defective contact or disconnection in wiring harness between C41 (female) (6) - C49 (2), (1) - C22 (13) - CR9 (female) (4)	Repair or replace
		Defective contact or disconnection in wiring harness between C41 (female) (6) - C38 (2), (1) - C23 (9) - CR9 (female) (3)	Repair or replace

Short circuit with chassis ground



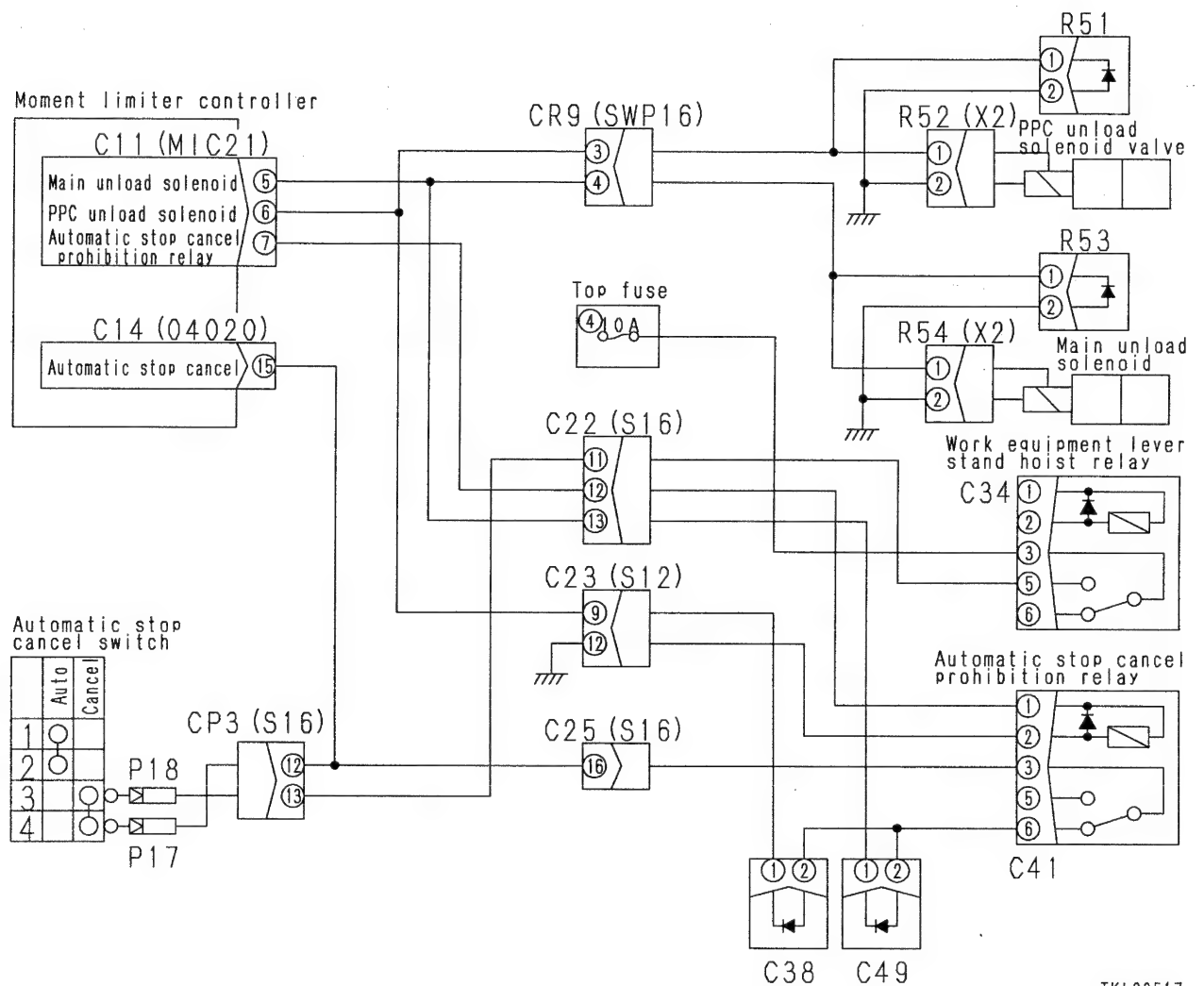
023S02

Short circuit with power source



EM-129 Related electric circuit diagram

023S02



EM-130 Abnormality in automatic stop cancel signal system

★ When no error code is displayed.

	Cause	Remedy
<div> <div>1 YES</div> <div> <div>In check mode, is there always input of automatic stop cancel signal?</div> <div> <div>NO</div> <div> <div>Turn starting switch ON.</div> <div>PTO switch: Operation 1</div> <div>Operate automatic stop cancel switch.</div> </div> </div> </div> </div>	Wiring harness between C14 (female) (15) and CR3 (female) (12) short circuiting with power source	Repair or replace
	Defective contact or disconnection in wiring harness between C14 (female) (15) and CP3 (female) (12)	Repair or replace

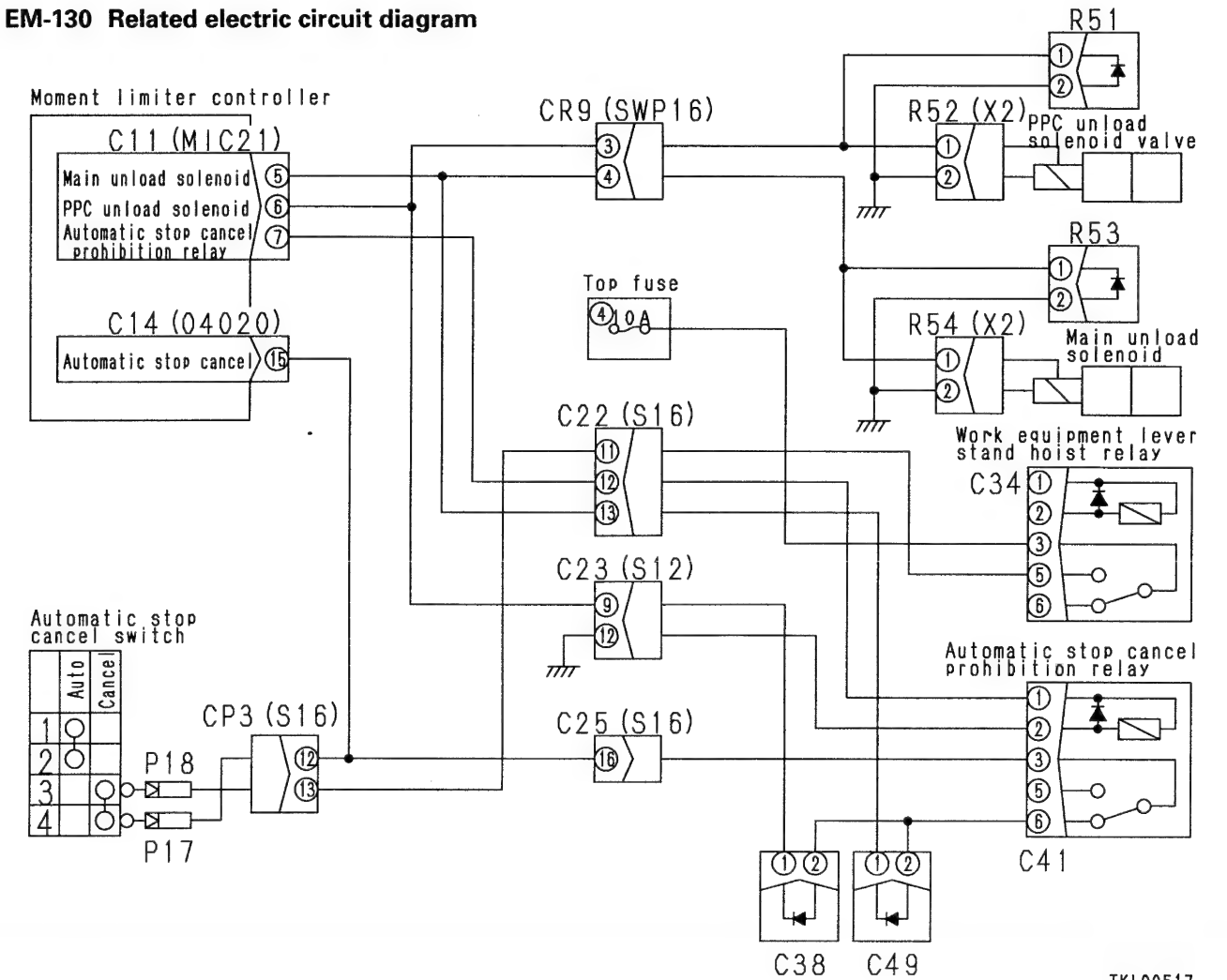
Short circuit with chassis ground

★ An abnormality in the automatic stop cancel prohibition relay system also occurs at the same time, so carry out Troubleshooting for EM-21 OSS error E53 (Automatic stop cancel prohibition relay short circuited with ground).

Short circuit with power source

★ An abnormality in the automatic stop cancel prohibition relay system also occurs at the same time, so carry out Troubleshooting for EM-37 OSS error E73 (Automatic stop cancel prohibition relay short circuited with power source).

EM-130 Related electric circuit diagram

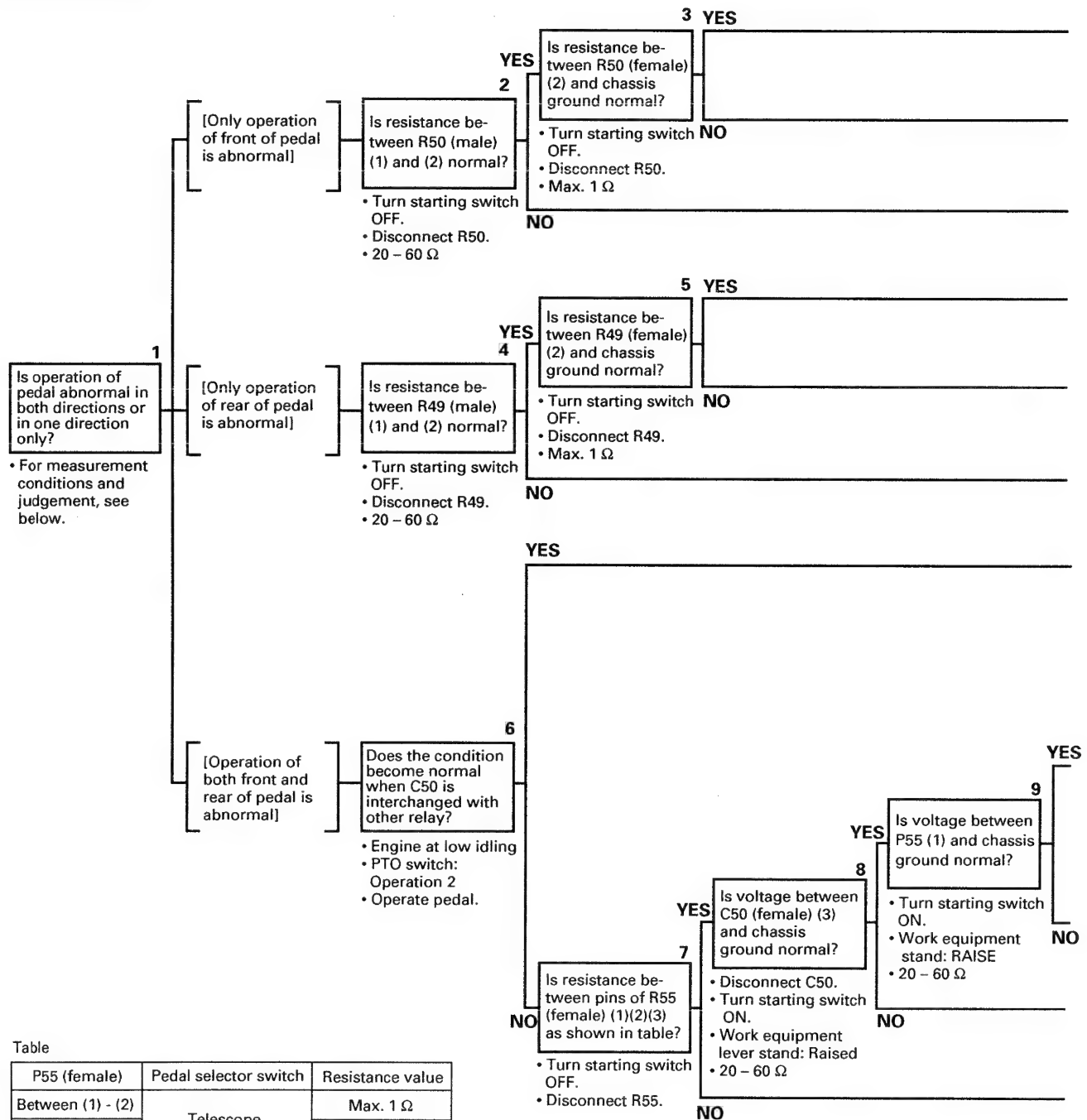


023S02

EM-131 Abnormality in pedal operation selector solenoid system

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection



Table

P55 (female)	Pedal selector switch	Resistance value
Between (1) - (2)	Telescope	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	Auxiliary winch	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω
Between (1)(2)(3) - chassis ground		Min. 1 MΩ

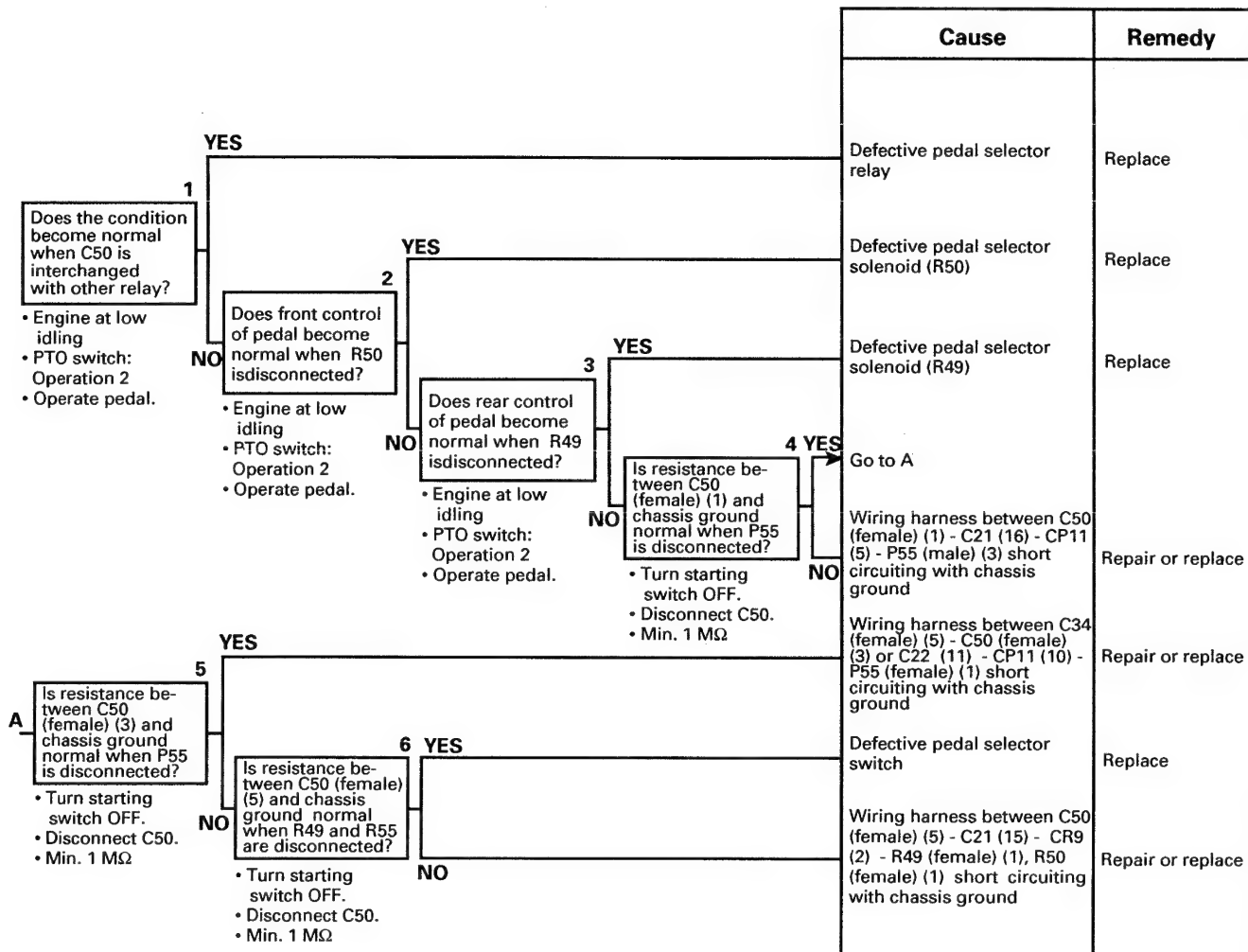
023S02

023S02

		Cause	Remedy
		Defective contact or disconnection in wiring harness between CR9 (male) (2) and R50 (female) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between R50 (female) (2) and chassis ground	Repair or replace
		Defective pedal selector solenoid (R50)	Replace
		Defective contact or disconnection in wiring harness between CR9 (male) (2) - R49 (female) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between R49 (female) (2) and chassis ground	Repair or replace
		Defective pedal selector solenoid (R49)	Replace
		Defective pedal selector relay	Replace
		Defective contact or disconnection in wiring harness between C50 (female) (5) - C21 (15) - CR9 (2) - R49 (female) (1), R50 (female) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between C50 (female) (1) - C21 (16) - CP11 (5) - R55 (male) (3)	Repair or replace
		Defective contact or disconnection in wiring harness between C50 (female) (2) - C23 (12) - chassis ground	Repair or replace
	<div> <div>10</div> <div>Is resistance between C50 (female) (2) and chassis ground normal?</div> <div> <div>YES</div> <div> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C50. • Max. 1 Ω </div> </div> <div> <div>11 YES</div> <div>Is voltage between C50 (female) (1) and chassis ground normal?</div> <div> <div>YES</div> <div> <ul style="list-style-type: none"> • Disconnect C50. • Pedal selector switch: Auxiliary winch • 20 - 30 V </div> </div> <div>NO</div> </div> </div>	Defective contact or disconnection in wiring harness between C50 (female) (3) - C22 (11) - CP11 (10) - R55 (male) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between C34 (female) (5) and C50 (female) (3)	Repair or replace
		Defective pedal selector switch	Replace

Short circuit with chassis ground

★ Short circuiting with the chassis ground occurs only when using the auxiliary winch in pedal selection operations, and the abnormality always occurs when operating the pedal in either direction.



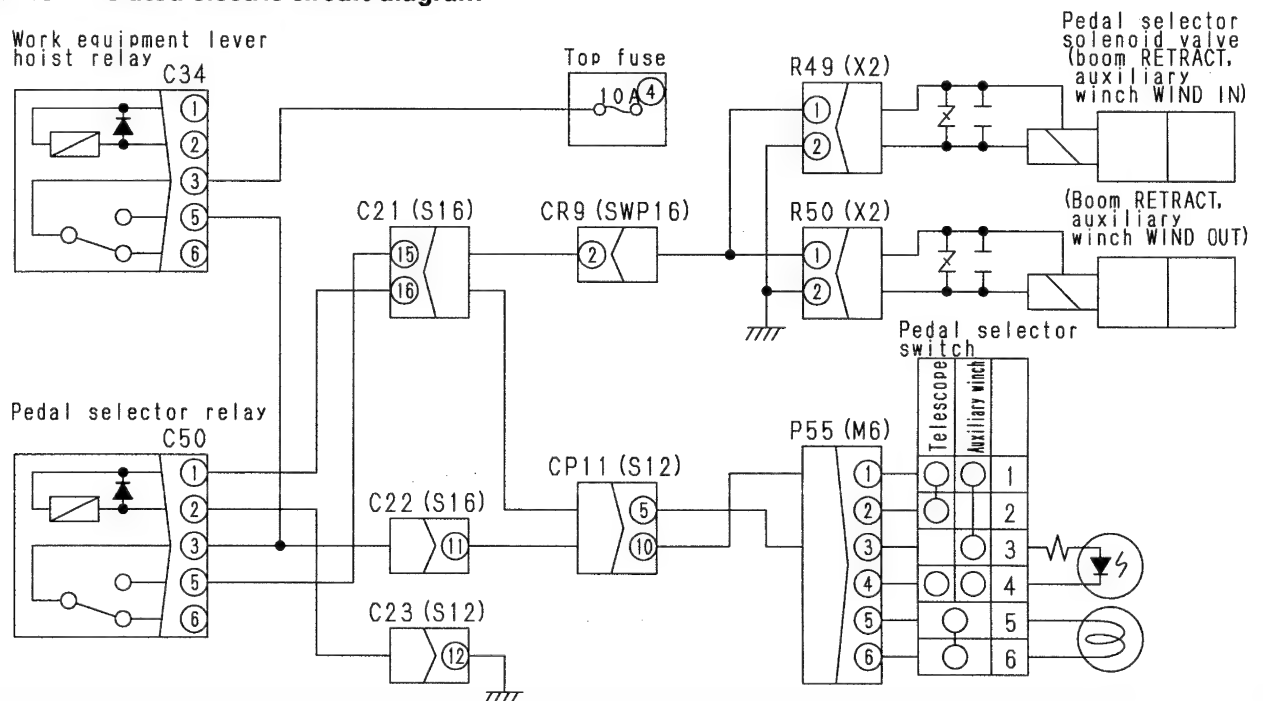
023S02

Short circuit with power source

★ Short circuiting with the power source occurs only when using the auxiliary winch in pedal selection operations, and the abnormality always occurs when operating the pedal in either direction.

	Cause	Remedy
<p>1 YES</p> <p>Does the condition become normal when C50 is interchanged with other relay?</p> <ul style="list-style-type: none"> • Engine at low idling • PTO switch: Operation 2 • Operate pedal. 	Defective pedal selector relay	Replace
<p>2 YES</p> <p>Does front control of pedal become normal when R50 is disconnected?</p> <ul style="list-style-type: none"> • Engine at low idling • PTO switch: Operation 2 • Operate pedal. 	Defective pedal selector solenoid (R50)	Replace
<p>3 YES</p> <p>Does rear control of pedal become normal when R49 is disconnected?</p> <ul style="list-style-type: none"> • Engine at low idling • PTO switch: Operation 2 • Operate pedal. 	Defective pedal selector solenoid (R49)	Replace
<p>4 YES</p> <p>Is voltage between C50 (female) (1) and chassis ground normal when P55 is disconnected?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C50. • Max. 1 V 	Go to A	
<p>4 NO</p> <p>Is voltage between C50 (female) (6) and chassis ground normal when R49 and R55 are disconnected?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C50. • Max. 1 V 	Wiring harness between C50 (female) (1) - C21 (16) - CP11 (5) - P55 (male) (3) short circuiting with chassis ground	Repair or replace
<p>5 YES</p> <p>Is voltage between C50 (female) (6) and chassis ground normal when R49 and R55 are disconnected?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C50. • Max. 1 V 	Defective pedal selector switch	Replace
<p>5 NO</p> <p>Is voltage between C50 (female) (6) and chassis ground normal when R49 and R55 are disconnected?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Disconnect C50. • Max. 1 V 	Wiring harness between C50 (female) (5) - C21 (15) - CR9 (2) - R49 (female) (1), R50 (female) (1) short circuiting with chassis ground	Repair or replace

EM-131 Related electric circuit diagram

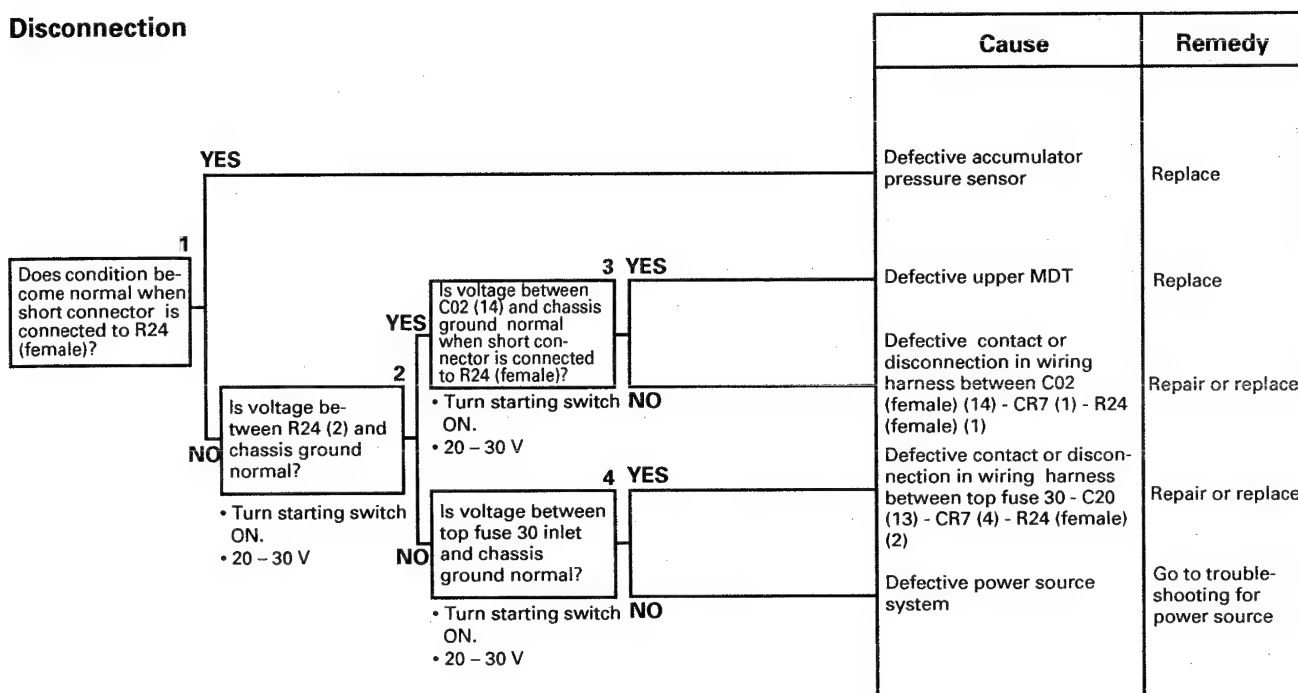


TKL00565

EM-132 Abnormality in accumulator pressure switch system

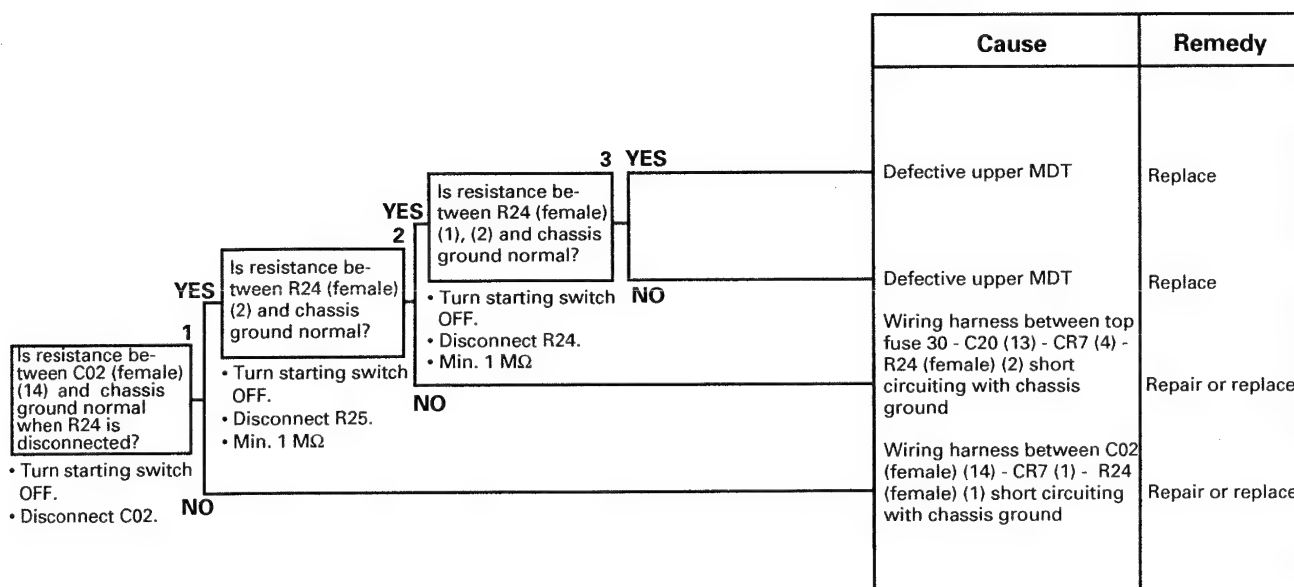
- ★ When no error code is displayed.
- ★ Check that top fuse 30 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

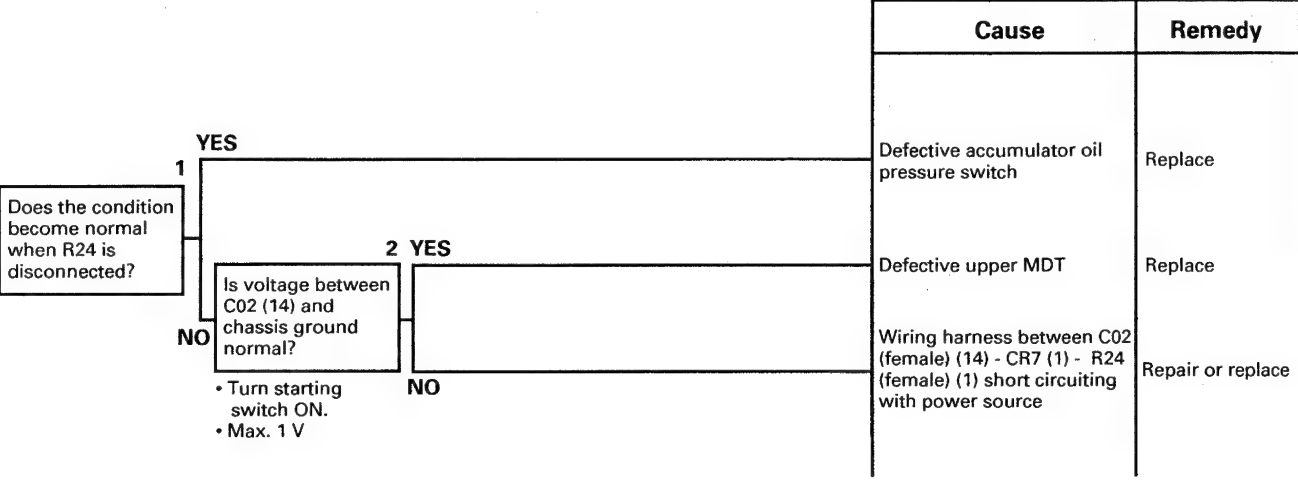


023S02

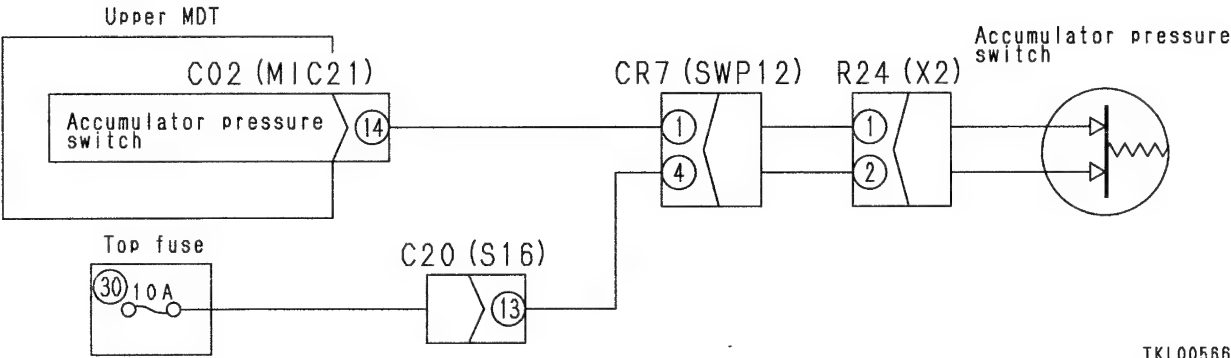
Short circuit with chassis ground



Short circuit with power source



EM-132 Related electric circuit diagram

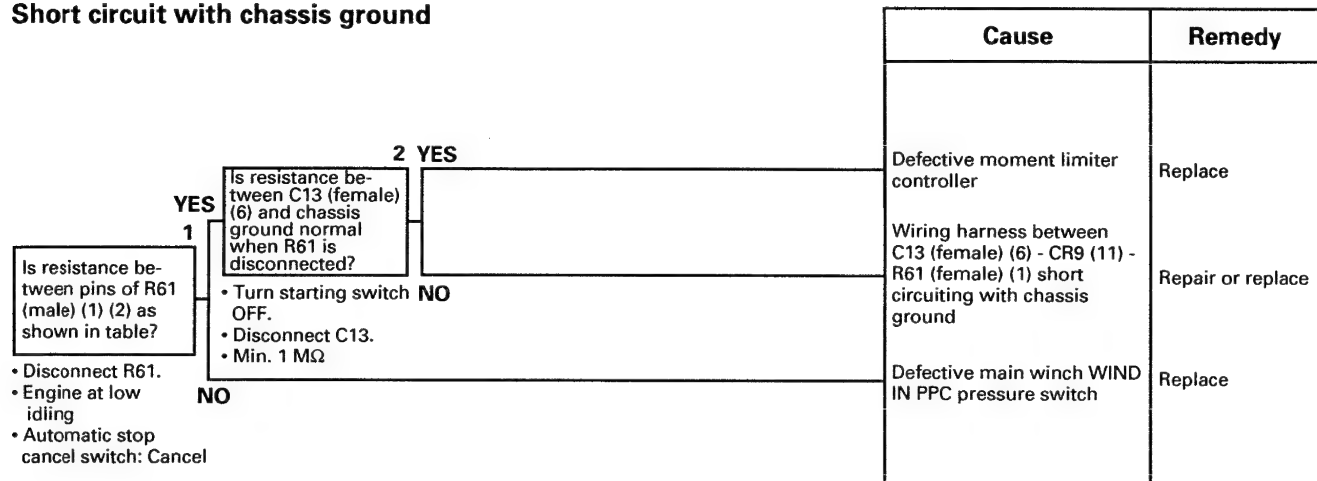


TKL00566

EM-133 Abnormality in main winch WIND IN PPC pressure switch system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Short circuit with chassis ground

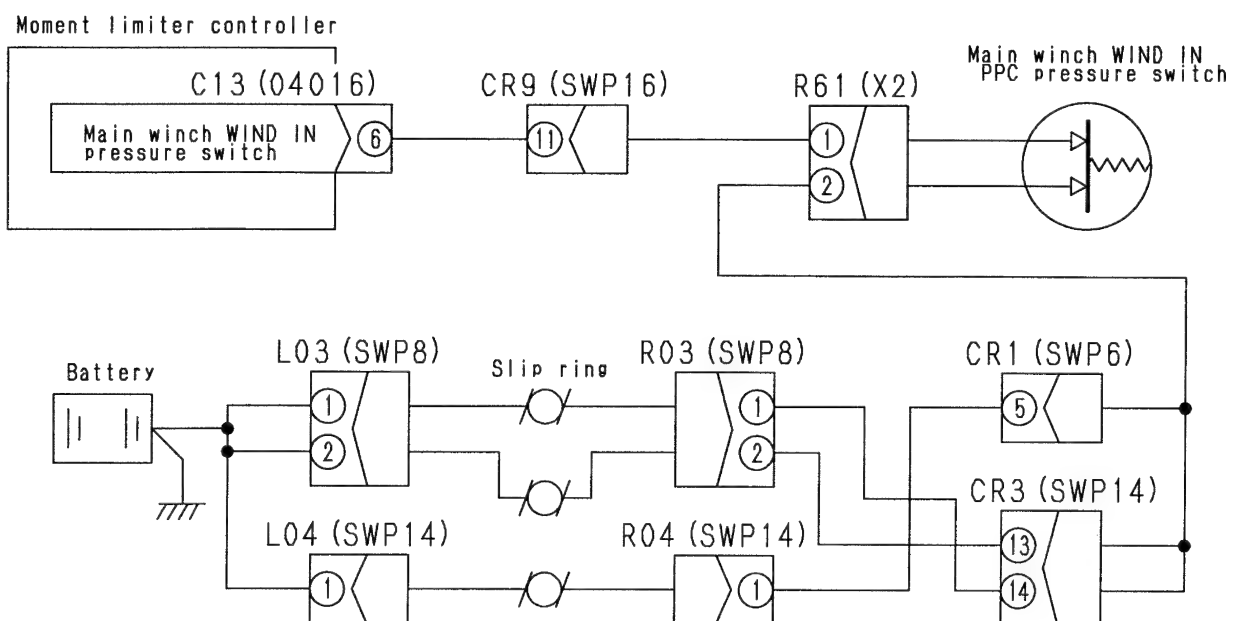


Table

R61 (male)	Main winch lever	Resistance value
Between (1) - (2)	At neutral	Max. 1 Ω
Between (1) - (2)	When winding in	Min. 1 MΩ
Between (1)(2) – chassis ground		Min. 1 MΩ

★ Operate the main winch in small movements.

EM-133 Related electric circuit diagram

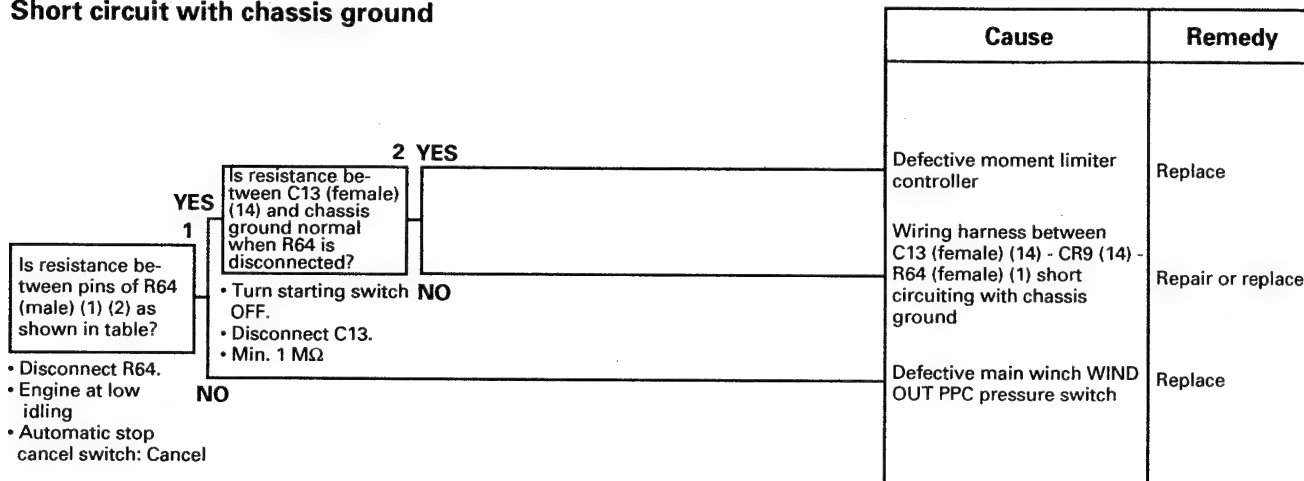


TKL00567

EM-134 Abnormality in main winch WIND OUT PPC pressure switch system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Short circuit with chassis ground

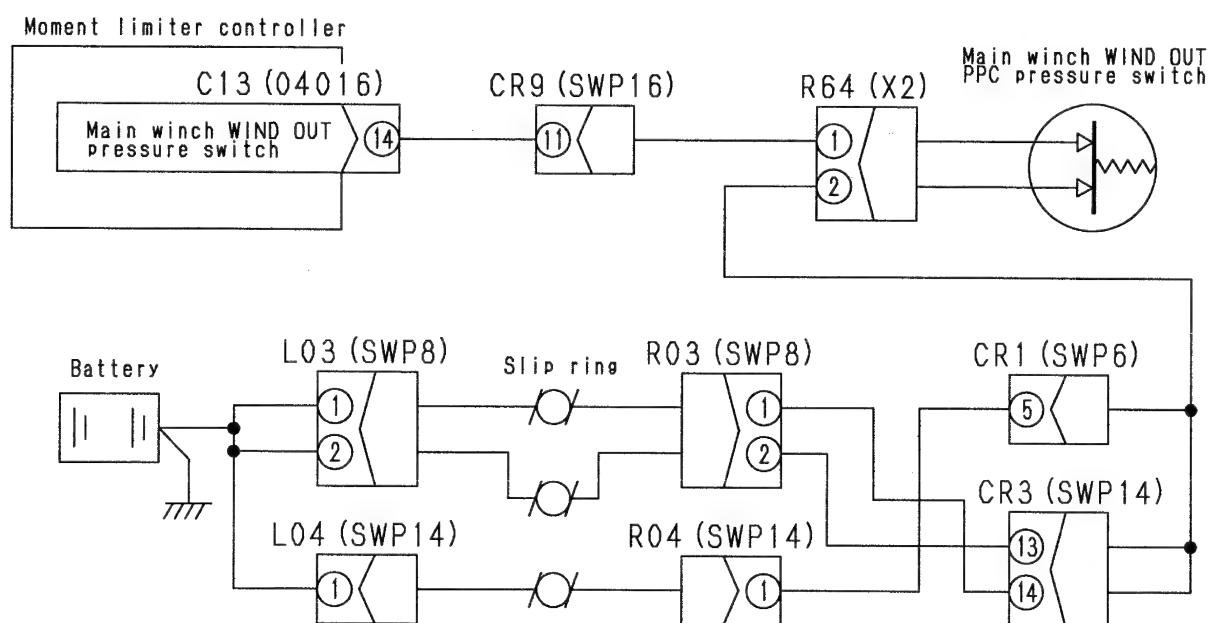


Table

R64 (male)	Main winch lever	Resistance value
Between (1) - (2)	At neutral	Max. 1 Ω
Between (1) - (2)	When winding out	Min. 1 MΩ
Between (1)(2) – chassis ground		Min. 1 MΩ

★ Operate the main winch in small movements.

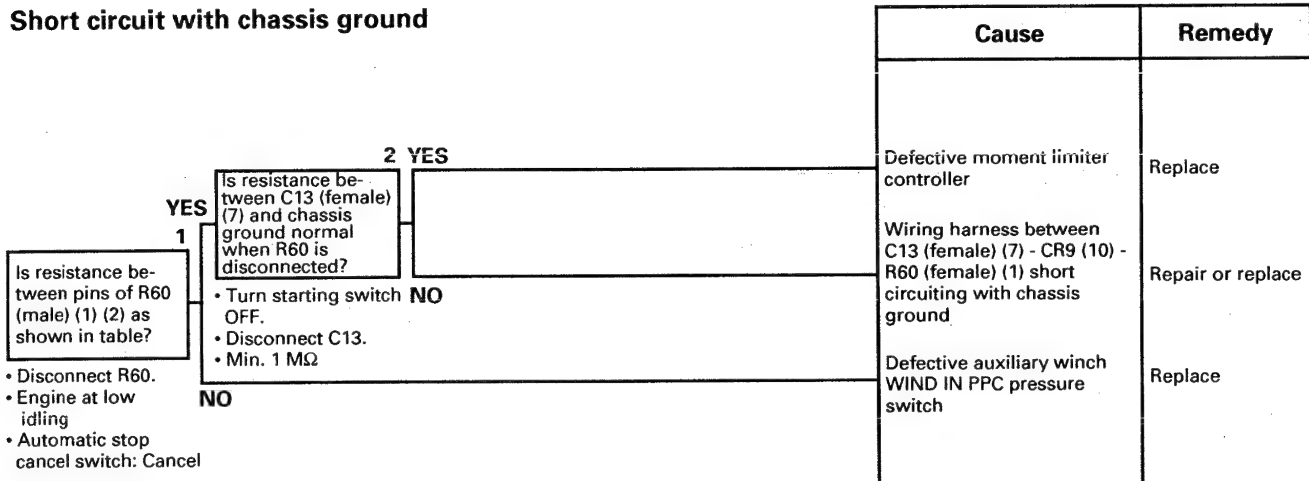
EM-134 Related electric circuit diagram



EM-135 Abnormality in auxiliary winch WIND IN PPC pressure switch system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Short circuit with chassis ground

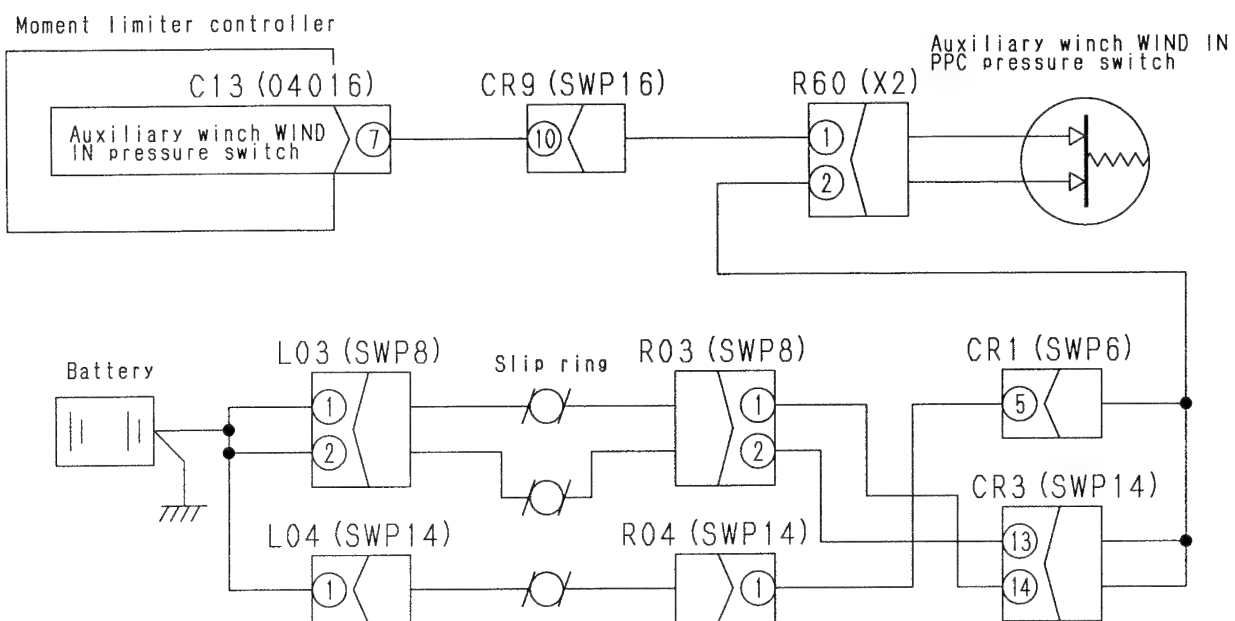


Table

R60 (male)	Auxiliary winch lever	Resistance value
Between (1) - (2)	At neutral	Max. 1 Ω
Between (1) - (2)	When winding in	Min. 1 M Ω
Between (1)(2) – chassis ground		Min. 1 M Ω

- ★ Operate the auxiliary winch in small movements.

EM-135 Related electric circuit diagram

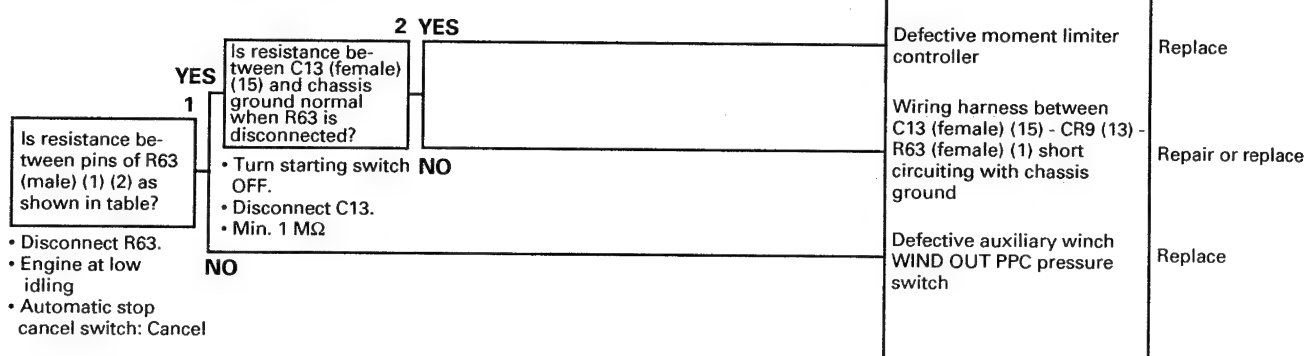


TKL00569

EM-136 Abnormality in auxiliary winch WIND OUT PPC pressure switch system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Short circuit with chassis ground

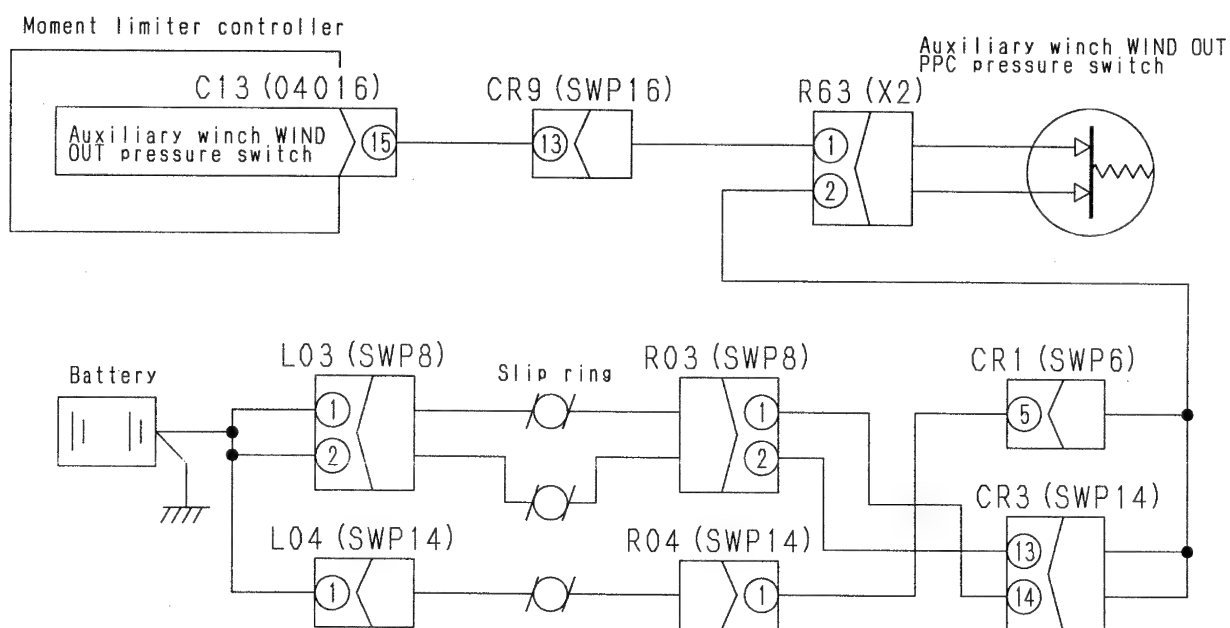


Table

R63 (male)	Auxiliary winch lever	Resistance value
Between (1) - (2)	At neutral	Max. 1 Ω
Between (1) - (2)	When winding out	Min. 1 MΩ
Between (1)(2) - chassis ground		Min. 1 MΩ

★ Operate the auxiliary winch in small movements.

EM-136 Related electric circuit diagram



TKL00570

EM-137 Abnormality in swing left PPC pressure switch system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Short circuit with chassis ground

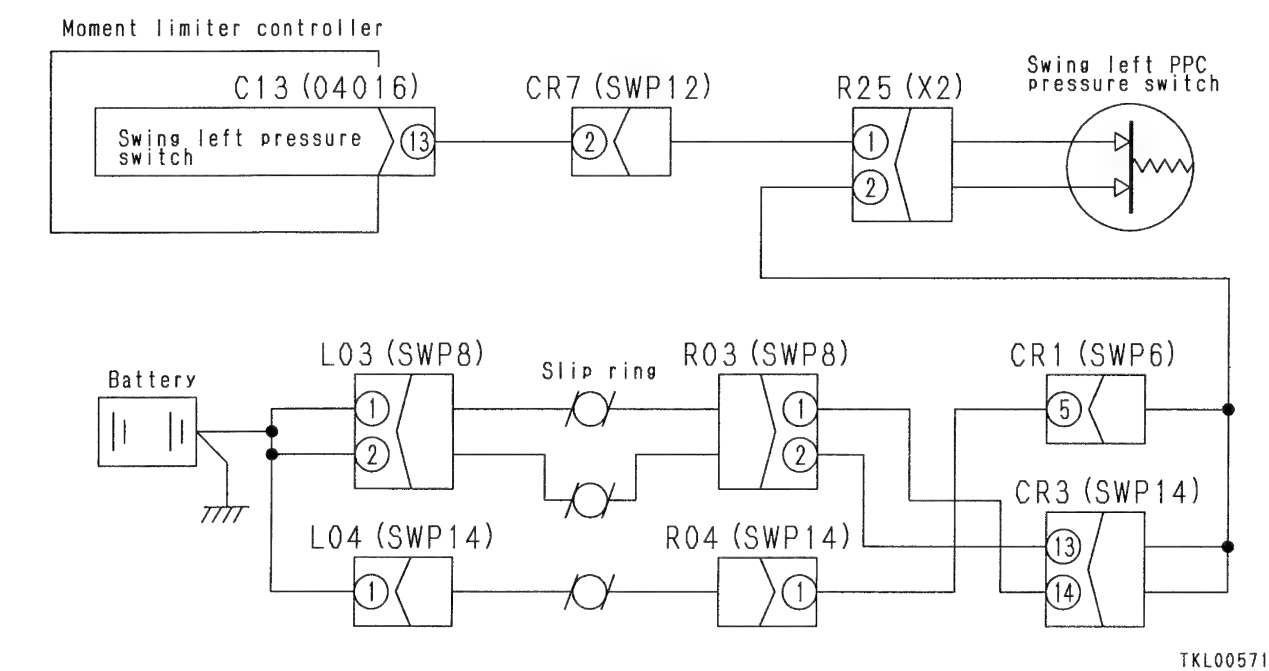
		Cause	Remedy
<div> <div> <div>Is resistance between pins of R25 (male) (1) (2) as shown in table?</div> <div> <div>YES</div> <div>1</div> </div> </div> <div> <div>Is resistance between C13 (female) (13) and chassis ground normal when R25 is disconnected?</div> <div> <div>2 YES</div> <div>NO</div> </div> </div> </div> <div> <div>• Disconnect R25.</div> <div>• Engine at low idling</div> <div>• Automatic stop cancel switch: Cancel</div> </div>	<div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C13.</div> <div>• Min. 1 MΩ</div> </div>	Defective moment limiter controller	Replace
		Wiring harness between C13 (female) (13) - CR7 (2) - R25 (female) (1) short circuiting with chassis ground	Repair or replace
		Defective swing left PPC pressure switch	Replace

Table

R25 (male)	Swing lever	Resistance value
Between (1) - (2)	At neutral	Max. 1 Ω
Between (1) - (2)	When winding left	Min. 1 MΩ
Between (1)(2) – chassis ground		Min. 1 MΩ

★ Operate the swing lever in small movements.

EM-137 Related electric circuit diagram



EM-138 Abnormality in swing right PPC pressure switch system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Short circuit with chassis ground

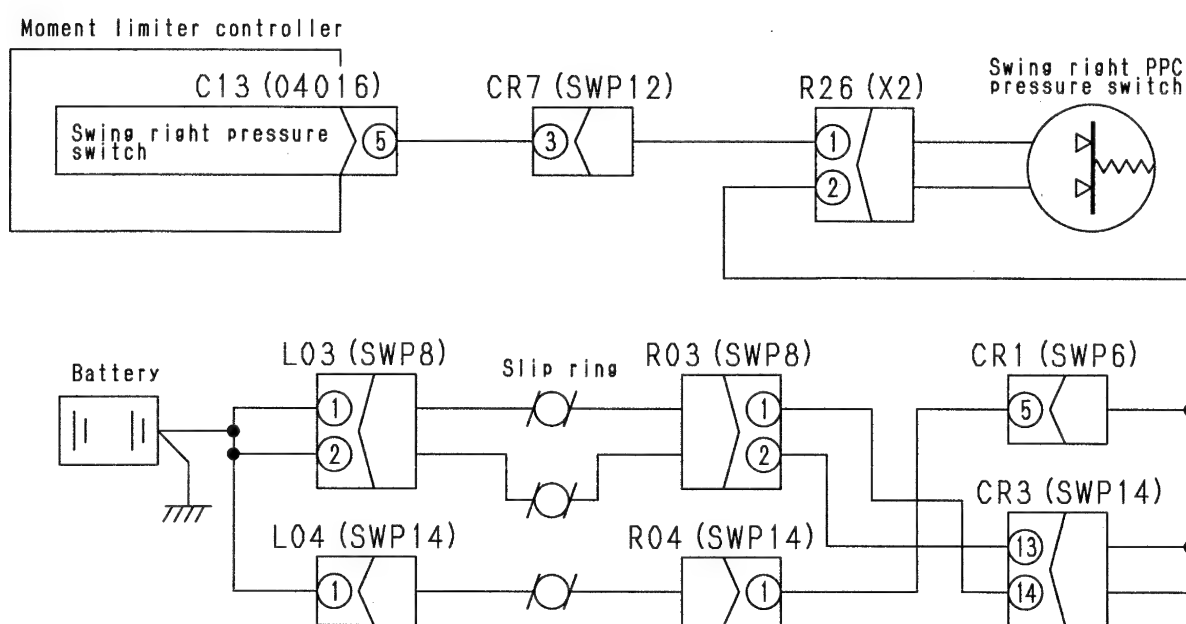
		Cause	Remedy
<p>1 YES</p> <p>Is resistance between pins of R26 (male) (1) (2) as shown in table?</p> <ul style="list-style-type: none"> • Disconnect R26. • Engine at low idling • Automatic stop cancel switch: Cancel 	2 YES	Defective moment limiter controller	Replace
	2 YES	Wiring harness between C13 (female) (5) - CR7 (3) - R26 (female) (1) short circuiting with chassis ground	Repair or replace
	NO	Defective swing right PPC pressure switch	Replace

Table

R26 (male)	Swing lever	Resistance value
Between (1) - (2)	At neutral	Max. 1 Ω
Between (1) - (2)	When winding right	Min. 1 M Ω
Between (1)(2) - chassis ground		Min. 1 M Ω

★ Operate the swing lever in small movements.

EM-138 Related electric circuit diagram



TKL00572

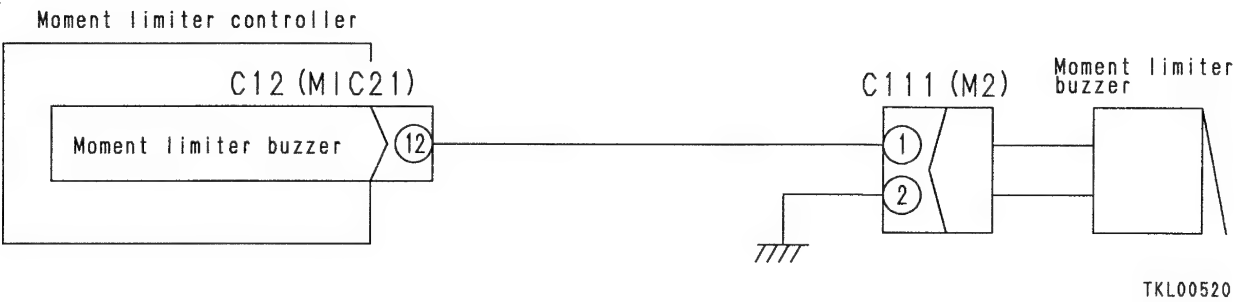
EM-139 Abnormality in moment limiter buzzer system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div>1</div> <div>Is resistance between C111 (female) (2) and chassis ground normal?</div> <div><ul style="list-style-type: none">• Turn starting switch OFF.• Disconnect C111.• Max. 1 Ω</div> <div>YES</div> <div>2</div> <div>Is resistance between C12 (female) (12) and chassis ground normal?</div> <div><ul style="list-style-type: none">• Turn starting switch OFF.• Disconnect C12 and C111.• Ground C111 (female) (1) to chassis.• Min. 1 MΩ</div> <div>NO</div> <div>3</div> <div>Is voltage between C12 (female) (12) and chassis ground normal when C111 is disconnected?</div> <div><ul style="list-style-type: none">• Disconnect C12.• Turn starting switch ON.• Max. 1 V</div> <div>YES</div> <div>4</div> <div>Is voltage between C12 (female) (12) and chassis ground normal?</div> <div><ul style="list-style-type: none">• For 3 sec. after check mode IN.• 17 – 30 V• Turn starting switch ON.• PTO switch: Any position except Travel</div> <div>YES</div> <div>NO</div>		Defective moment limiter buzzer	Replace
		Defective moment limiter controller	Repair or replace
		Wiring harness between C12 (female) (12) and C111 (female) (1) short circuiting with power source	Repair or replace
		Defective contact or disconnection in wiring harness between C12 (female) (12) and C111 (female) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between C111 (female) (2) and chassis ground	Repair or replace

023S02

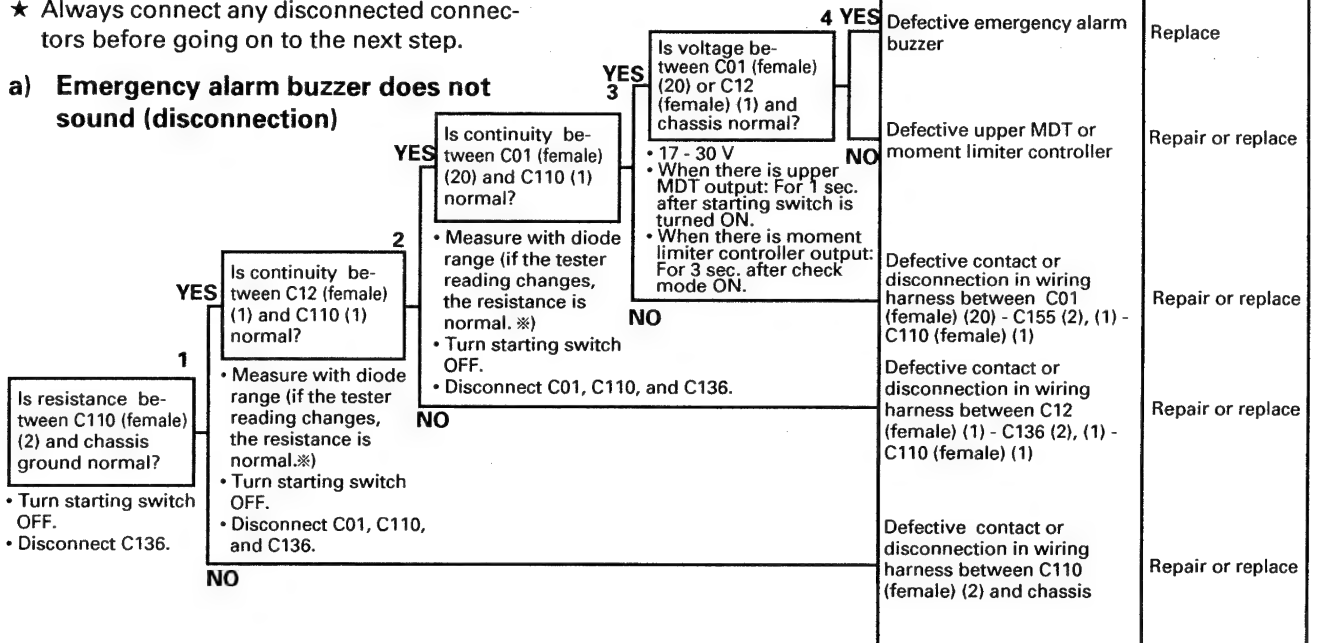
EM-139 Related electric circuit diagram



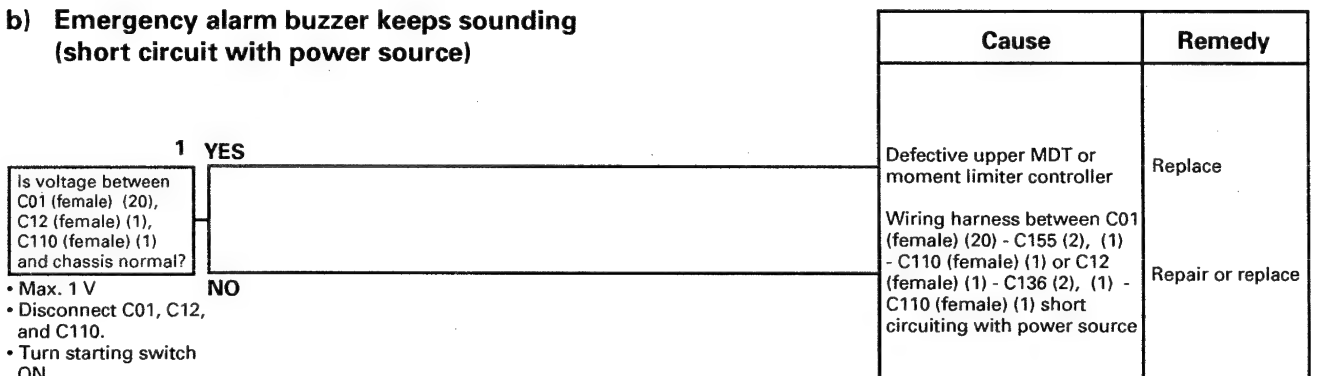
EM-140 Abnormality in emergency alarm buzzer system

- ★ When no error code is displayed.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

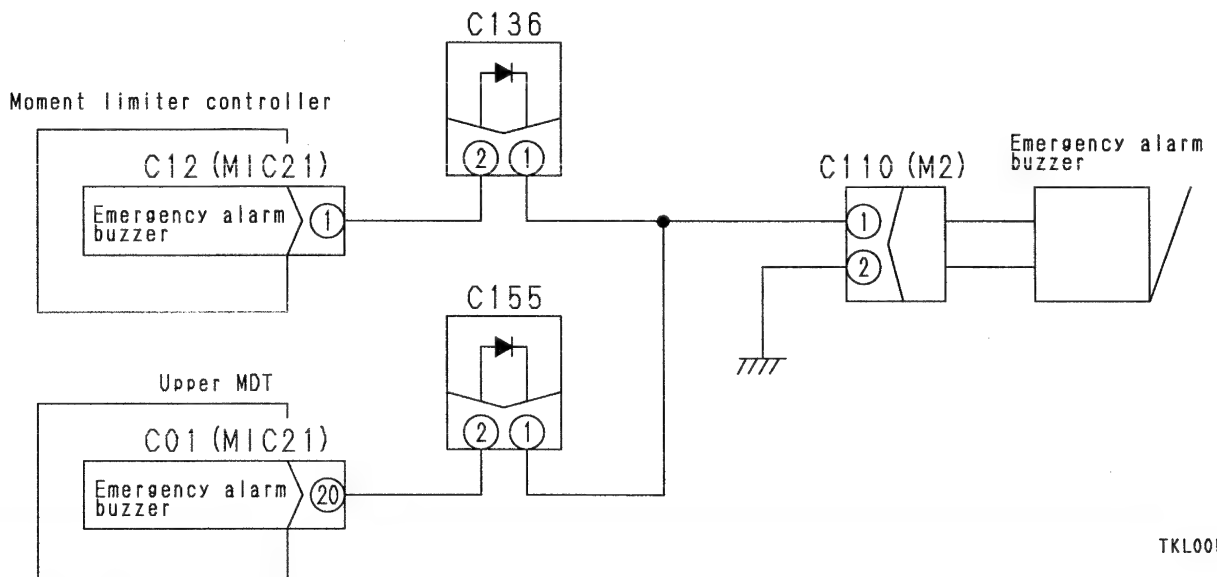
a) Emergency alarm buzzer does not sound (disconnection)



b) Emergency alarm buzzer keeps sounding (short circuit with power source)



EM-140 Related electric circuit diagram



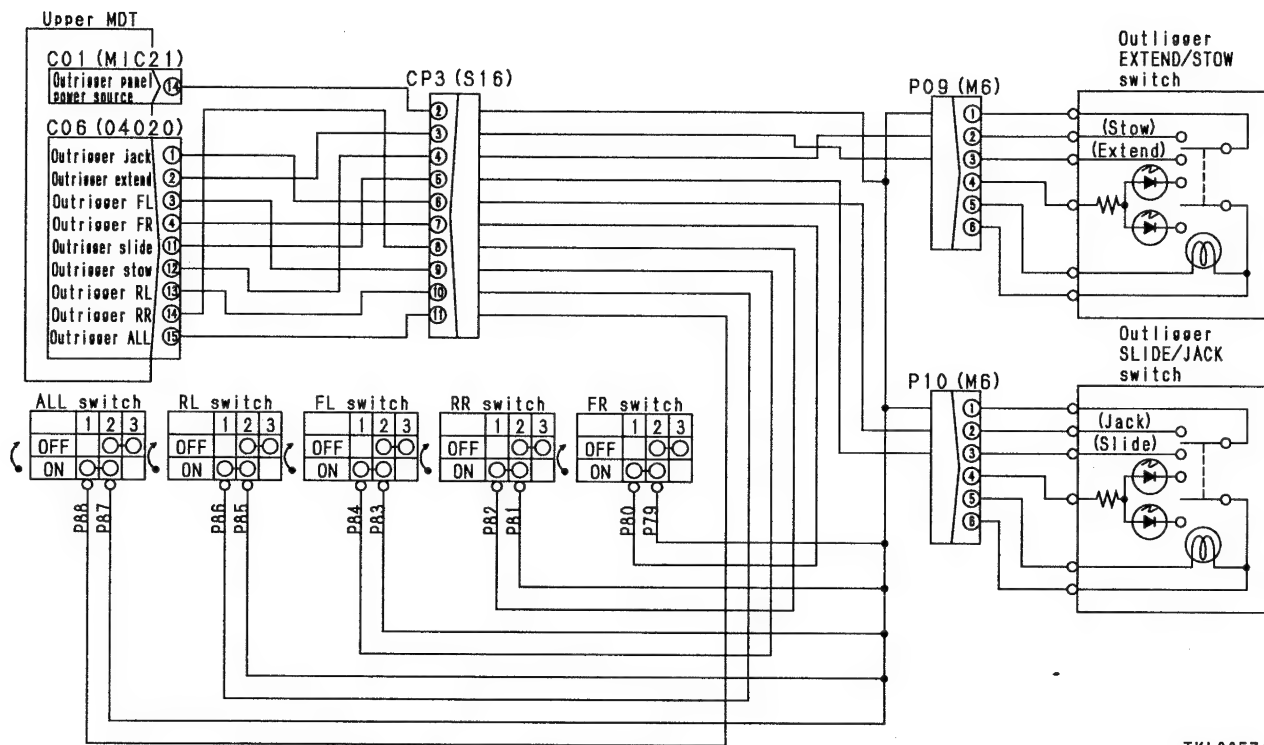
TKL00573

- ★ When no error code is displayed.
- ★ For the circuit from each switch output to the upper MDT, carry out the troubleshooting for abnormality in the switch system.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<pre> graph TD Q1[Is voltage between C01 (14) and chassis ground normal?] -- YES --> A1[• Turn starting switch ON. • PTO switch: Operation 1 • Shift lever: N • 20 – 30 V] Q1 -- NO --> Q2[Is voltage between P09 (1) and chassis ground normal?] Q2 -- YES --> A2[• Turn starting switch ON. • PTO switch: Operation 1 • Shift lever: N • 20 – 30 V] Q2 -- NO --> Q3[Is voltage between P10 (1) and chassis ground normal?] Q3 -- YES --> A3[• Turn starting switch ON. • PTO switch: Operation 1 • Shift lever: N • 20 – 30 V] Q3 -- NO --> Q4[Is voltage between P87 and chassis ground normal?] Q4 -- YES --> A4[Go to A] Q4 -- NO --> B1[Defective upper MDT] Q4 -- YES --> Q5[Is voltage between P85 and chassis ground normal?] Q5 -- YES --> A5[• Turn starting switch ON. • PTO switch: Operation 1 • Shift lever: N • 20 – 30 V] Q5 -- NO --> Q6[Is voltage between P79 and chassis ground normal?] Q6 -- YES --> A6[• Turn starting switch ON. • PTO switch: Operation 1 • Shift lever: N • 20 – 30 V] Q6 -- NO --> Q7[Is voltage between P83 and chassis ground normal?] Q7 -- YES --> A7[• Turn starting switch ON. • PTO switch: Operation 1 • Shift lever: N • 20 – 30 V] Q7 -- NO --> B2[Defective contact or disconnection in wiring harness between CP3 (male) (2) and P83] </pre>	<p>1</p> <p>Is voltage between C01 (14) and chassis ground normal?</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Operation 1</p> <p>• Shift lever: N</p> <p>• 20 – 30 V</p> <p>NO</p> <p>2</p> <p>Is voltage between P09 (1) and chassis ground normal?</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Operation 1</p> <p>• Shift lever: N</p> <p>• 20 – 30 V</p> <p>NO</p> <p>3</p> <p>Is voltage between P10 (1) and chassis ground normal?</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Operation 1</p> <p>• Shift lever: N</p> <p>• 20 – 30 V</p> <p>NO</p> <p>4</p> <p>Is voltage between P87 and chassis ground normal?</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Operation 1</p> <p>• Shift lever: N</p> <p>• 20 – 30 V</p> <p>NO</p> <p>5</p> <p>Is voltage between P83 and chassis ground normal?</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Operation 1</p> <p>• Shift lever: N</p> <p>• 20 – 30 V</p> <p>NO</p> <p>6</p> <p>Is voltage between P79 and chassis ground normal?</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Operation 1</p> <p>• Shift lever: N</p> <p>• 20 – 30 V</p> <p>NO</p> <p>7</p> <p>Is voltage between P85 and chassis ground normal?</p> <p>• Turn starting switch ON.</p> <p>• PTO switch: Operation 1</p> <p>• Shift lever: N</p> <p>• 20 – 30 V</p>	<p>Go to A</p> <p>Defective contact or disconnection in wiring harness between CP3 (male) (2) and P87</p> <p>Defective contact or disconnection in wiring harness between CP3 (male) (2) and P10 (male) (1)</p> <p>Defective contact or disconnection in wiring harness between C01 (female) (14) - CP3 (2) - P09 (male) (1)</p> <p>Defective upper MDT</p> <p>Defective contact or disconnection in wiring harness between CP3 (male) (2) and P81</p> <p>Defective contact or disconnection in wiring harness between CP3 (male) (2) and P85</p> <p>Defective contact or disconnection in wiring harness between CP3 (male) (2) and P79</p> <p>Defective contact or disconnection in wiring harness between CP3 (male) (2) and P83</p>	<p>Repair or replace</p> <p>Repair or replace</p> <p>Repair or replace</p> <p>Replace</p> <p>Repair or replace</p> <p>Repair or replace</p> <p>Repair or replace</p> <p>Repair or replace</p>

023S02

EM-201 Related electric circuit diagram



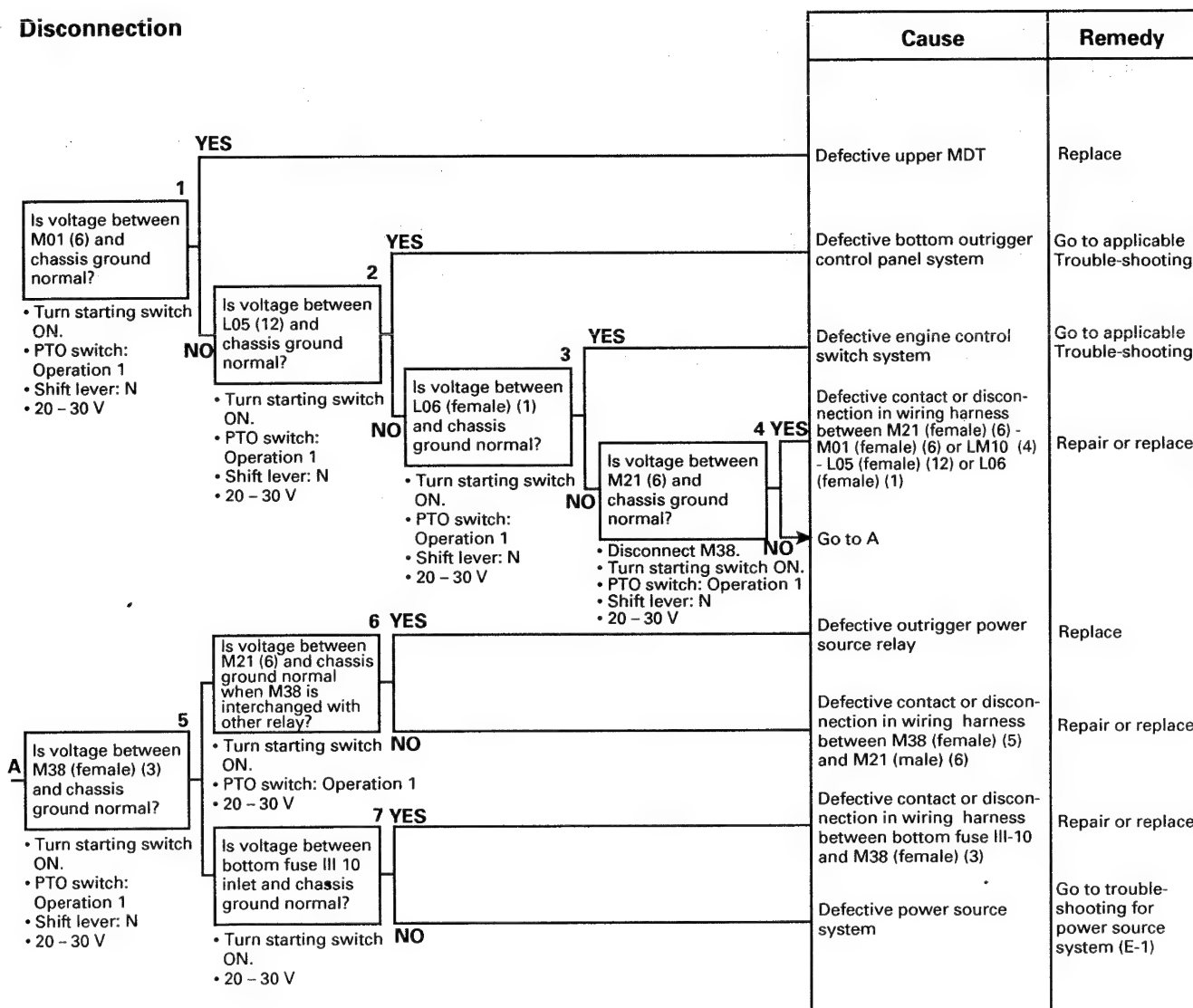
TKL00574

023S02

EM-202 Abnormality in outrigger power source relay (outrigger power source/bottom panel power source)system

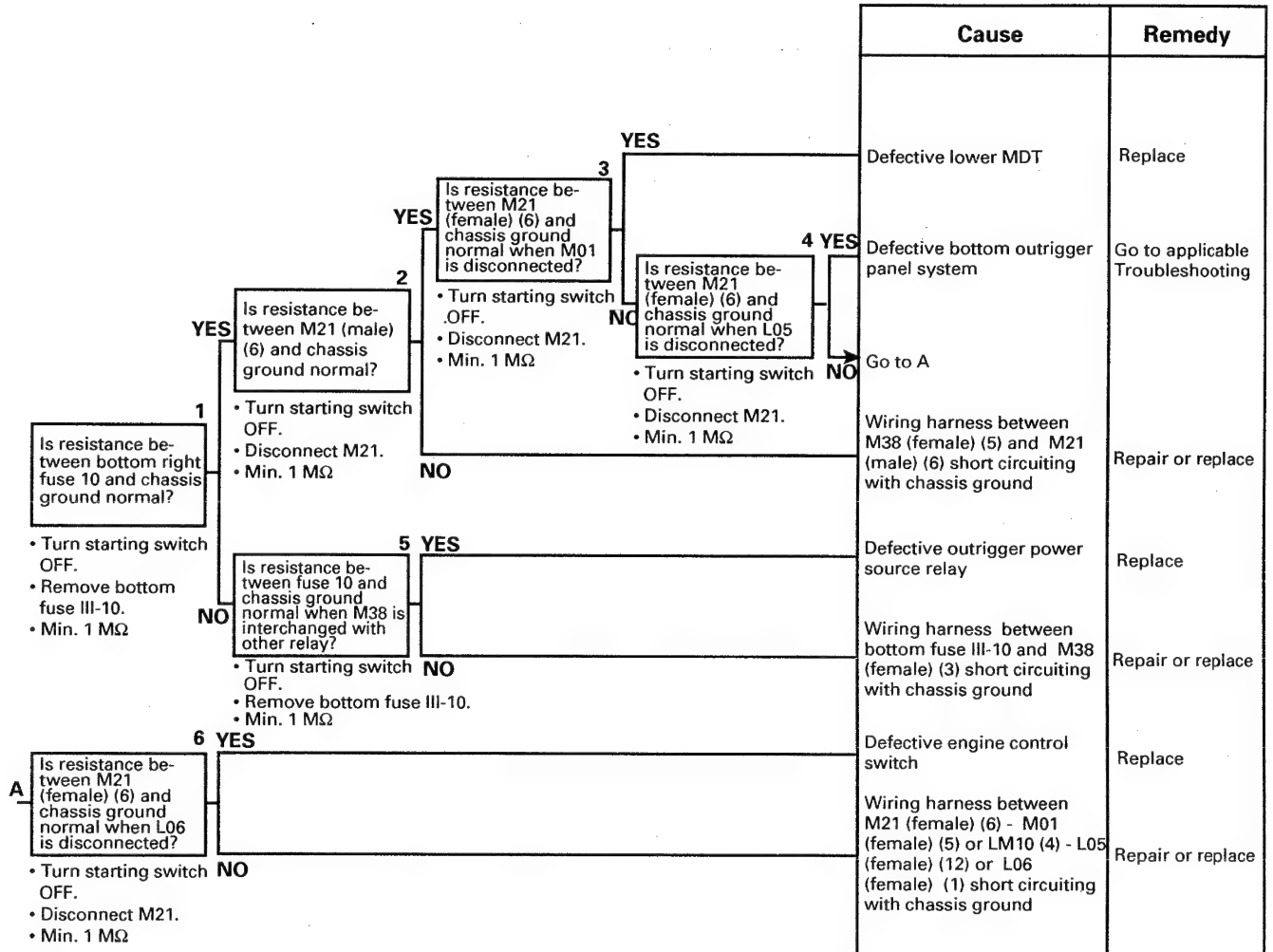
- ★ When no error code is displayed.
- ★ Check that bottom right fuse 10 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection

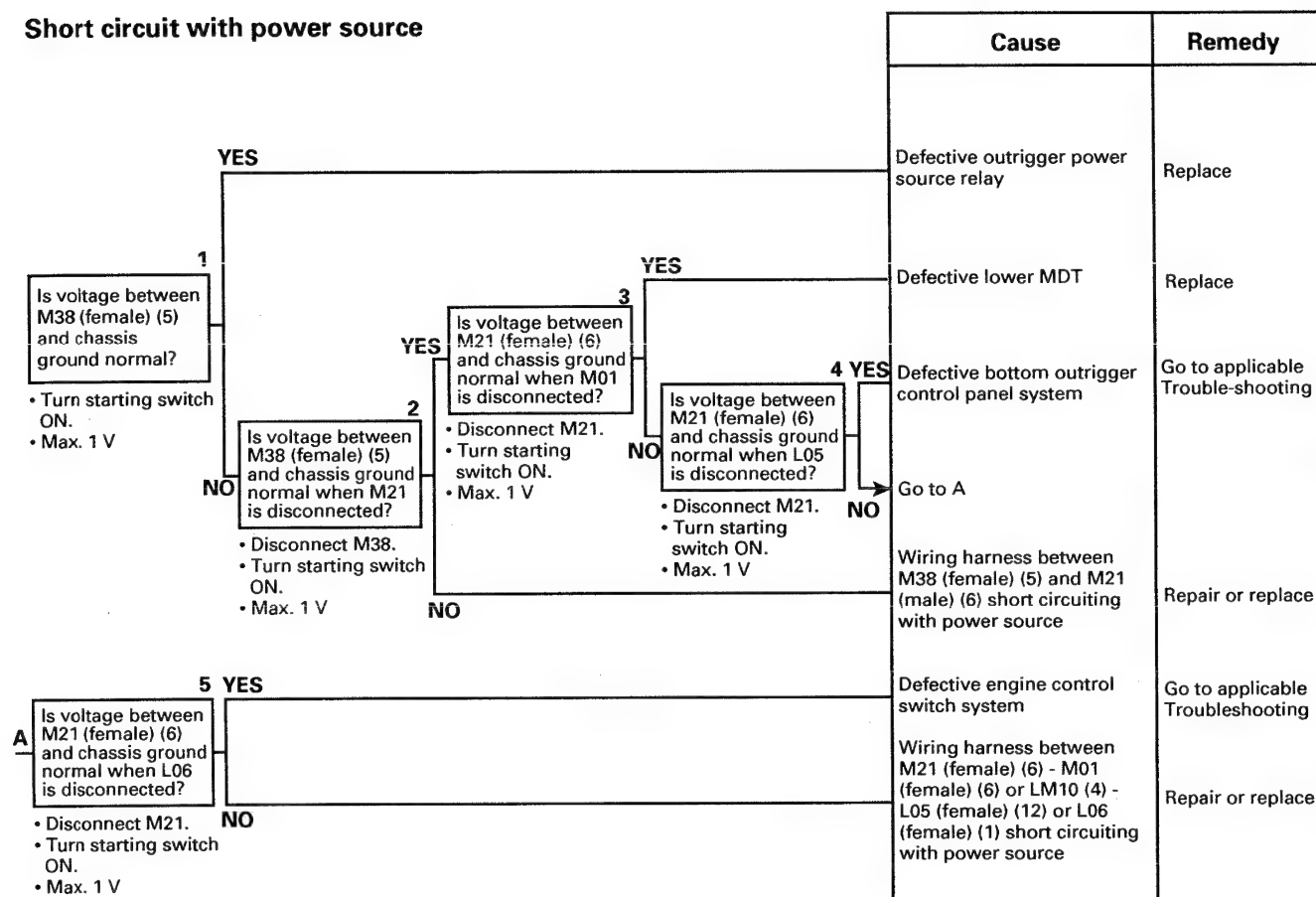


023S02

Short circuit with chassis ground

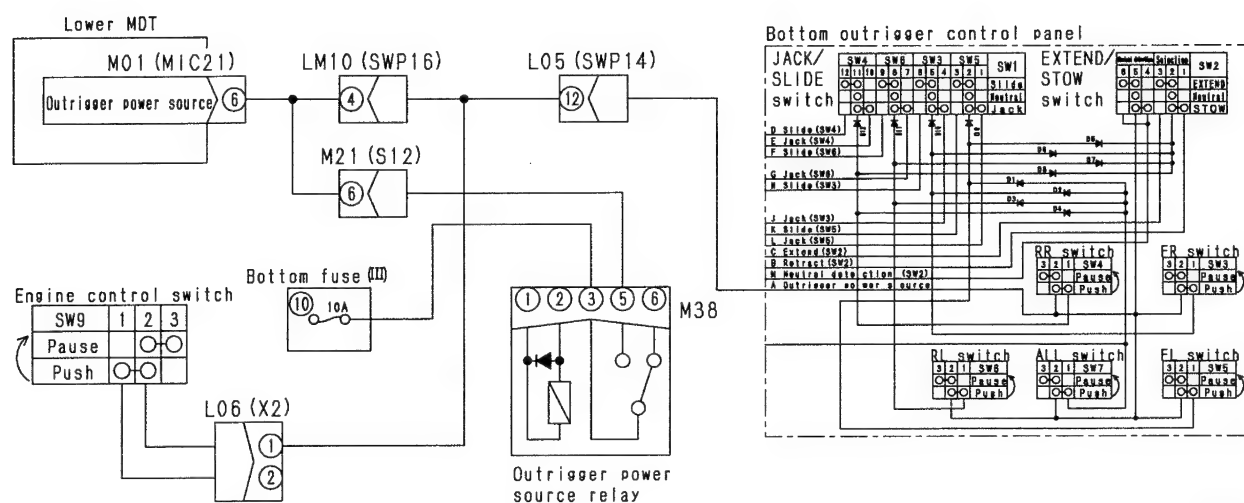


Short circuit with power source



023S02

EM-202 Related electric circuit diagram

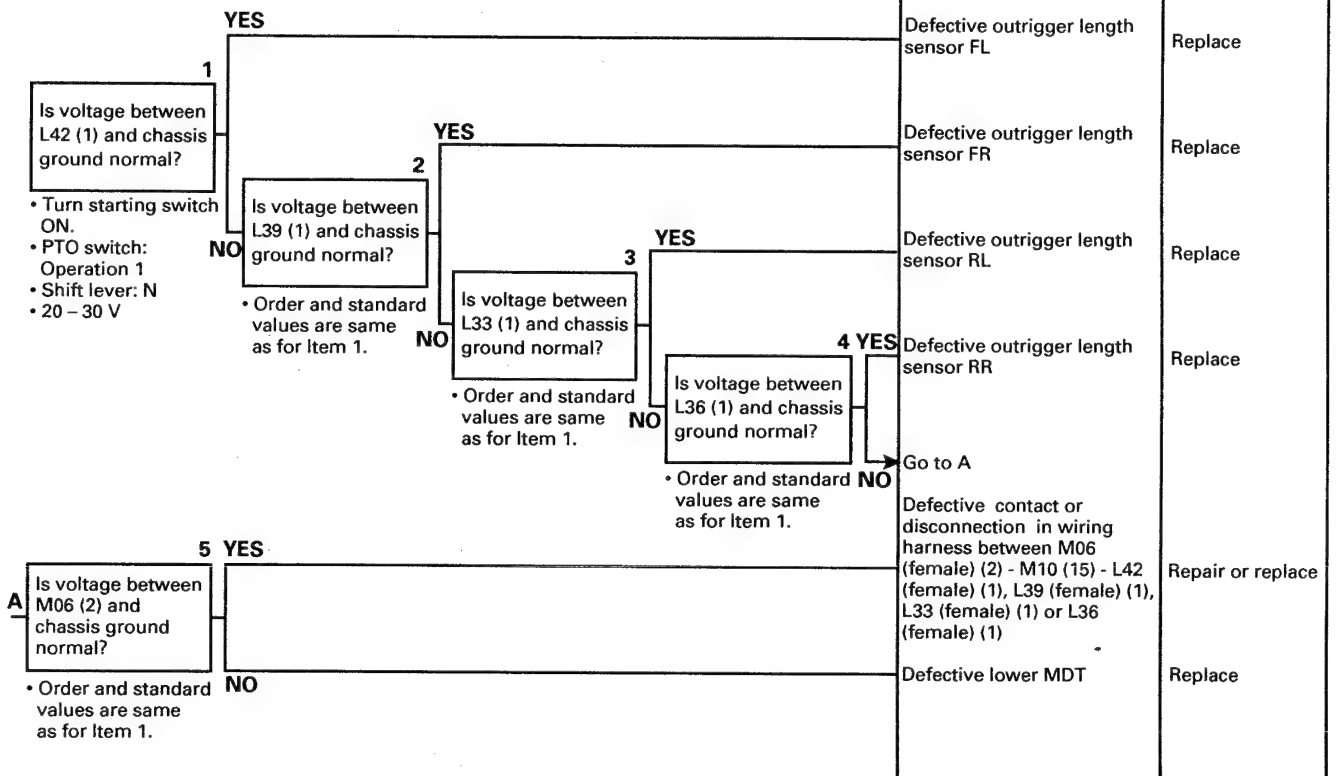


TKL00575

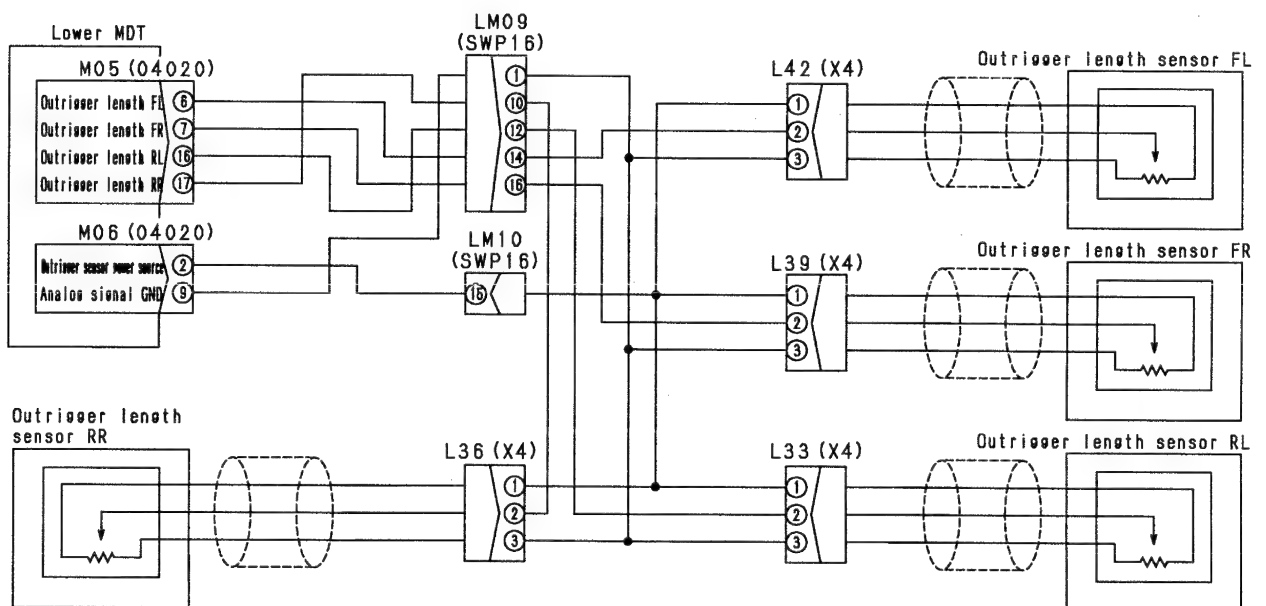
EM-203 Abnormality in outrigger length sensor power source system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection



EM-203 Related electric circuit diagram

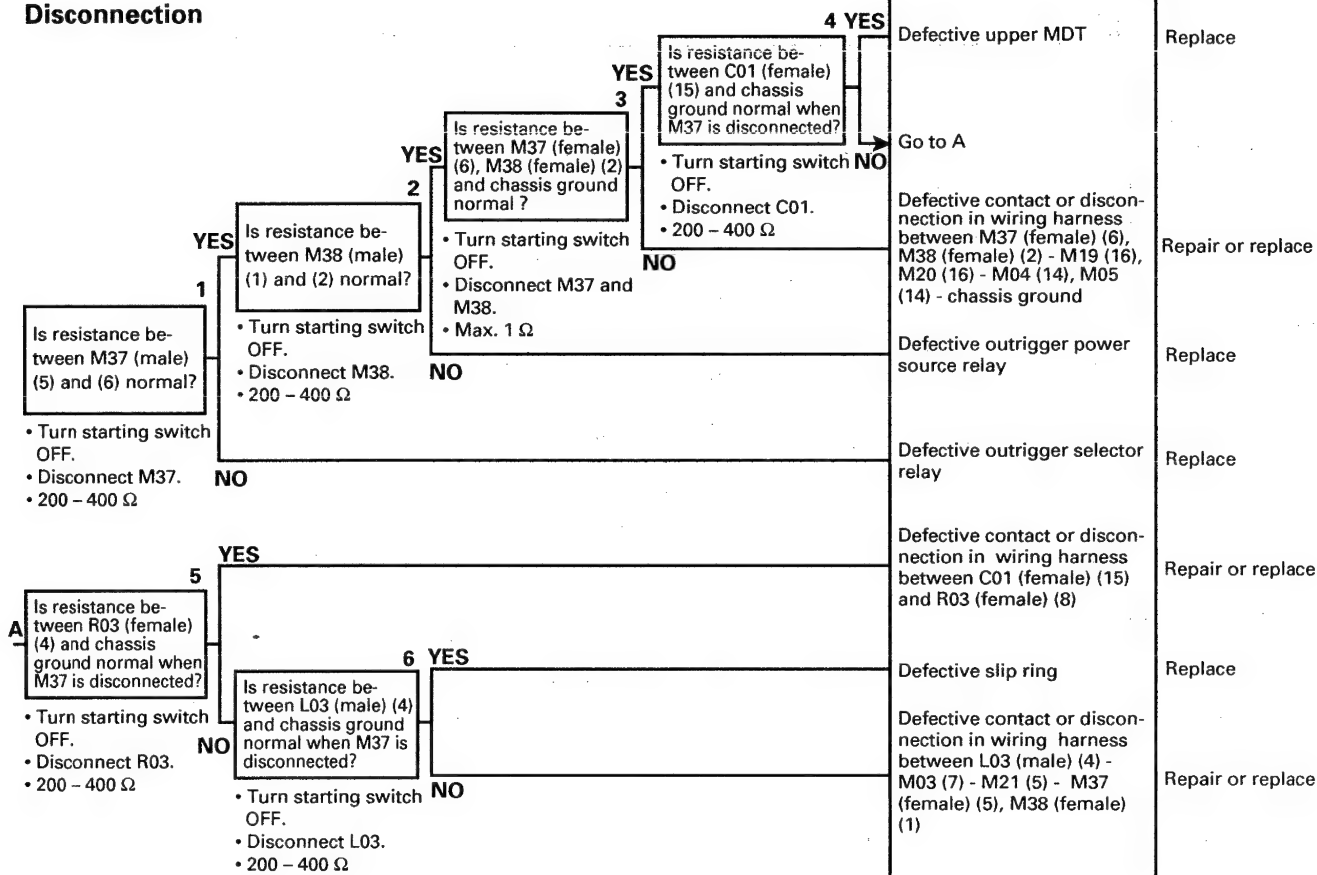


TKL00576

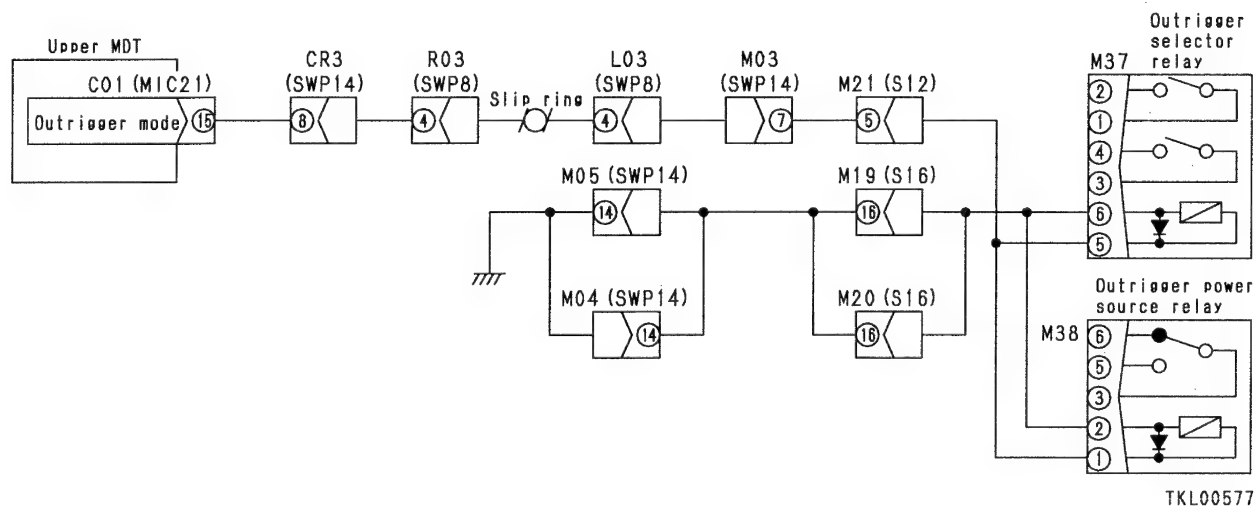
EM-204 Abnormality in outrigger mode system

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection



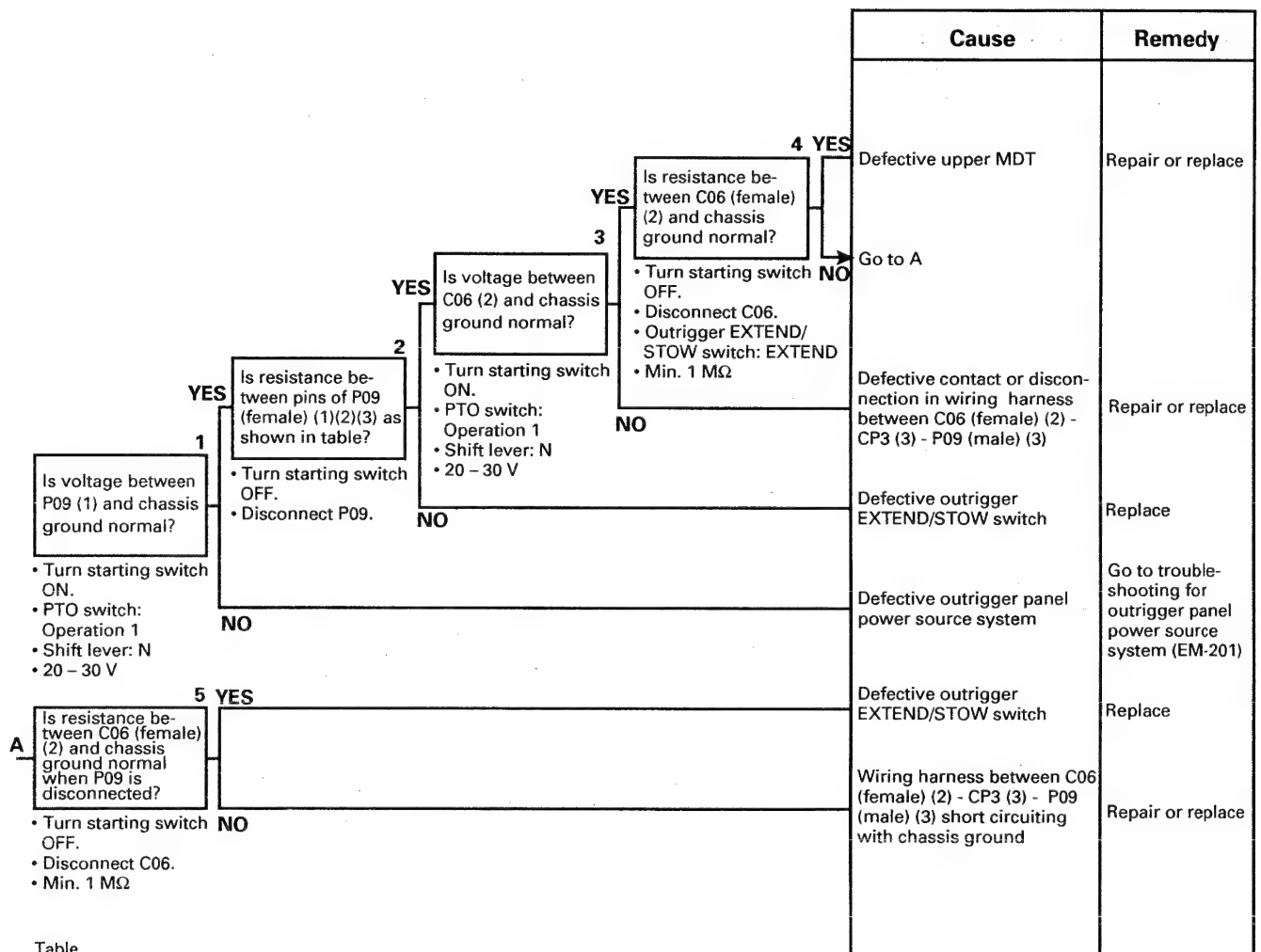
EM-204 Related electric circuit diagram



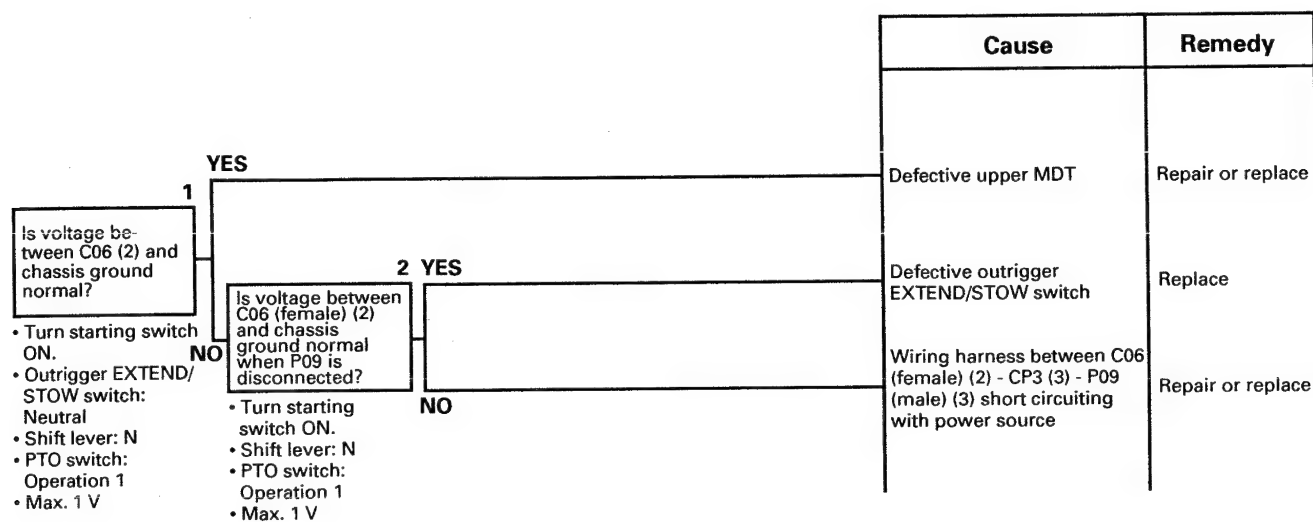
EM-205 Defective operation of top outrigger EXTEND/STOW switch (EXTEND) system
(When the actuation conditions are OK, even if the top outrigger EXTEND/STOW switch is operated to the EXTEND position, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Does not work when operated (disconnection, short circuit with chassis ground)

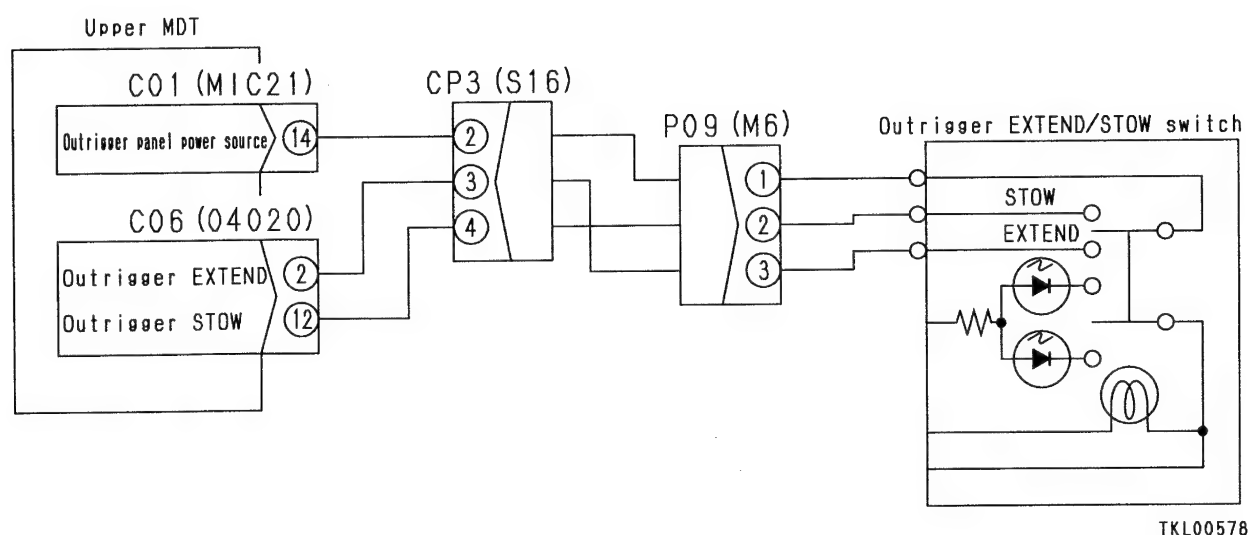


b) Moves when not operated (short circuit with power source)



023S02

EM-205 Related electric circuit diagram



EM-206 Defective operation of top outrigger EXTEND/STOW switch (STOW) system

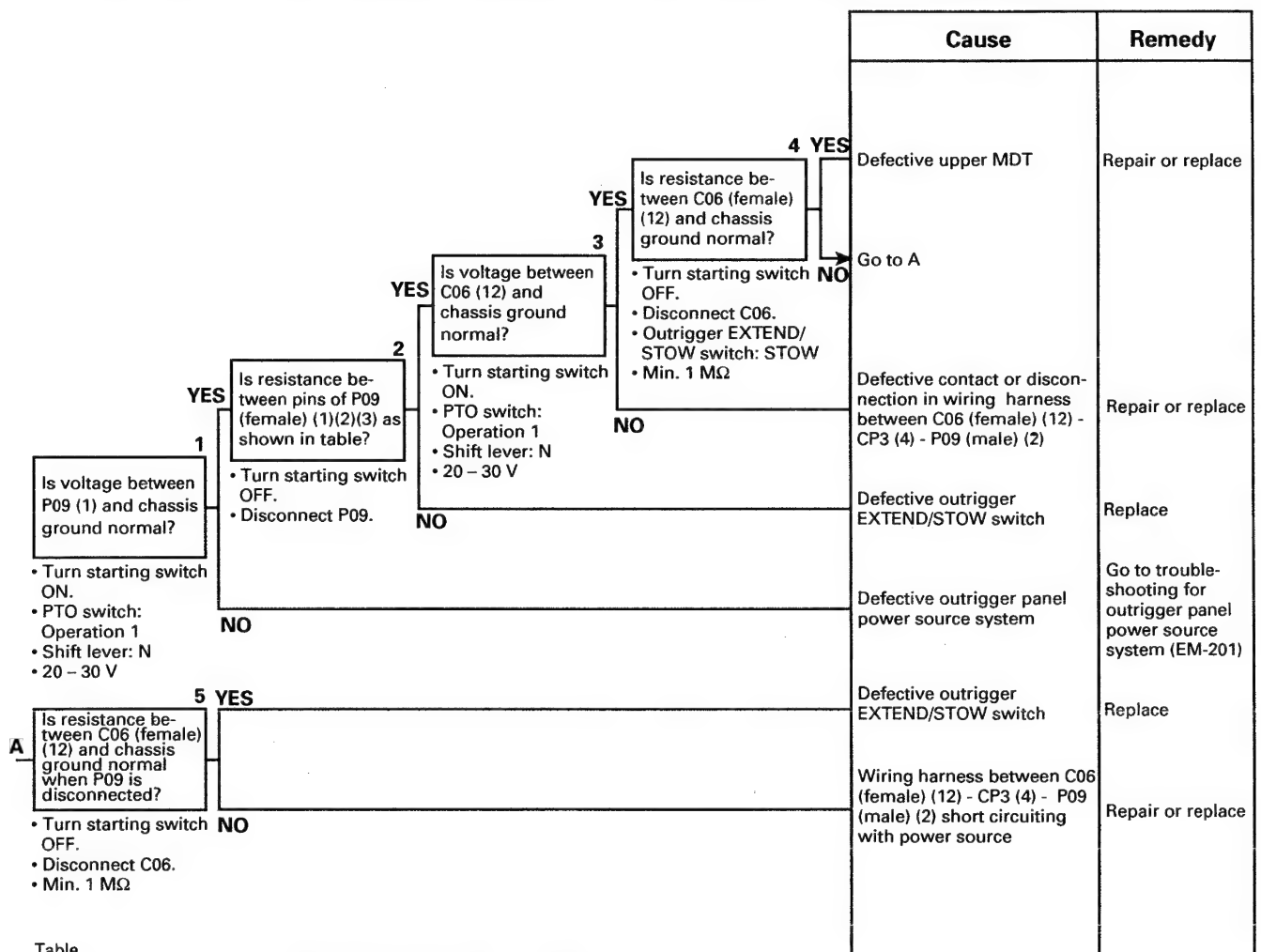
(When the actuation conditions are OK, even if the top outrigger EXTEND/STOW switch is operated to the STOW position, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

★ When no error code is displayed.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

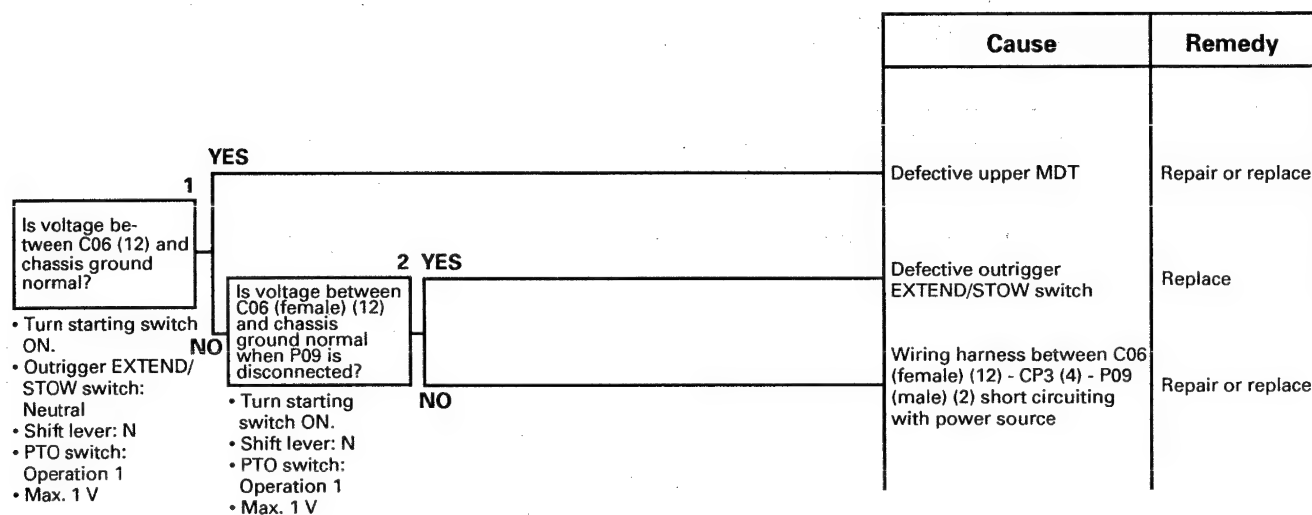
a) Does not work when operated (disconnection, short circuit with chassis ground)



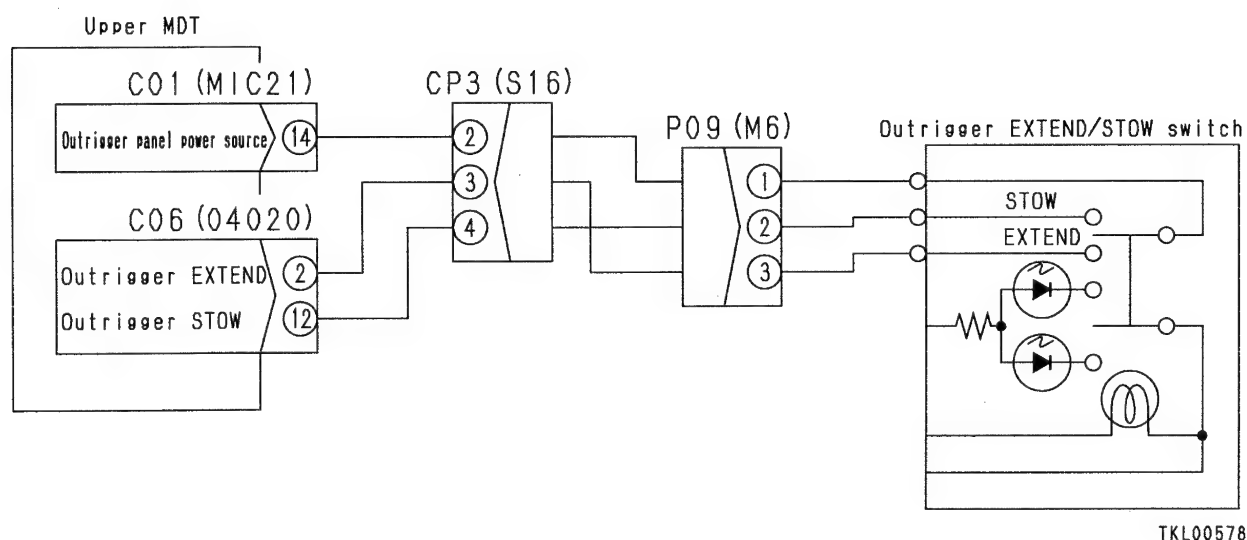
Table

P09 (female)	Outrigger EXTEND/STOW switch	Resistance value
Between (1) - (2)	EXTEND	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω
Between (1) - (2)	Neutral	Min. 1 MΩ
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	STOW	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ

b) Moves when not operated (short circuit with power source)



EM-206 Related electric circuit diagram



EM-207 Defective operation of top outrigger SLIDE/JACK switch (SLIDE) system

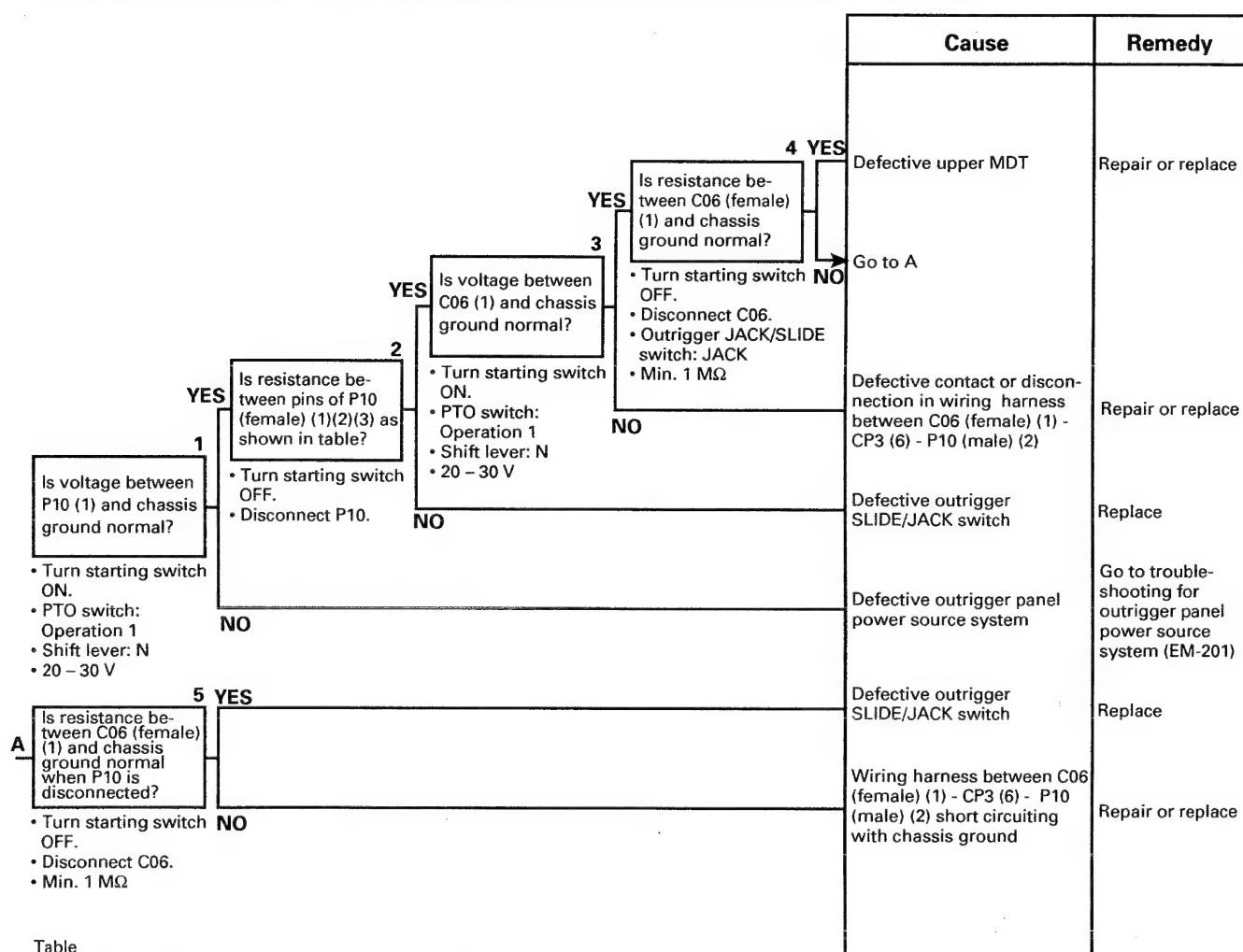
(When the actuation conditions are OK, even if the top outrigger SLIDE/JACK switch is operated to the SLIDE position, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

★ When no error code is displayed.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

a) Does not work when operated (disconnection, short circuit with chassis ground)



Table

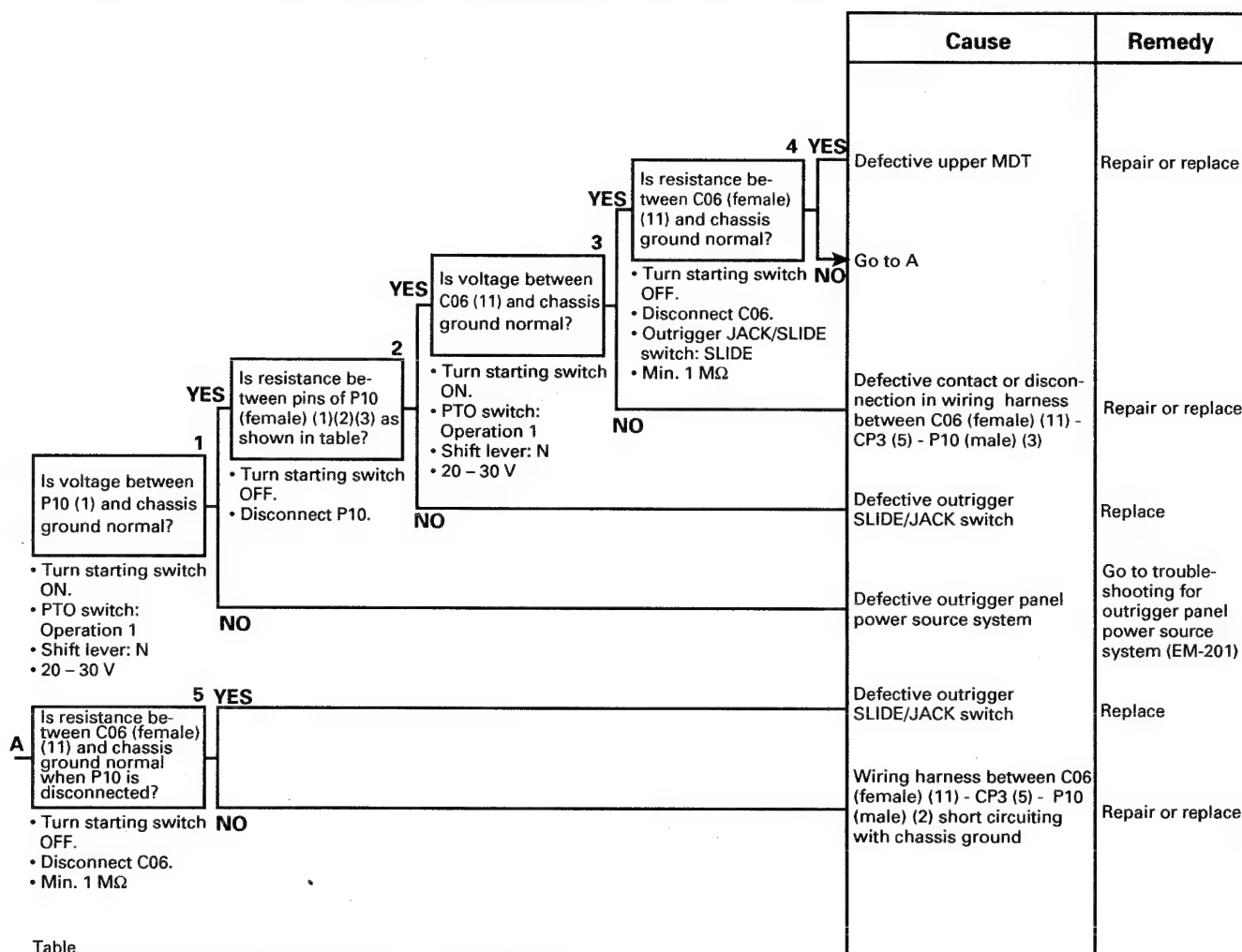
P10 (female)	Outrigger SLIDE/JACK switch	Resistance value
Between (1) - (2)	JACK	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω
Between (1) - (2)	Neutral	Min. 1 MΩ
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	SLIDE	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ

EM-208 Defective operation of top outrigger SLIDE/JACK switch (JACK) system

(When the actuation conditions are OK, even if the top outrigger JACK/SLIDE switch is operated to the EXTEND position, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

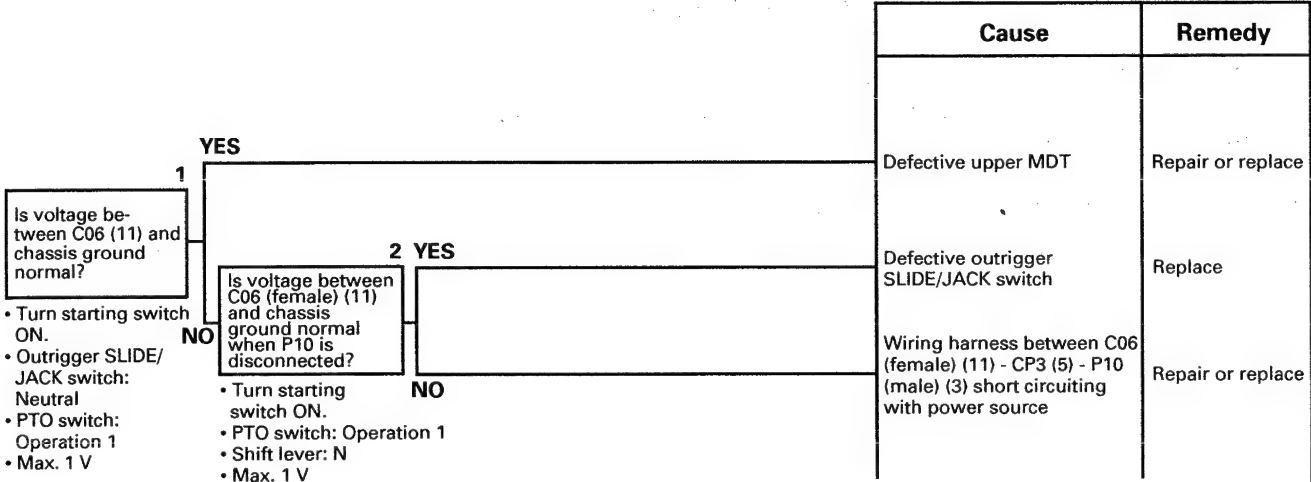
a) Does not work when operated (disconnection, short circuit with chassis ground)



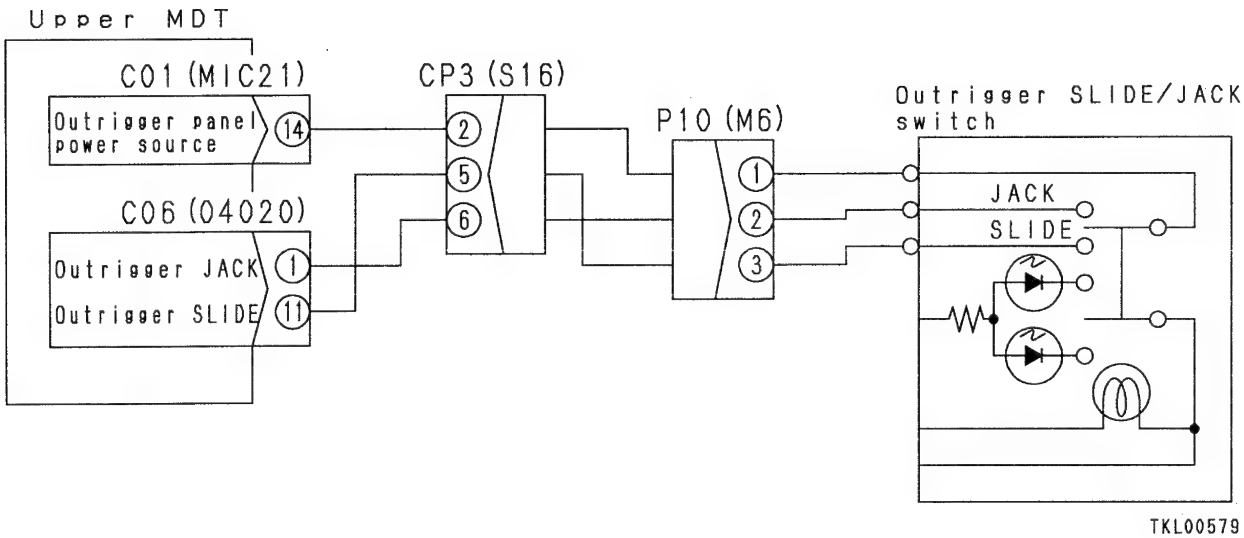
Table

P10 (female)	Outrigger SLIDE/JACK switch	Resistance value
Between (1) - (2)	JACK	Min. 1 MΩ
Between (1) - (3)		Max. 1 Ω
Between (1) - (2)	Neutral	Min. 1 MΩ
Between (1) - (3)		Min. 1 MΩ
Between (1) - (2)	SLIDE	Max. 1 Ω
Between (1) - (3)		Min. 1 MΩ

b) Moves when not operated (short circuit with power source)



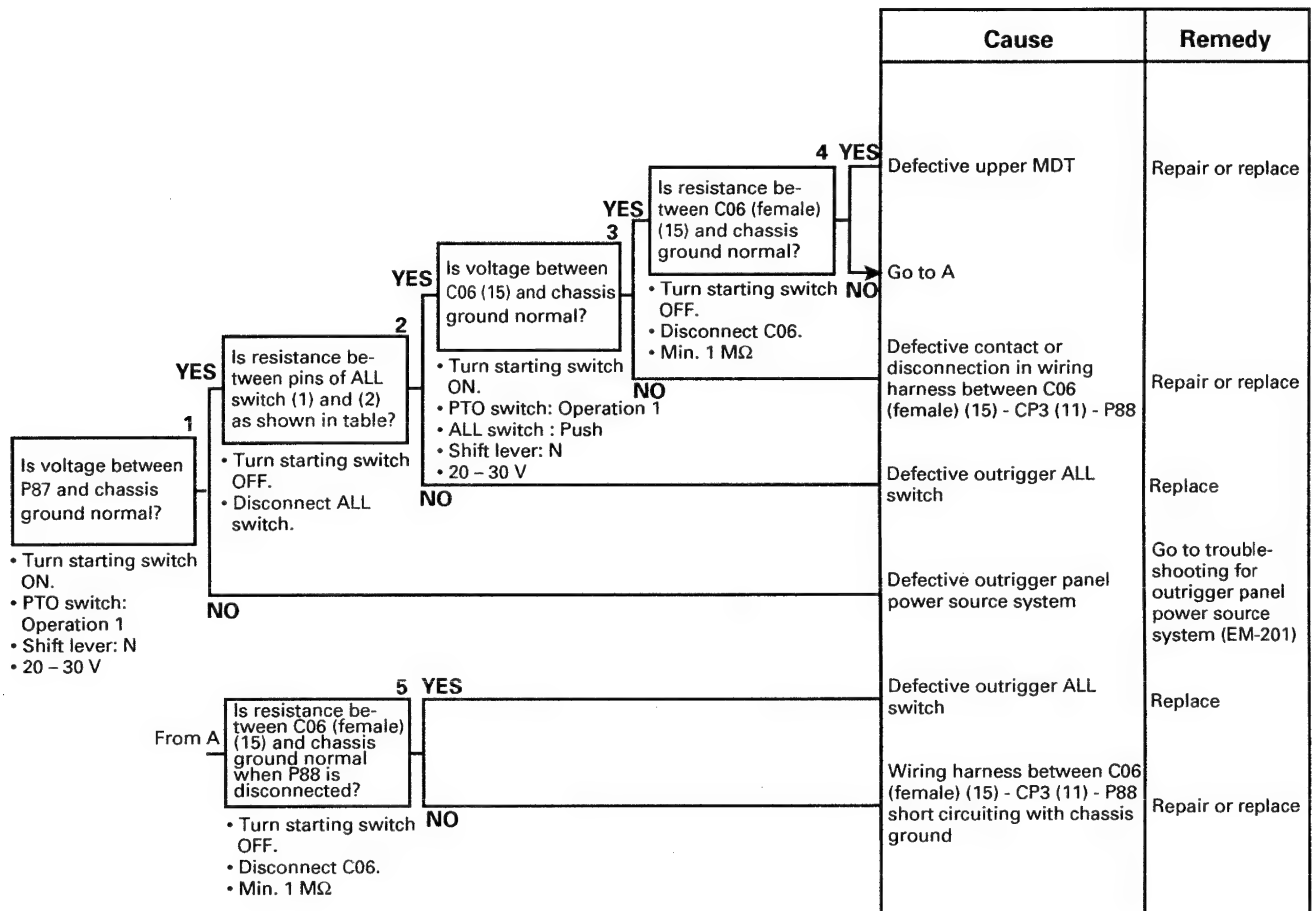
EM-208 Related electric circuit diagram



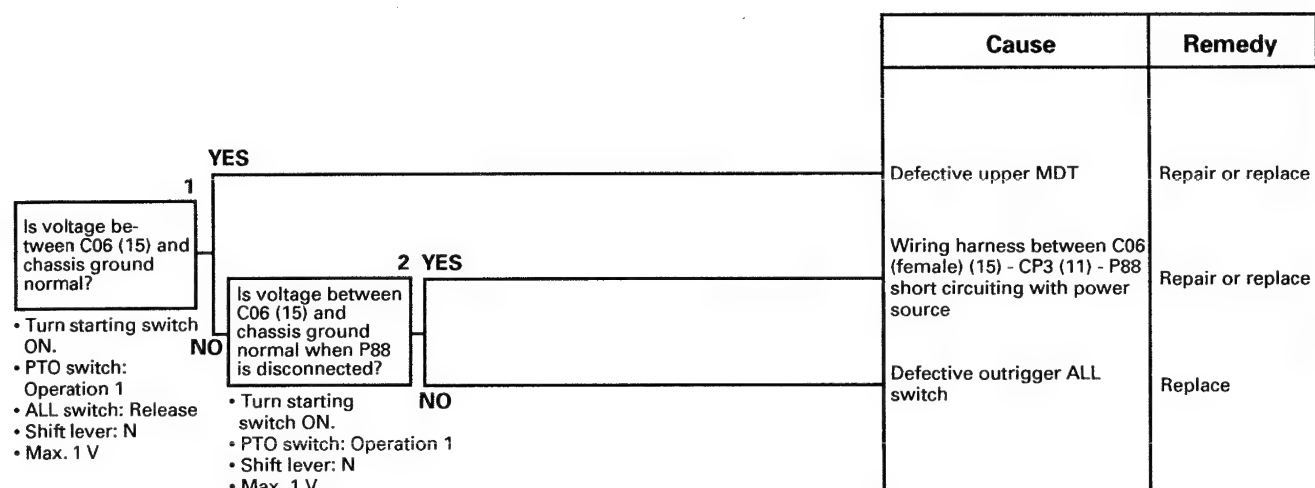
EM-209 Defective operation of top outrigger ALL switch system (When the actuation conditions are OK, even if the top outrigger ALL switch is operated, the outriggers do not move, or the outriggers move even when the switch is not being pressed.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Does not work when operated (disconnection, short circuit with chassis ground)

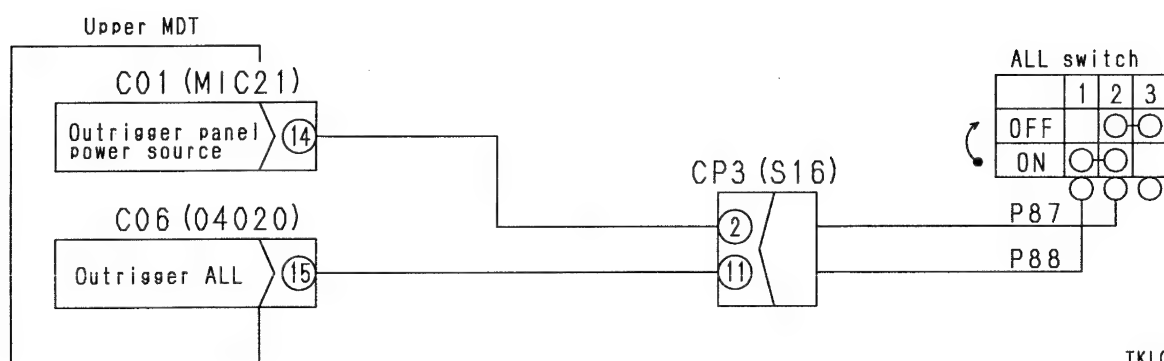


b) Moves when not operated (short circuit with power source)



023S02

EM-209 Related electric circuit diagram



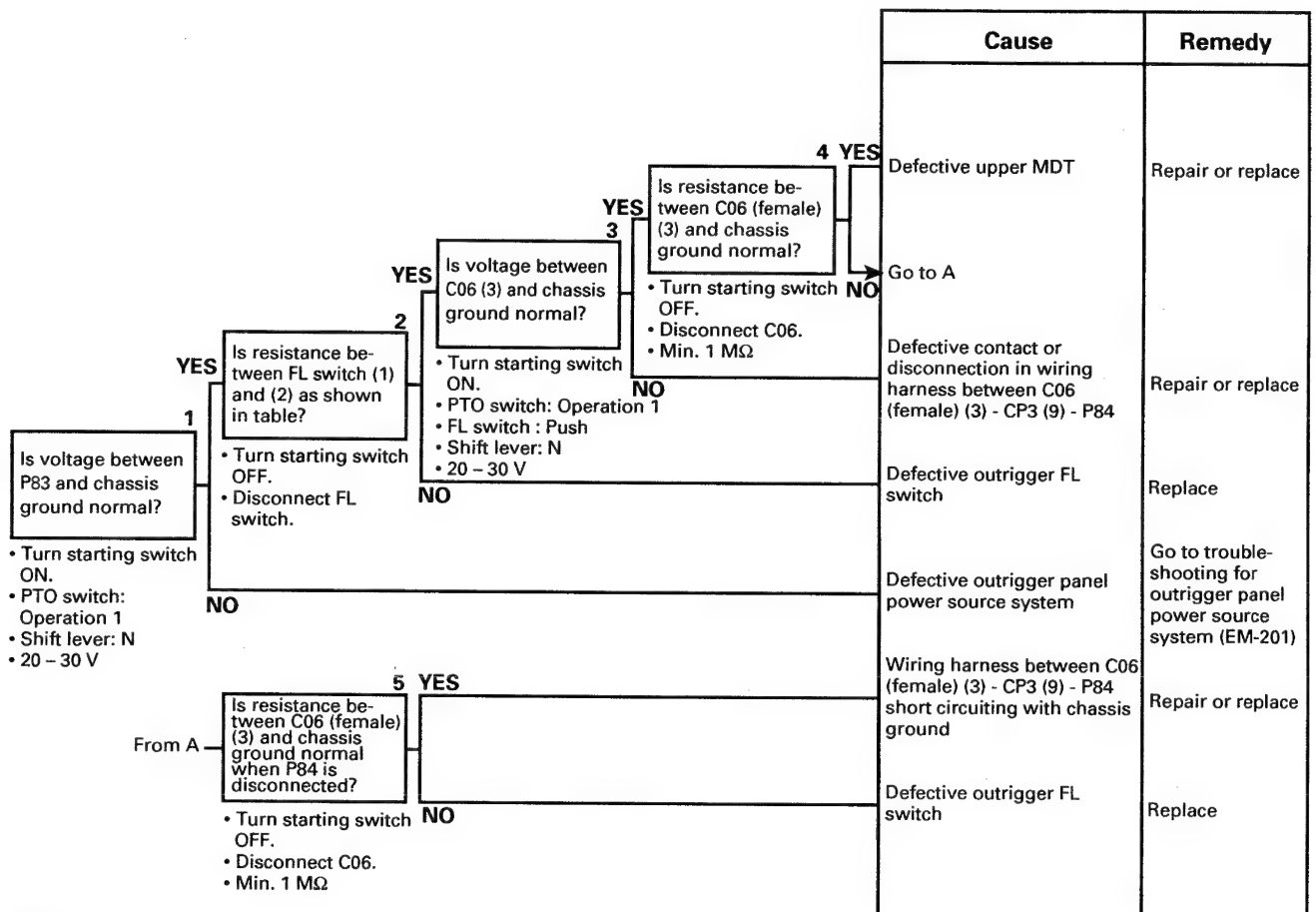
TKL00580

EM-210 Defective operation of top outrigger FL switch system (When the actuation conditions are OK, even if the top outrigger FL switch is operated, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Does not work when operated (disconnection, short circuit with chassis ground)

023S02



Table

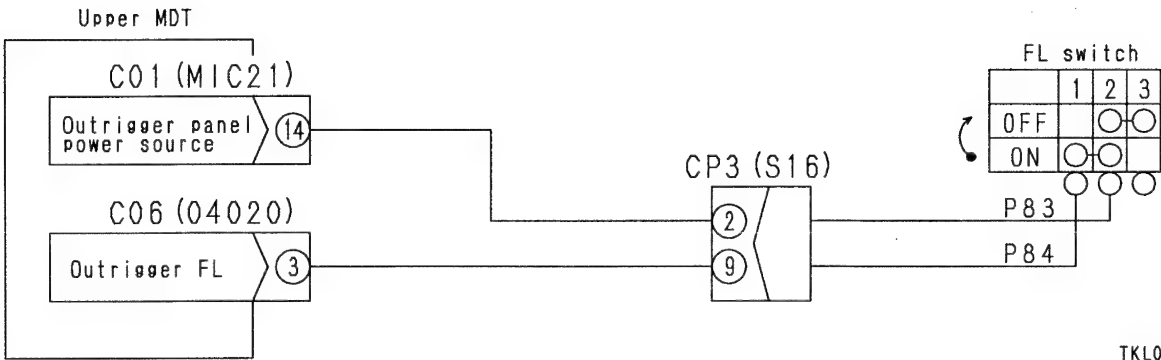
FL switch		Resistance value
Between (1) - (2)	Release	Min. 1 MΩ
	Push	Max. 1 Ω

b) Moves when not operated (short circuit with power source)

		Cause	Remedy
<div> <div> <div>1</div> <div>Is voltage between C06 (3) and chassis ground normal?</div> </div> <div> <div>• Turn starting switch ON.</div> <div>• PTO switch: Operation 1</div> <div>• FL switch: Release</div> <div>• Shift lever: N</div> <div>• Max. 1 V</div> </div> </div>	YES	Defective upper MDT	Repair or replace
	NO	<div> <div>2 YES</div> <div>Is voltage between C06 (3) and chassis ground normal when P84 is disconnected?</div> </div>	<div> <div>Wiring harness between C06 (female) (3) - CP3 (9) - P84 short circuiting with power source</div> <div>Repair or replace</div> </div>
	NO	Defective outrigger FL switch	Replace

023S02

EM-210 Related electric circuit diagram

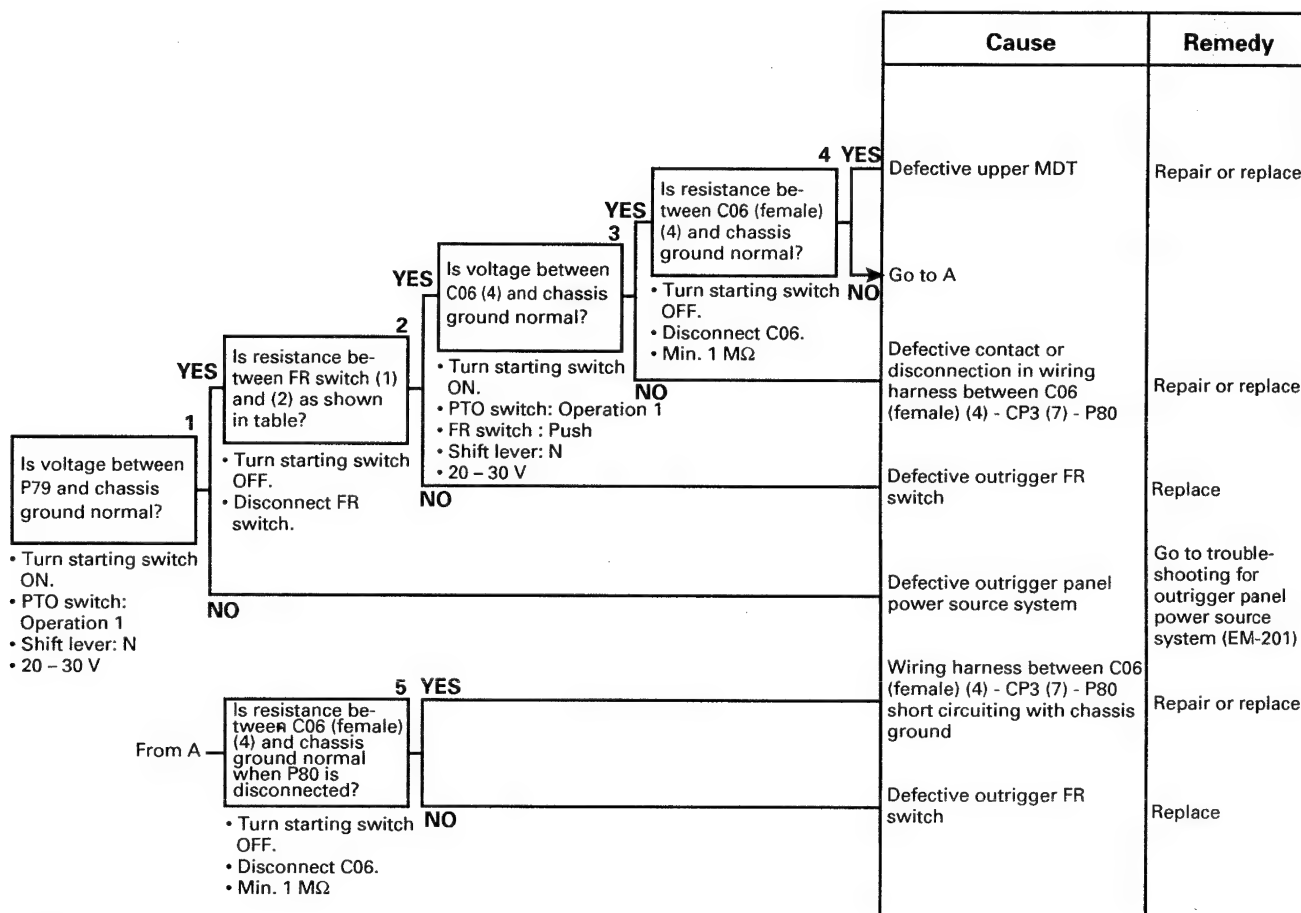


EM-211 Defective operation of top outrigger FR switch system (When the actuation conditions are OK, even if the top outrigger FR switch is operated, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Does not work when operated (disconnection, short circuit with chassis ground)

023S02



Table

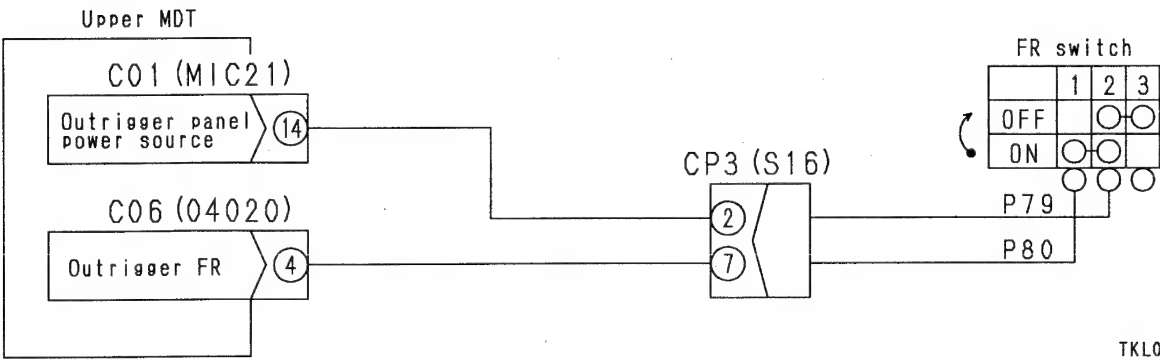
FR switch		Resistance value
Between (1) - (2)	Release	Min. 1 MΩ
	Push	Max. 1 Ω

b) Moves when not operated (short circuit with power source)

		Cause	Remedy
<div><div><div>1</div><div>Is voltage between C06 (4) and chassis ground normal?</div><div><div><div>• Turn starting switch ON.</div><div>• PTO switch: Operation 1</div><div>• FR switch: Release</div><div>• Shift lever: N</div><div>• Max. 1 V</div></div></div><div><div>YES</div><div>2</div><div>Is voltage between C06 (4) and chassis ground normal when P80 is disconnected?</div><div><div><div>• Turn starting switch ON.</div><div>• PTO switch: Operation 1</div><div>• Shift lever: N</div><div>• Max. 1 V</div></div></div><div><div>NO</div><div>NO</div></div></div></div><div>Defective upper MDT</div><div>Repair or replace</div></div>			
		Wiring harness between C06 (female) (4) - CP3 (7) - P80 short circuiting with power source	Repair or replace
		Defective outrigger FR switch	Replace

023S02

EM-211 Related electric circuit diagram

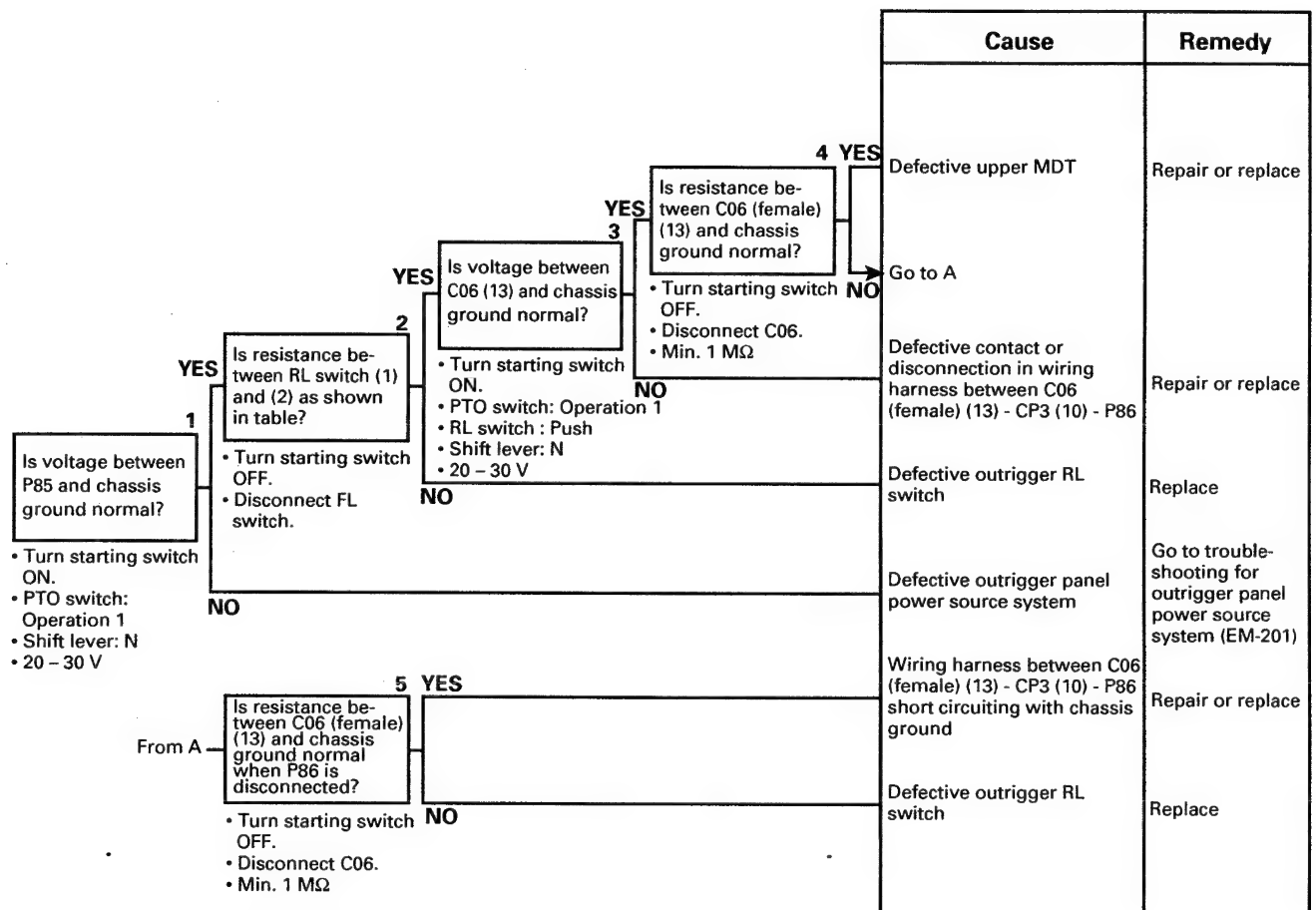


EM-212 Defective operation of top outrigger RL switch system (When the actuation conditions are OK, even if the top outrigger RL switch is operated, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Does not work when operated (disconnection, short circuit with chassis ground)

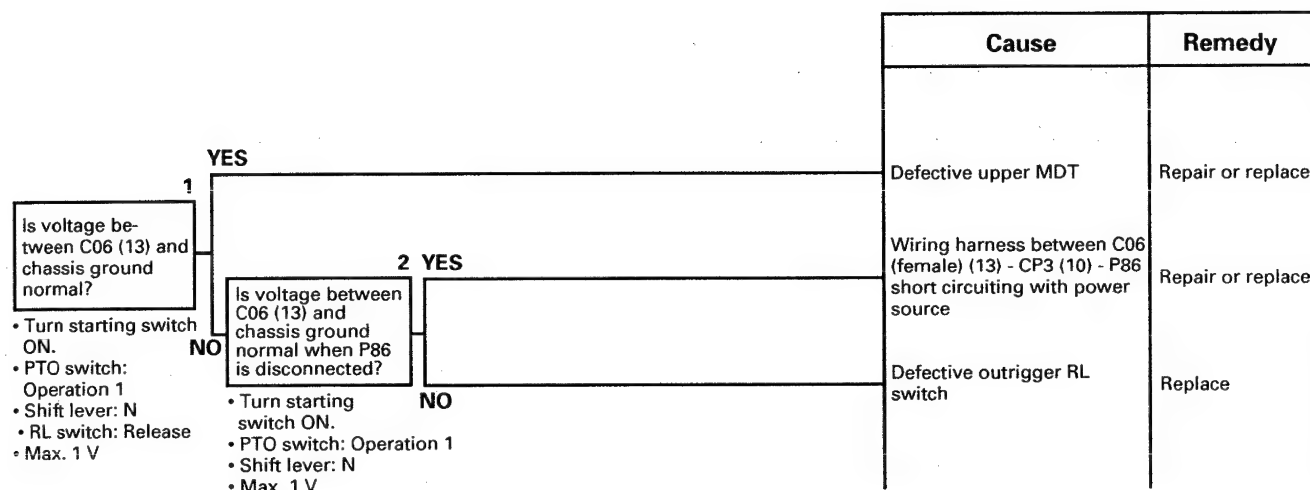
023S02



Table

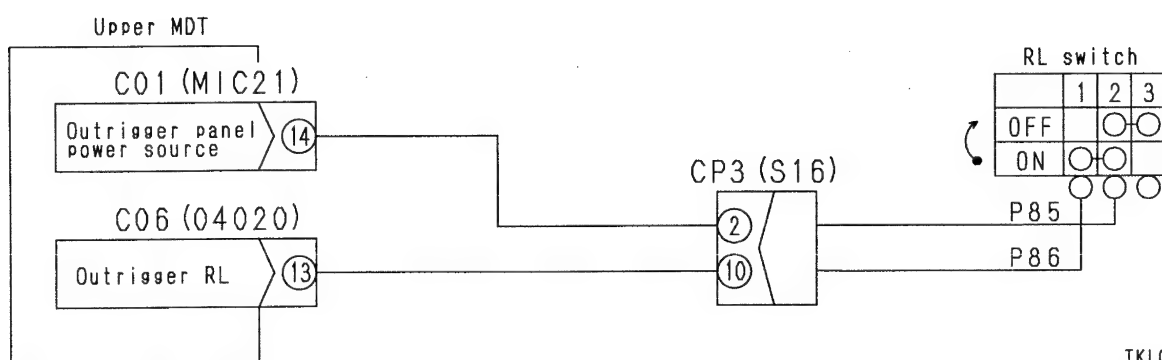
RL switch		Resistance value
Between (1) - (2)	Release	Min. 1 MΩ
	Push	Max. 1 Ω

b) Moves when not operated (short circuit with power source)



023S02

EM-212 Related electric circuit diagram

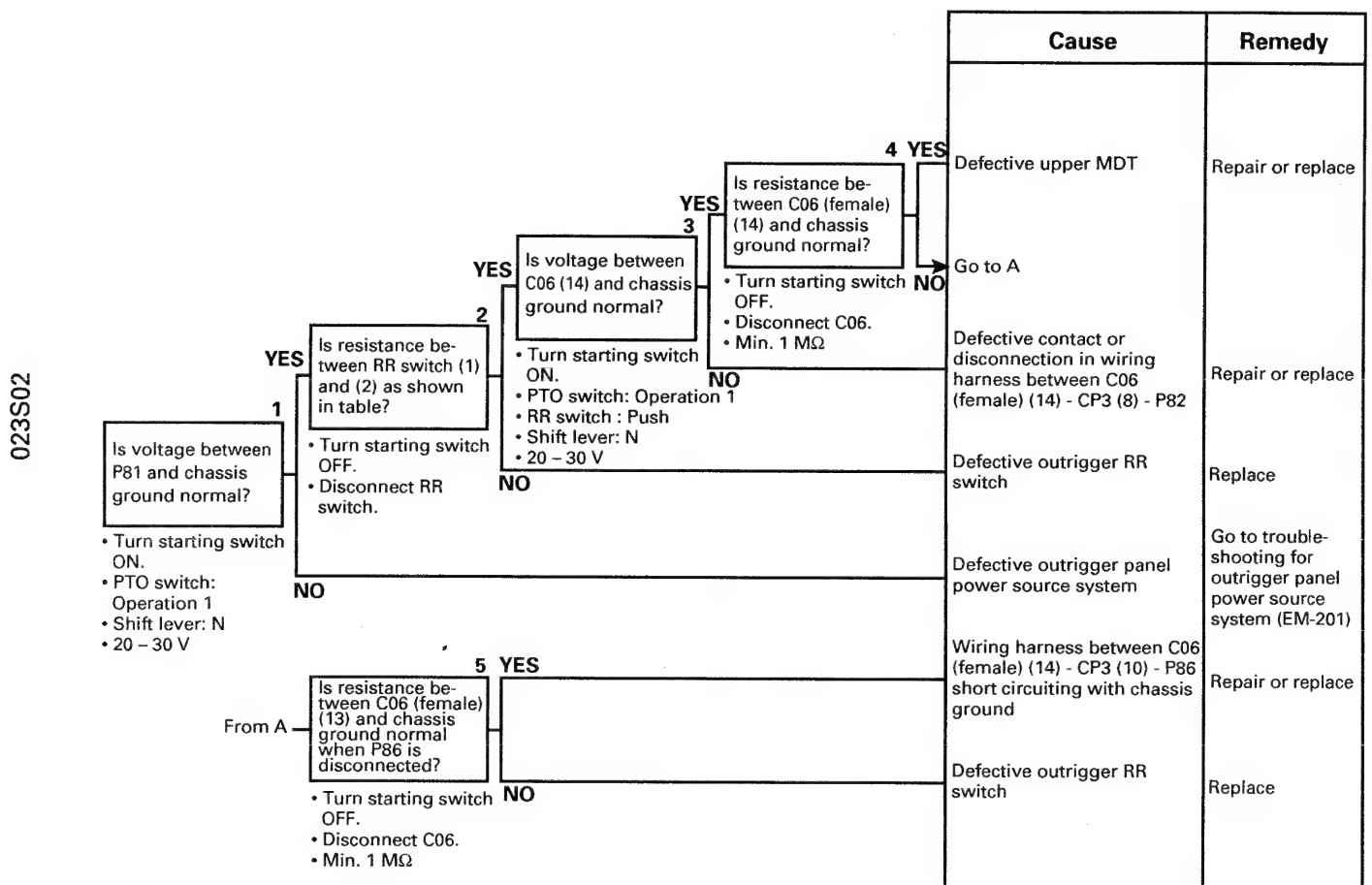


TKL00583

EM-213 Defective operation of top outrigger RR switch system
(When the actuation conditions are OK, even if the top outrigger RR switch is operated, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

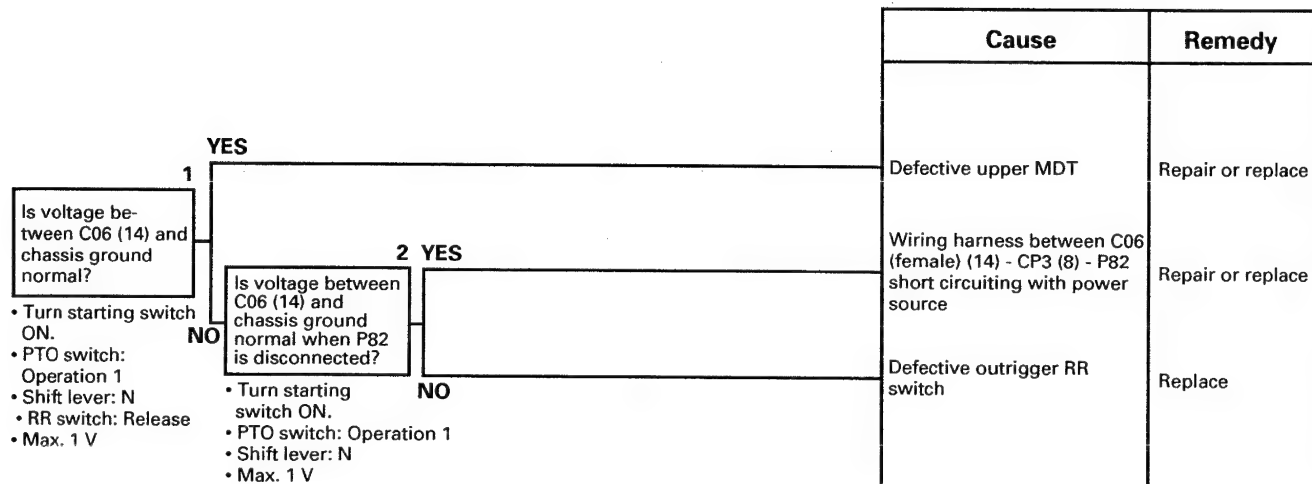
a) Does not work when operated (disconnection, short circuit with chassis ground)



Table

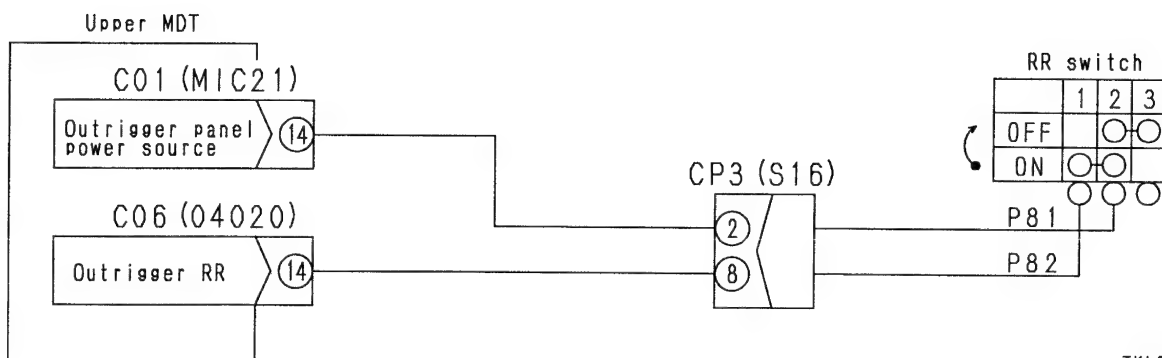
RR switch		Resistance value
Between (1) - (2)	Release	Min. 1 MΩ
	Push	Max. 1 Ω

b) Moves when not operated (short circuit with power source)



023S02

EM-212 Related electric circuit diagram



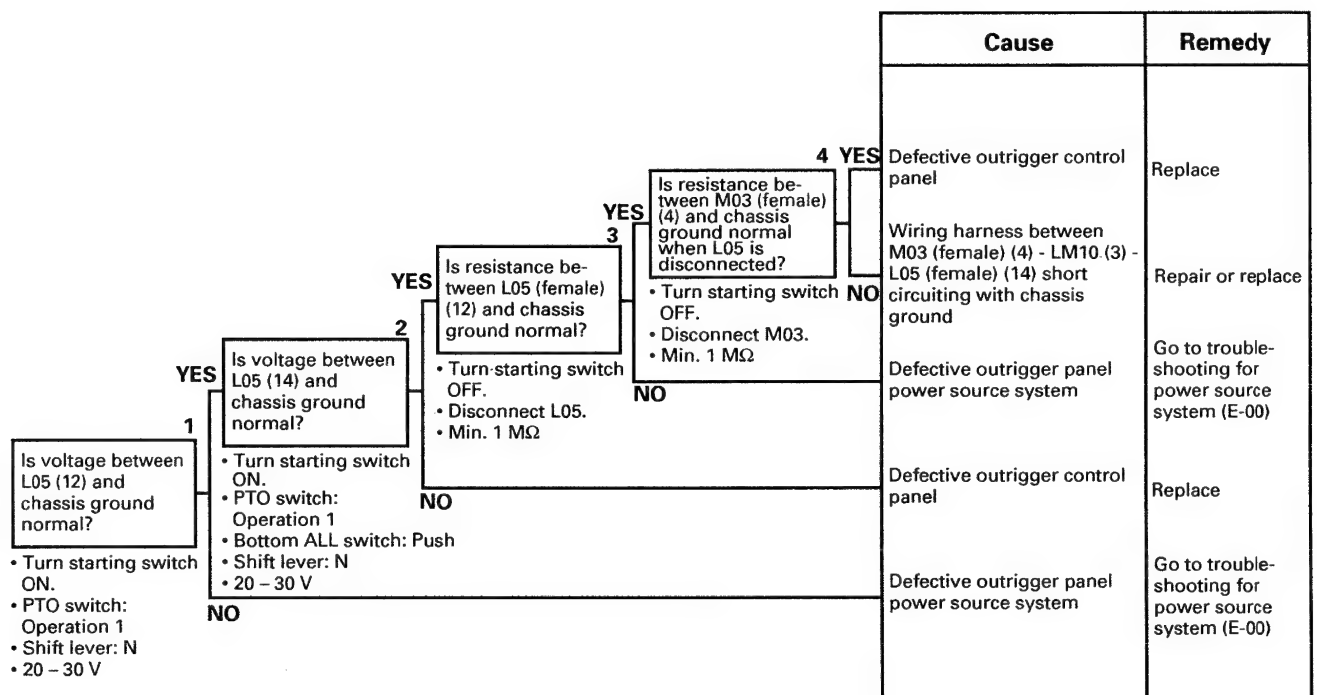
TKL00584

EM-214 Defective operation of bottom outrigger ALL switch system (When the actuation conditions are OK, even if the top outrigger ALL switch is operated, the outriggers do not move, or the outriggers move even when the switch is not being operated.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Does not work when operated (disconnection, short circuit with chassis ground)

023S02



b) Moves when not operated (short circuit with power source)

1 YES

Is voltage between M03 (3) and chassis ground normal when L05 is disconnected?

• Turn starting switch NO ON.

• Max. 1 V

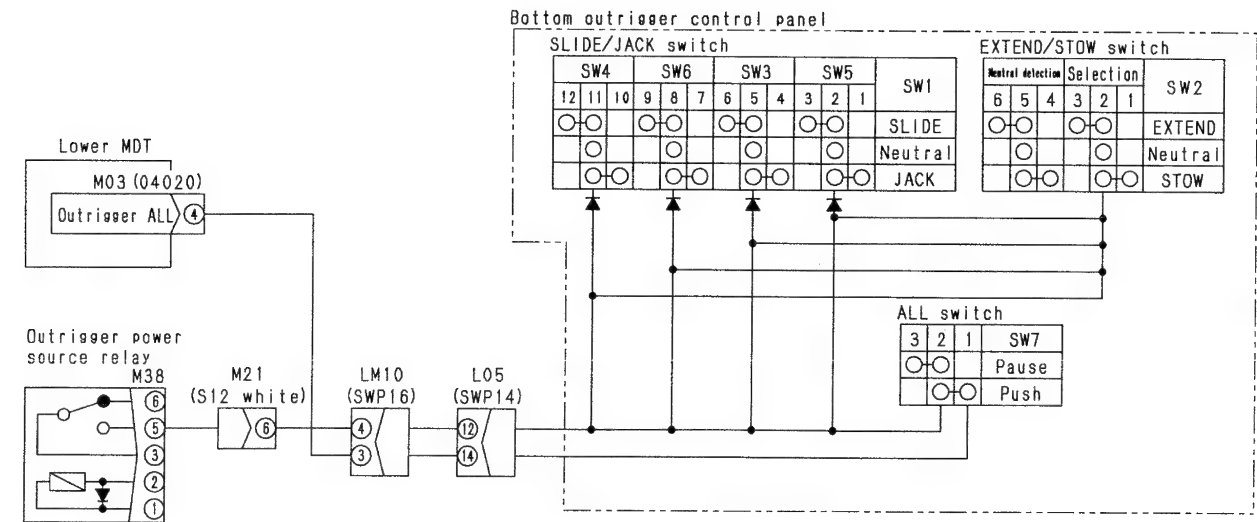
Defective outrigger control panel

Replace

Wiring harness between M03 (female) (4) - LM10 (3) - L05 (female) (14) short circuiting with power source

Repair or replace

EM-214 Related electric circuit diagram



TKL00585

EM-215 Defective operation of bottom outrigger control panel (RL jack) system

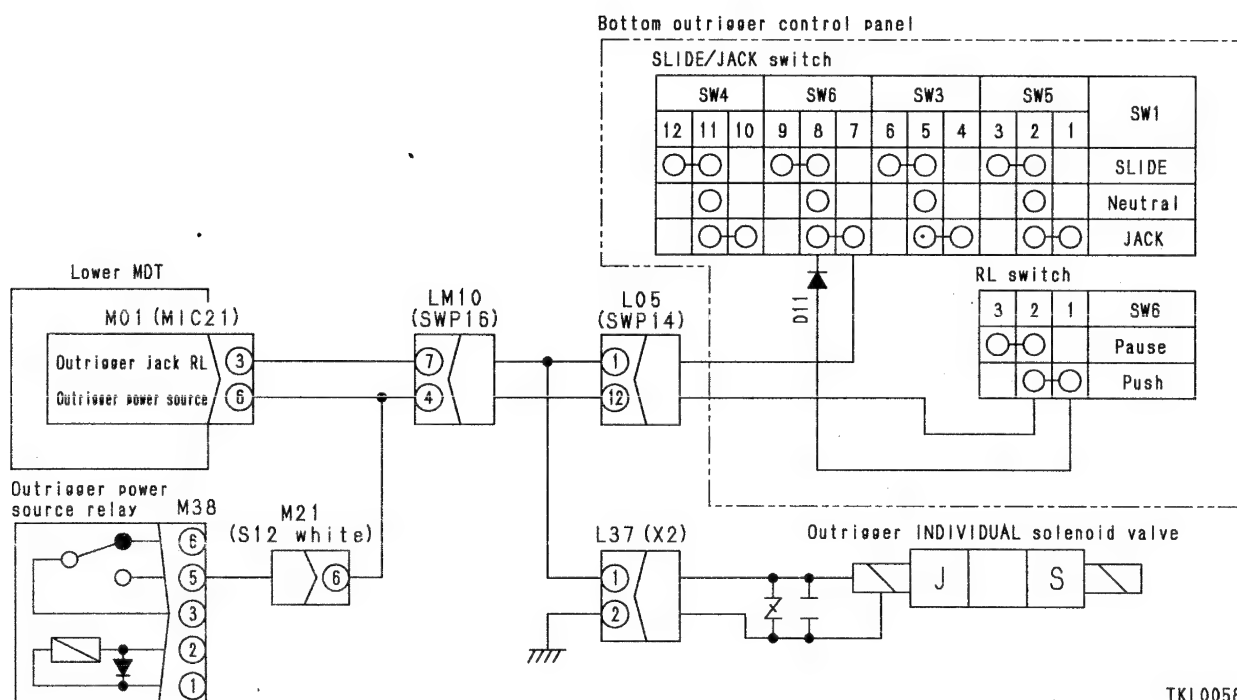
(When the actuation conditions are OK, even if the bottom outrigger RL jack switch is operated, the outriggers do not move.)

X-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Is resistance between L05 (female) (1) and chassis ground normal?</p> <p>• Turn starting switch NO OFF. • Disconnect L05. • 20 – 30 V</p>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (1) and connecting point of LM10 (male) (7) and L37 (female) (1)	Repair or replace

EM-215 Related electric circuit diagram (X-shaped outrigger)

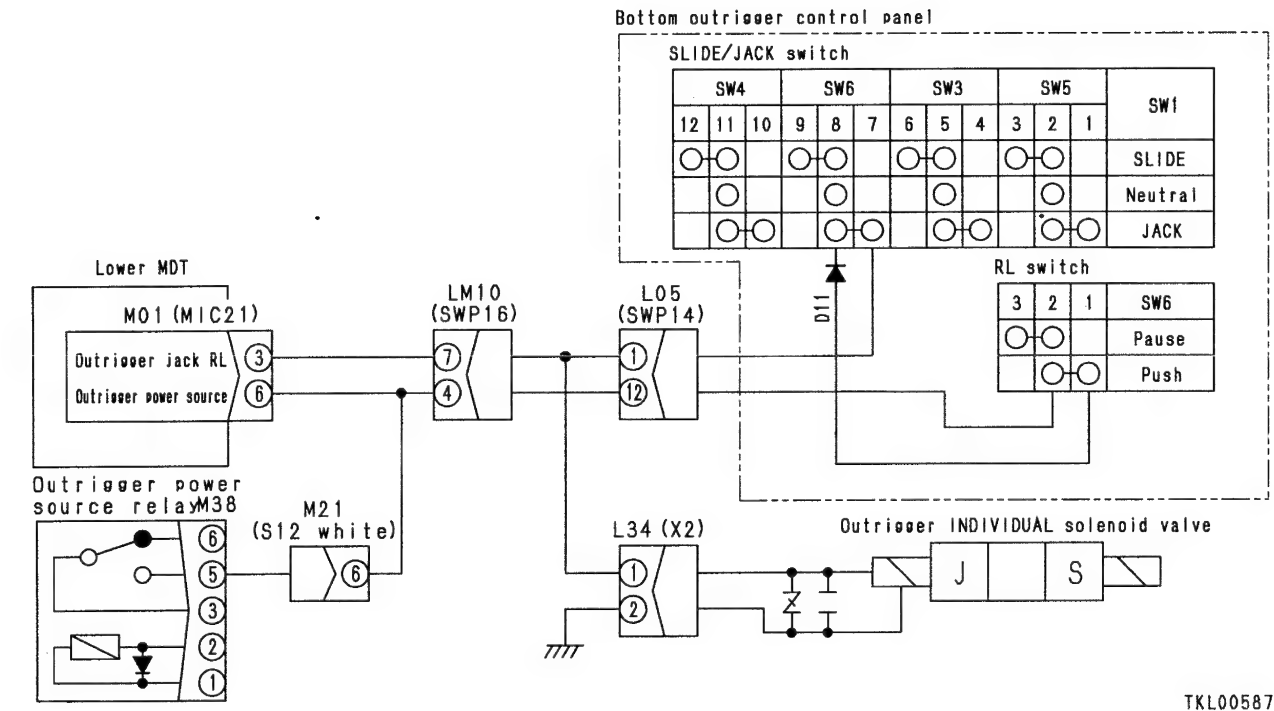


H-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (5) and chassis ground normal?</div> <div> <div>• Turn starting switch NO OFF.</div> <div>• Disconnect L05.</div> <div>• 20 – 30 V</div> </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (5) and connecting point of LM10 (male) (7) and L34 (female) (1)	Repair or replace

EM-215 Related electric circuit diagram (H-shaped outrigger)



EM-216 Defective operation of bottom outrigger control panel (FL jack) system

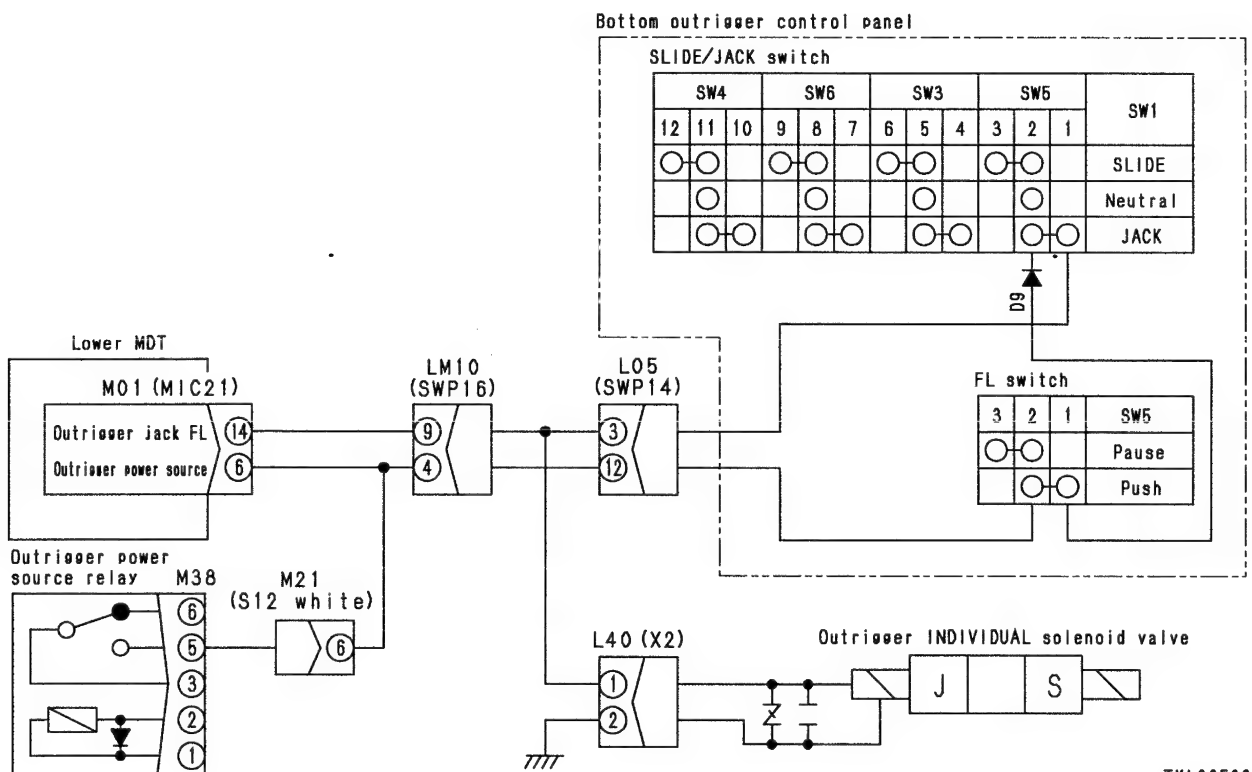
(When the actuation conditions are OK, even if the bottom outrigger FL jack switch is operated, the outriggers do not move.)

X-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div style="border: 1px solid black; padding: 5px; width: 150px;"> Is resistance between L05 (female) (3) and chassis ground normal? </div>	1 YES	Defective outrigger control panel	Replace
	NO	Defective contact or disconnection in wiring harness between L05 (female) (3) - connecting point of LM10 (male) (9) and L40 (female) (1)	Repair or replace
• Turn starting switch OFF. • Disconnect L05. • 20 - 30 V			

EM-216 Related electric circuit diagram (X-shaped outrigger)



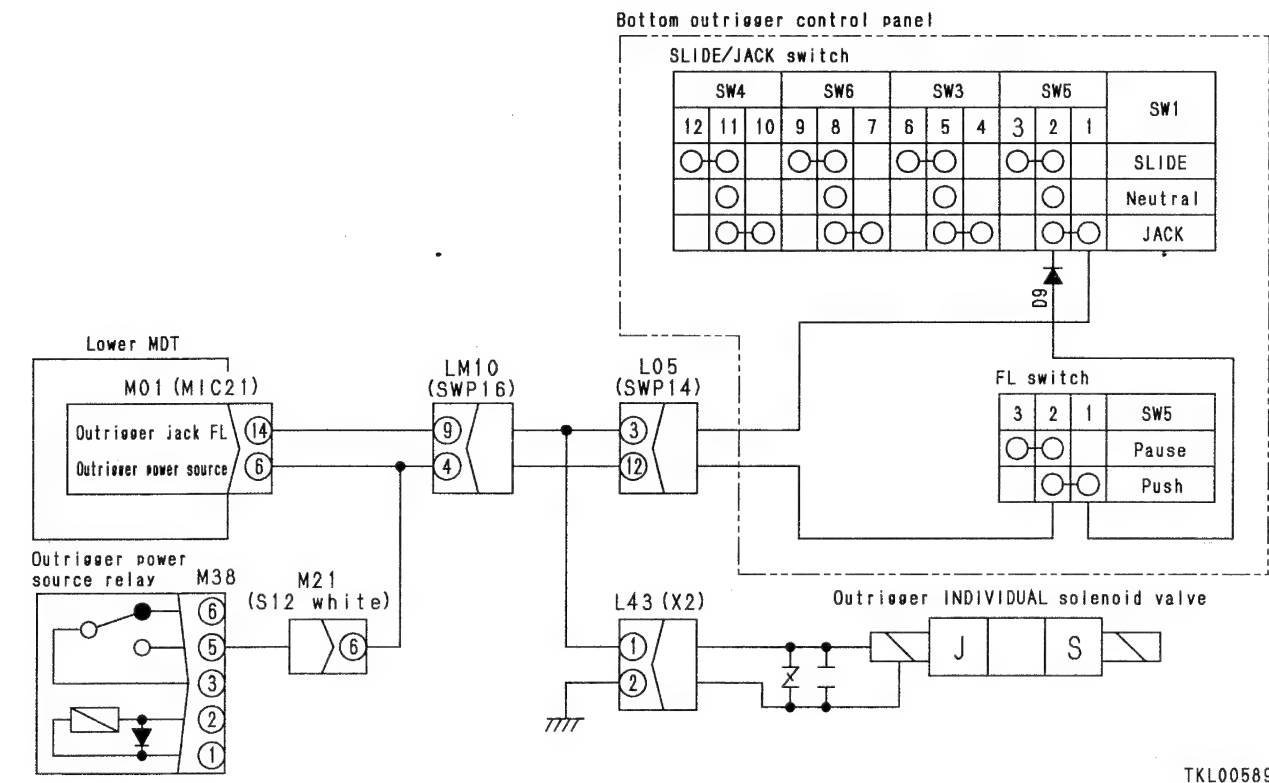
TKL00588

H-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (7) and chassis ground normal?</div> <div> <ul style="list-style-type: none"> • Turn starting switch NO OFF. • Disconnect L05. • 20 – 30 V </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (7) and connecting point of LM10 (male) (9) and L43 (female) (1)	Repair or replace

EM-216 Related electric circuit diagram (H-shaped outrigger)



TKL00589

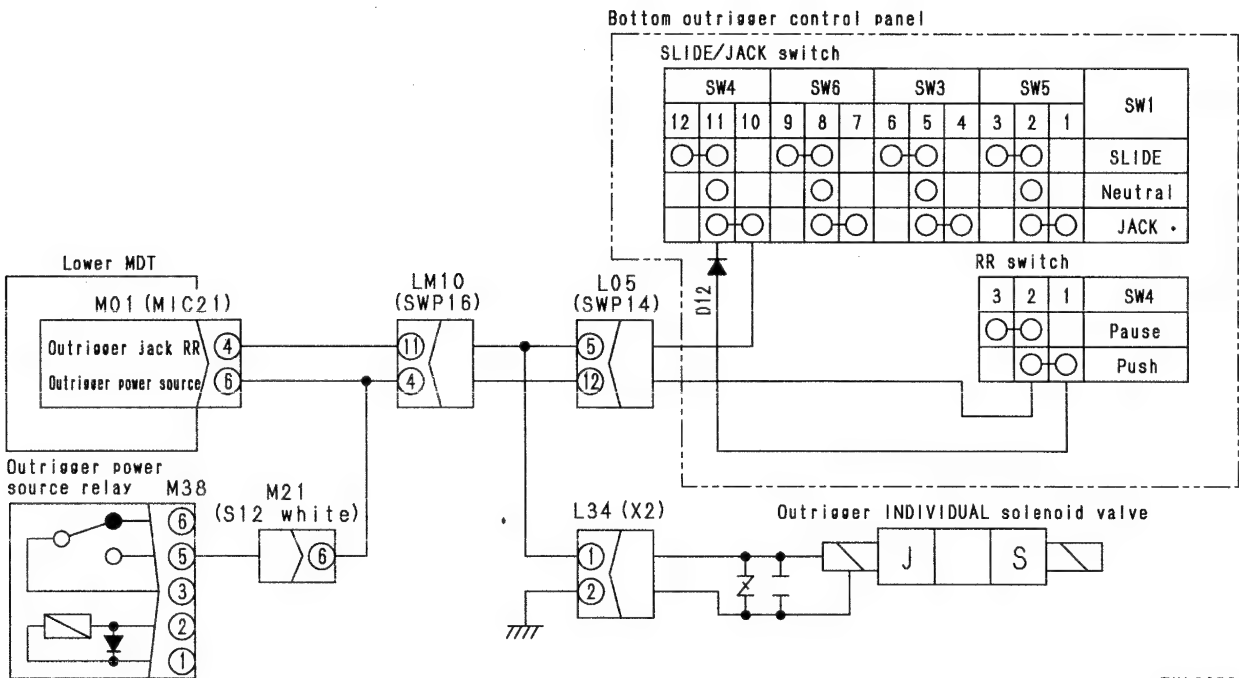
EM-217 Defective operation of bottom outrigger control panel (RR jack) system **(When the actuation conditions are OK, even if the bottom outrigger RR jack switch is operated, the outriggers do not move.)**

X-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (5) and chassis ground normal?</div> <div> <div>• Turn starting switch NO OFF.</div> <div>• Disconnect L05.</div> <div>• 20 – 30 V</div> </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (5) and connecting point of LM10 (male) (11) and L34 (female) (1)	Repair or replace

EM-217 Related electric circuit diagram (X-shaped outrigger)



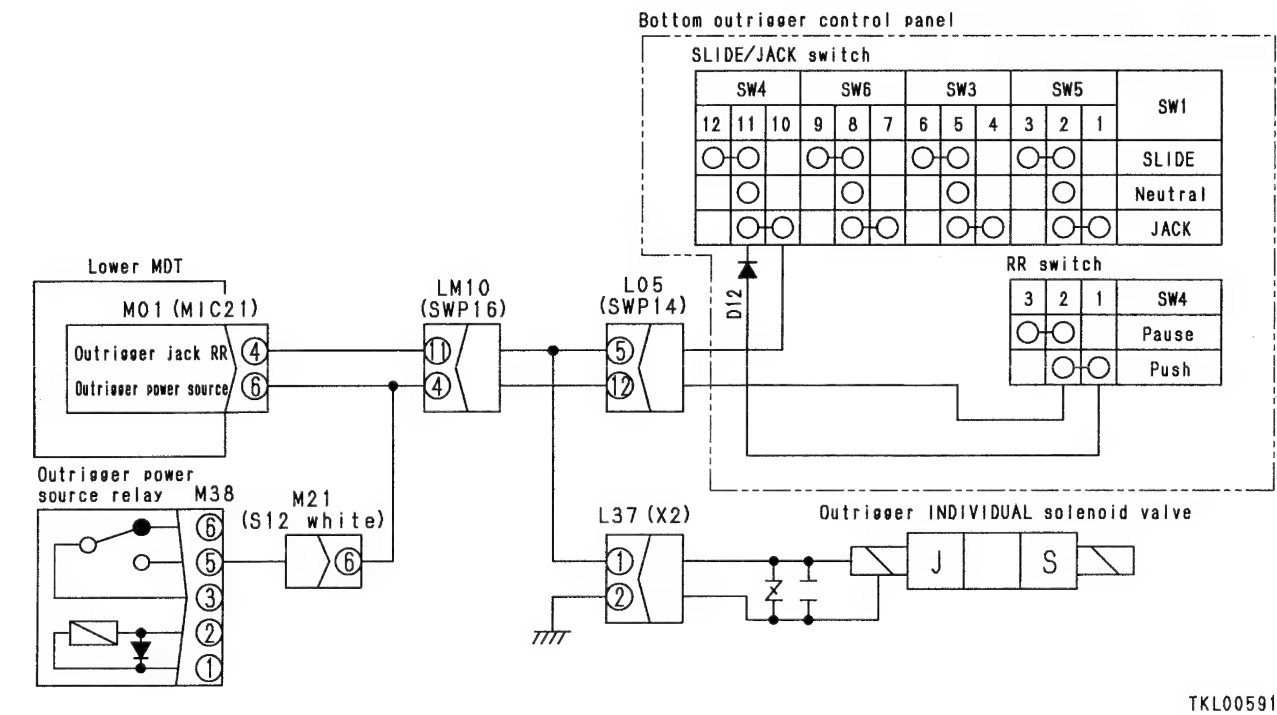
TKL00590

H-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (1) and chassis ground normal?</div> <div> <div>• Turn starting switch OFF.</div> <div>• Disconnect L05.</div> <div>• 20 – 30 V</div> </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (1) and connecting point of LM10 (male) (11) and L37 (female) (1)	Repair or replace

EM-217 Related electric circuit diagram (H-shaped outrigger)



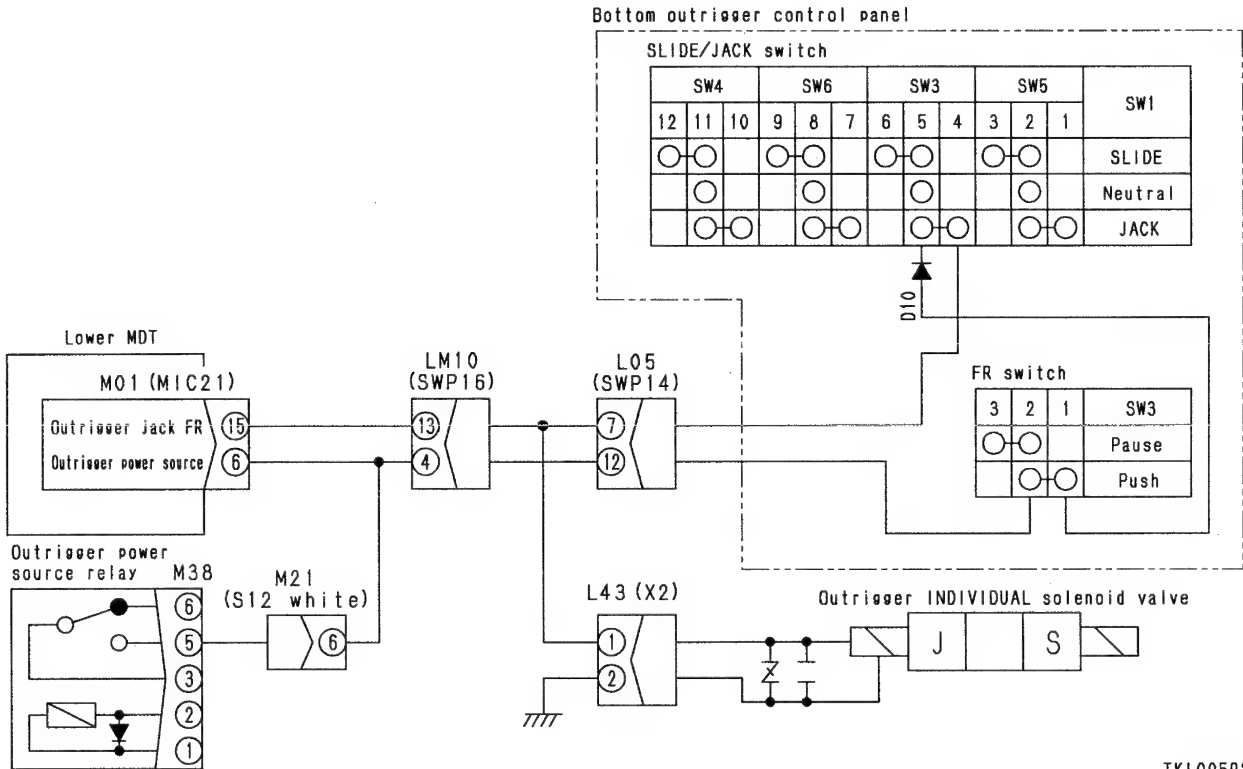
EM-218 Defective operation of bottom outrigger contro panel (FR jack) system
(When the actuation conditions are OK, even if the bottom outrigger FR jack switch is operated, the outriggers do not move.)

X-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (7) and chassis ground normal?</div> <div> <div>• Turn starting switch NO OFF.</div> <div>• Disconnect L05.</div> <div>• 20 – 30 V</div> </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (7) and connecting point of LM10 (male) (13) and L43 (female) (1)	Repair or replace

EM-218 Related electric circuit diagram (X-shaped outrigger)



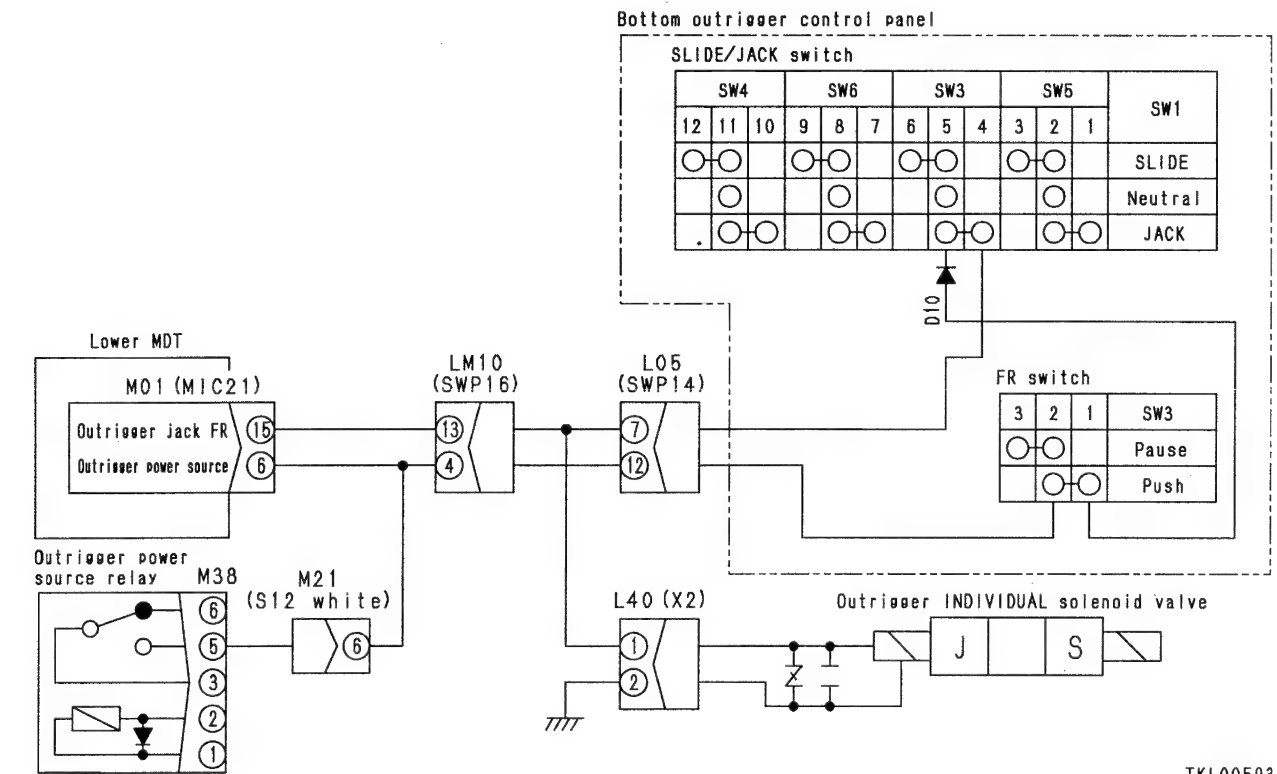
TKL00592

H-shaped outrigger specification

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (3) and chassis ground normal?</div> <div> <div>• Turn starting switch NO OFF.</div> <div>• Disconnect L05.</div> <div>• 20 – 30 V</div> </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (3) and connecting point of LM10 (male) (13) and L40 (female) (1)	Repair or replace

EM-218 Related electric circuit diagram (H-shaped outrigger)



TKL00593

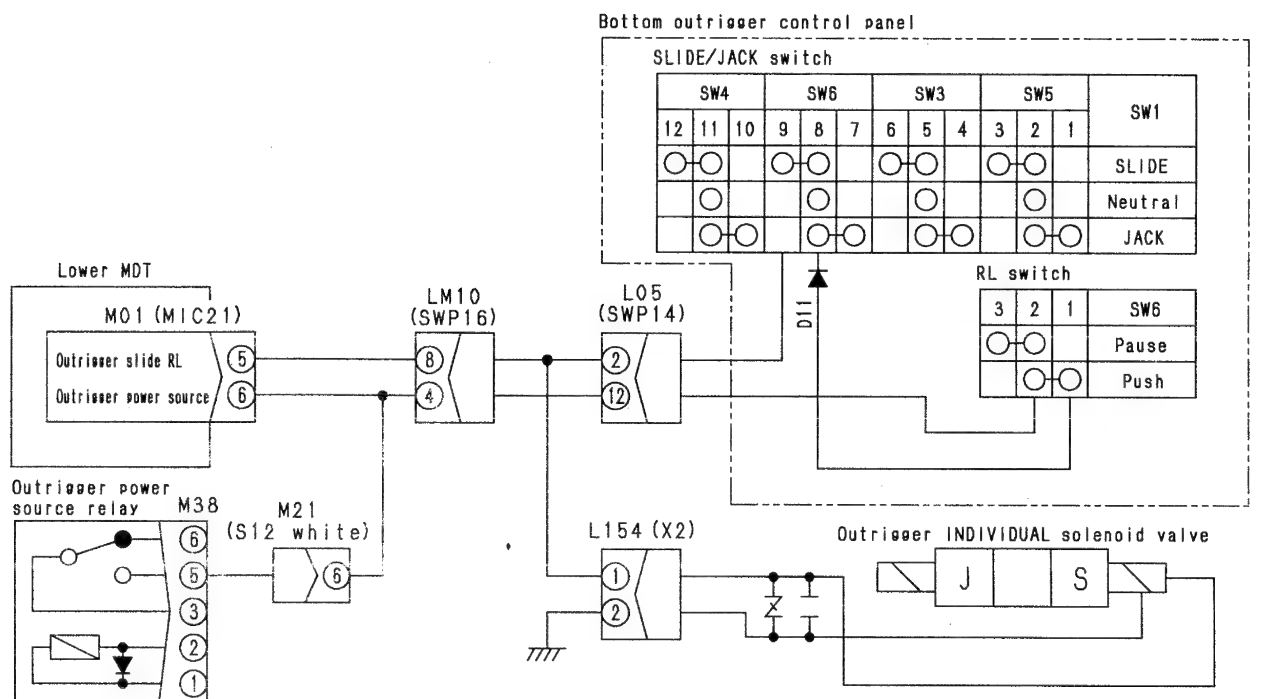
EM-219 Defective operation of bottom outrigger control panel (RL slide) system

(When the actuation conditions are OK, even if the bottom outrigger RL slide switch is operated, the outriggers do not move.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 YES</p> <p>Is resistance between L05 (female) (2) and chassis ground normal?</p> <p>• Turn starting switch NO OFF.</p> <p>• Disconnect L05.</p> <p>• 20 – 30 V</p>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (2) and connecting point of LM10 (male) (8) and L154 (female) (1)	Repair or replace

EM-219 Related electric circuit diagram

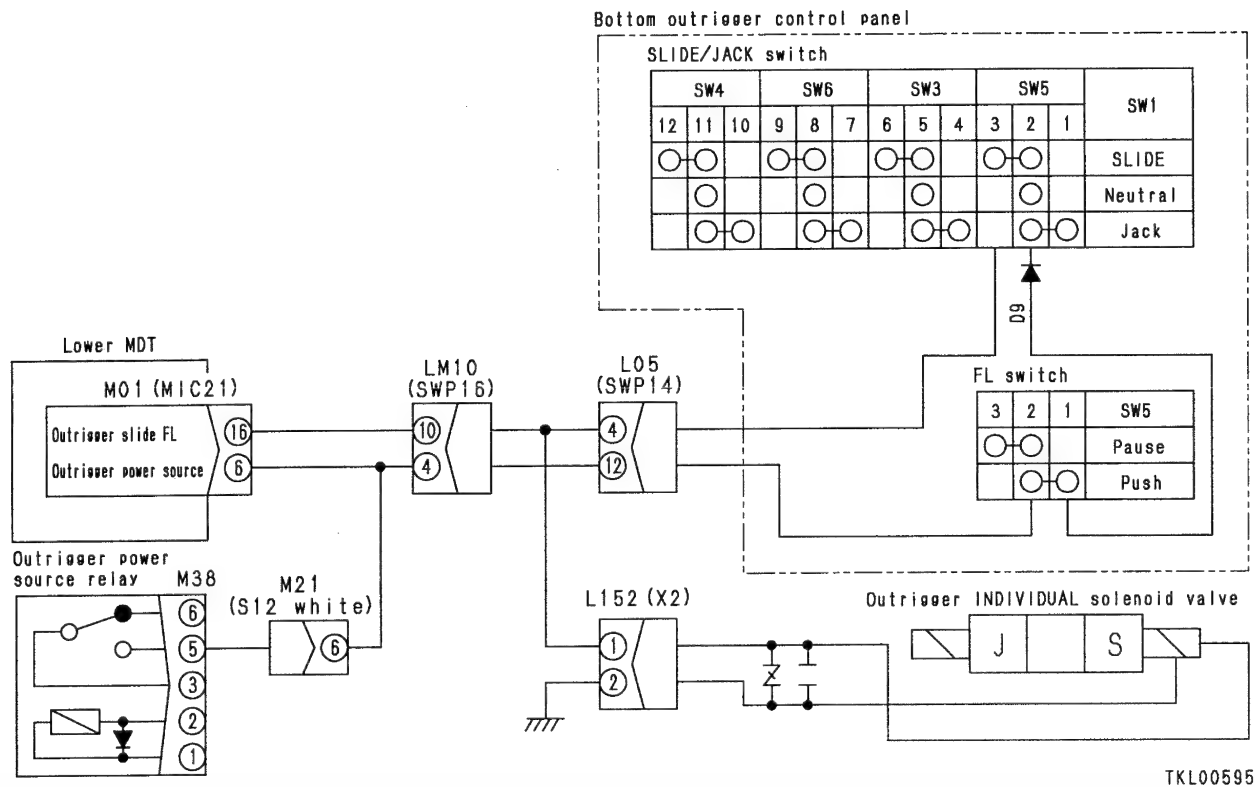


EM-220
Defective operation of bottom outrigger control panel (FL slide) system
(When the actuation conditions are OK, even if the bottom outrigger FL slide switch is operated, the outriggers do not move.)

- ★ When no error code is displayed.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (4) and chassis ground normal?</div> <div> <ul style="list-style-type: none"> • Turn starting switch NO OFF. • Disconnect L05. • 20 – 30 V </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (4) and connecting point of LM10 (male) (10) and L152 (female) (1)	Repair or replace

EM-220 Related electric circuit diagram



EM-221

Defective operation of bottom outrigger control panel (RR slide) system
(When the actuation conditions are OK, even if the bottom outrigger RR slide switch is operated, the outriggers do not move.)

- ★

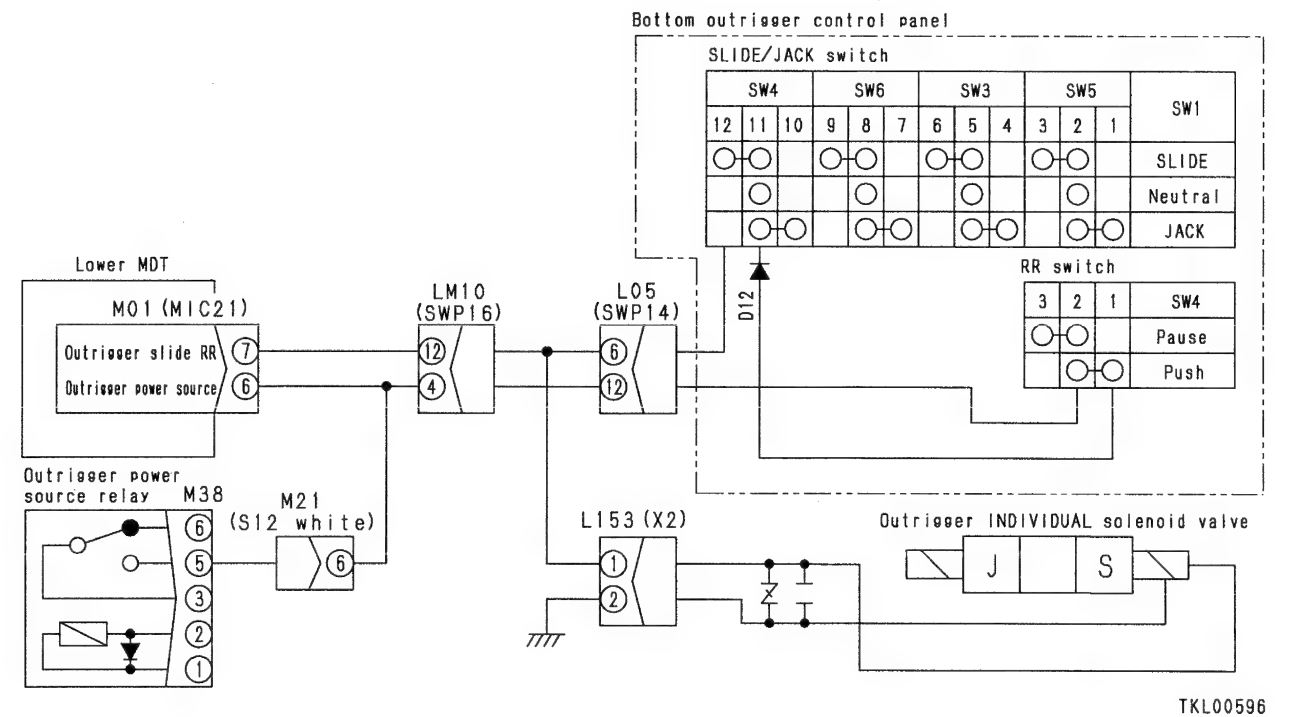
When no error code is displayed.
- ★

Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★

Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (6) and chassis ground normal?</div> <div> <div>• Turn starting switch NO OFF.</div> <div>• Disconnect L05.</div> <div>• 20 – 30 V</div> </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (6) and connecting point of LM10 (male) (12) and L153 (female) (1)	Repair or replace

EM-221 Related electric circuit diagram



EM-222

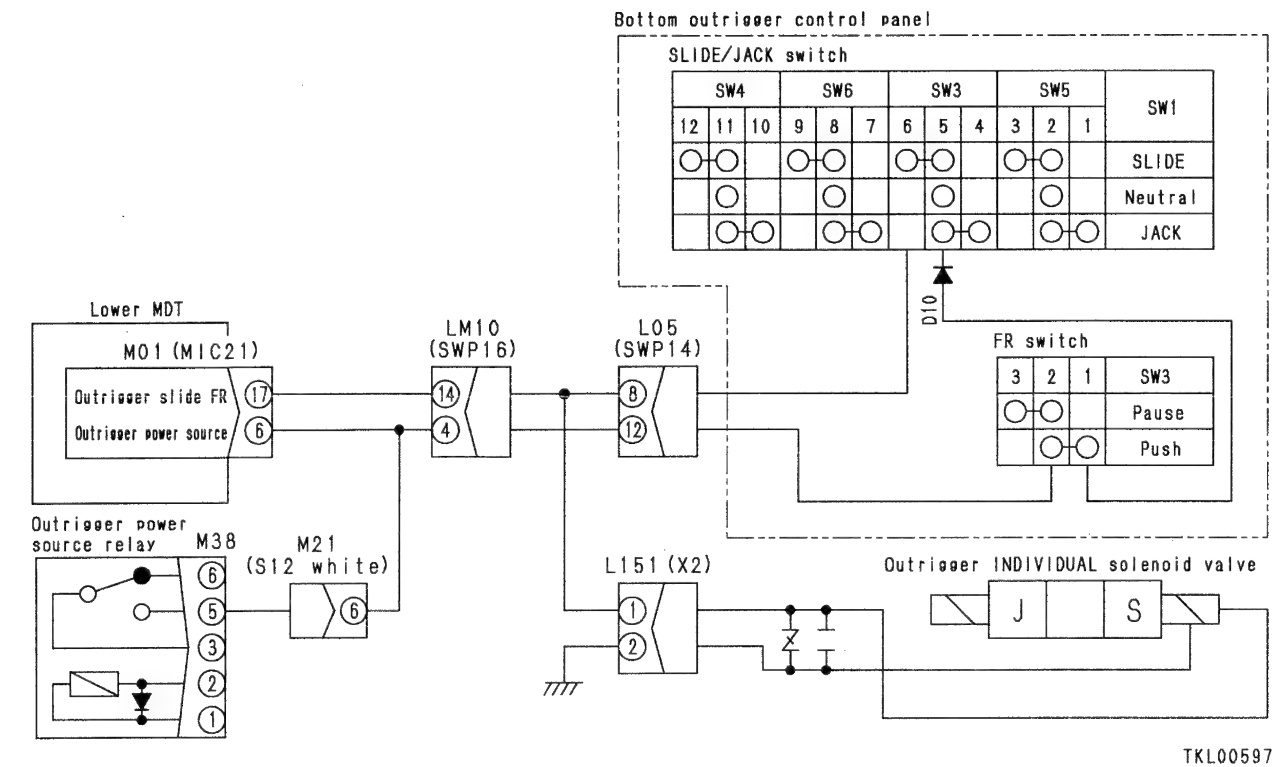
Defective operation of bottom outrigger control panel (FR slide) system

(When the actuation conditions are OK, even if the bottom outrigger FR slide switch is operated, the outriggers do not move.)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is resistance between L05 (female) (8) and chassis ground normal?</div> <div> <div>• Turn starting switch OFF.</div> <div>• Disconnect L05.</div> <div>• 20 – 30 V</div> </div> </div>		Defective outrigger control panel	Replace
		Defective contact or disconnection in wiring harness between L05 (female) (8) - connecting point of LM10 (male) (14) and L151 (female) (1)	Repair or replace

EM-222
Related electric circuit diagram

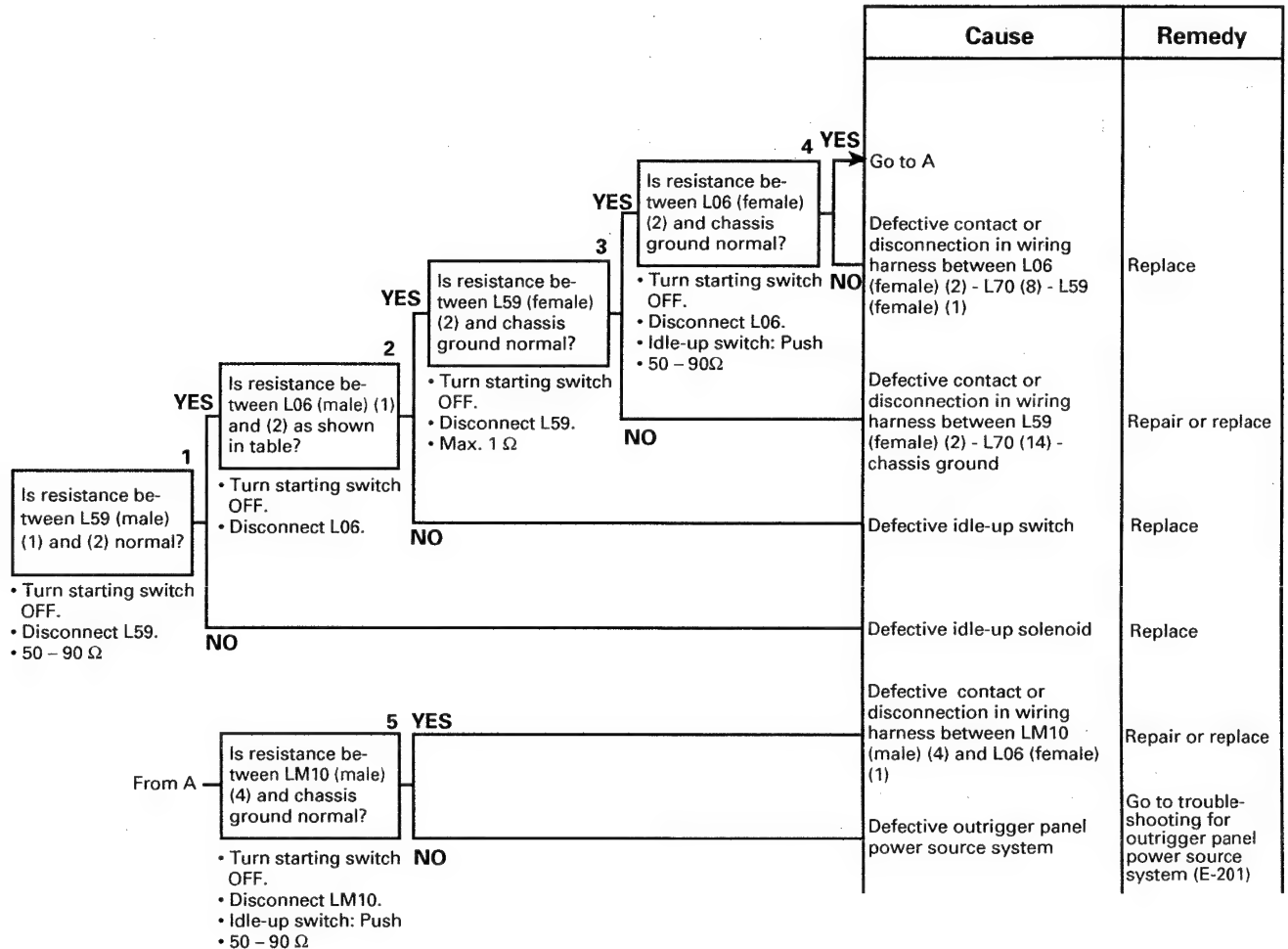


TKL00597

EM-223 Abnormality in idle-up switch system

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

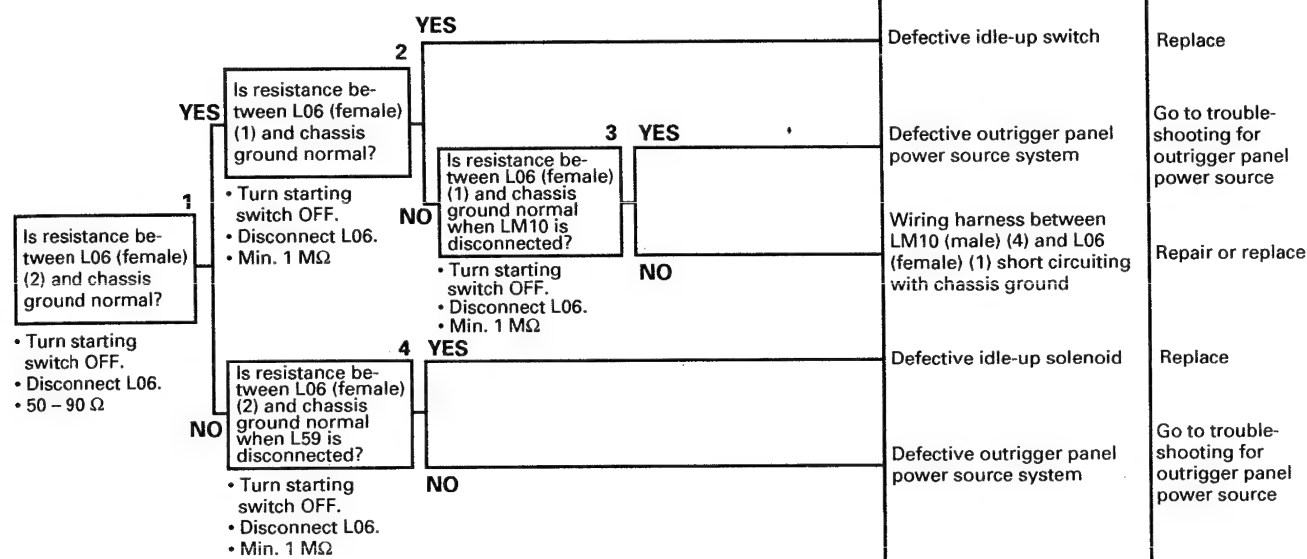
Disconnection



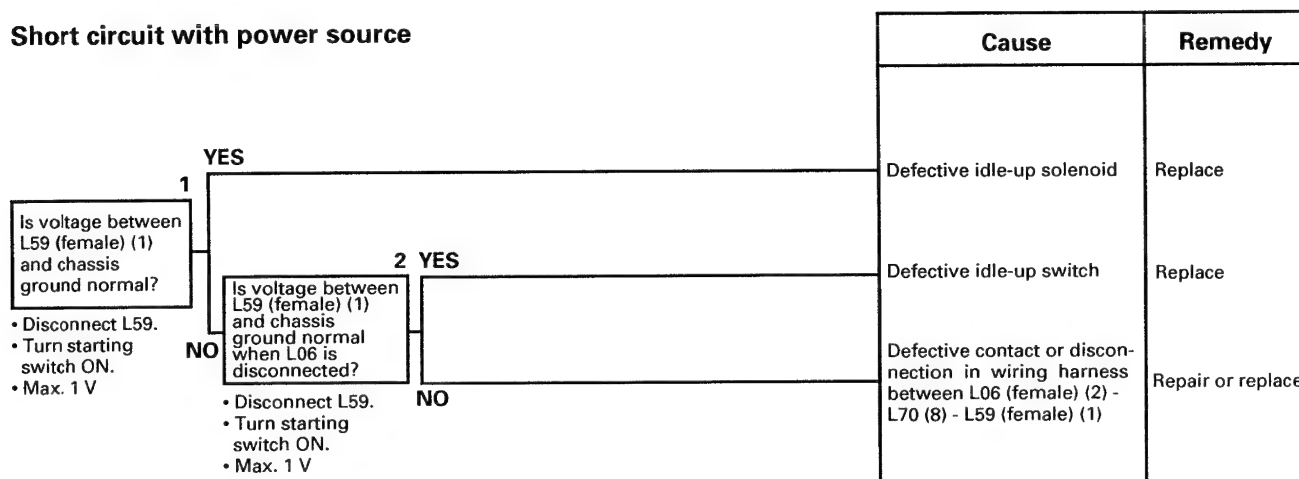
Table

L06 (male)	Idle-up switch	Resistance value
Between (1) and (2)	Release	Min. 1 MΩ
	Push	Max. 1 Ω

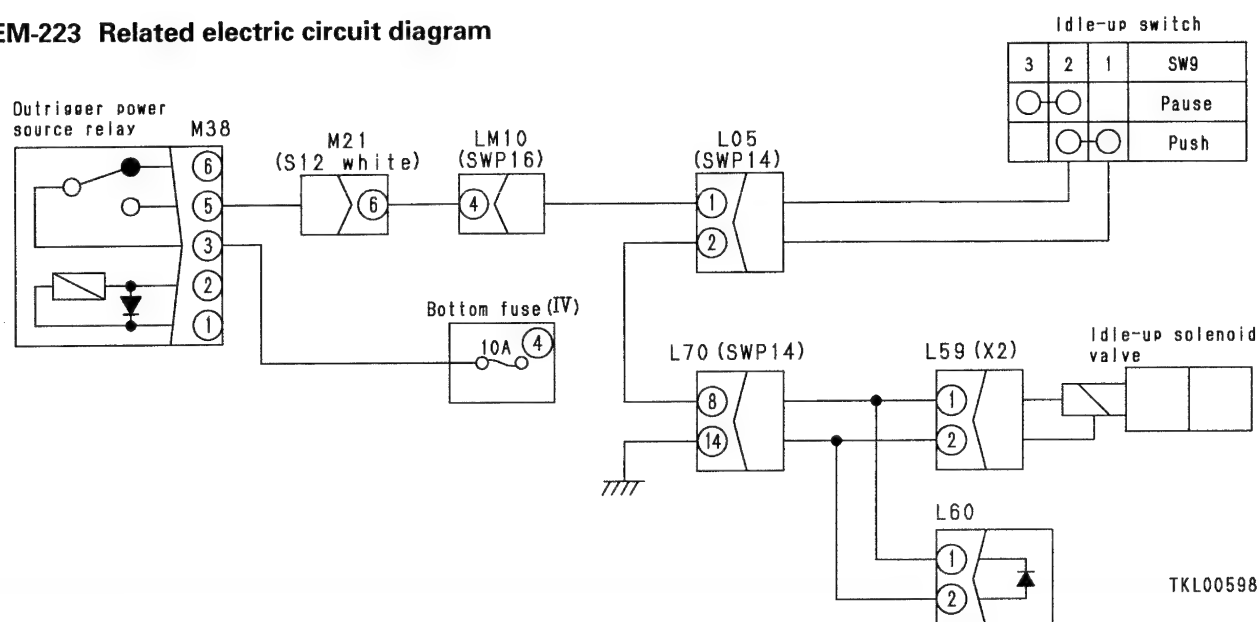
Short circuit with chassis ground



Short circuit with power source



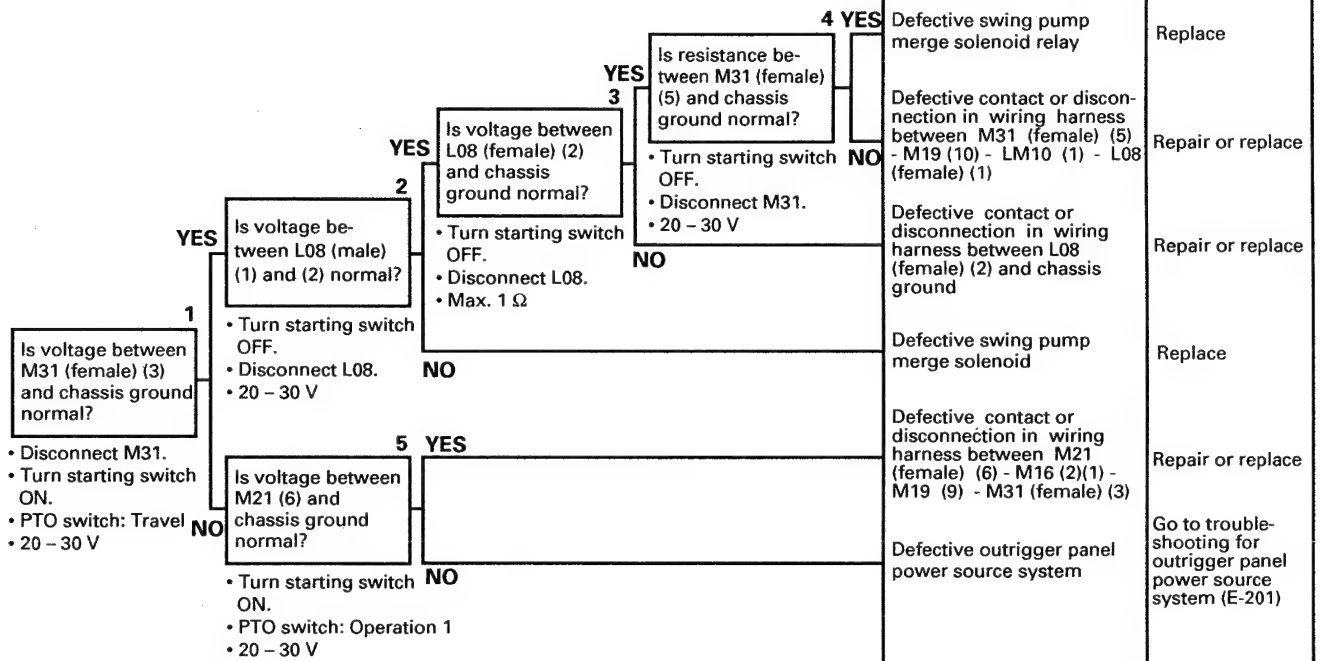
EM-223 Related electric circuit diagram



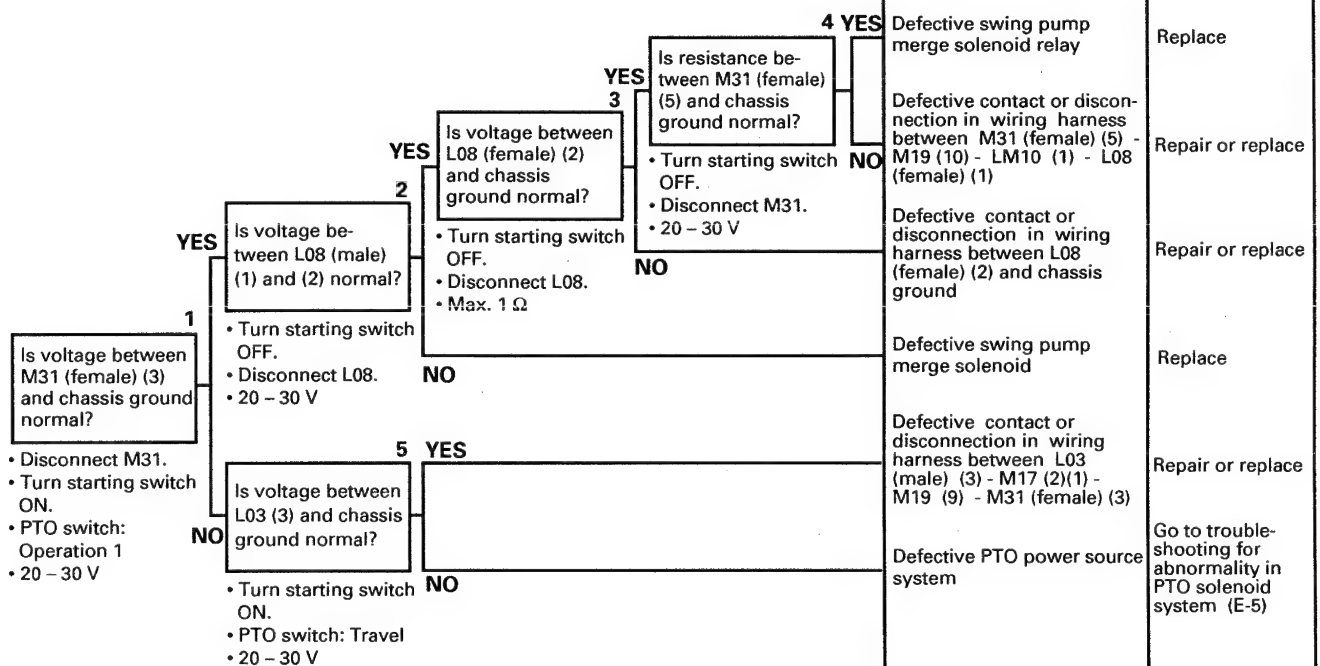
EM-224 Abnormality in swing pump merge solenoid system

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Disconnection (When PTO switch is at Operation 1)



Disconnection (When PTO switch is at Travel)



Short circuit with chassis ground (When PTO switch is at Operation 1)

				Cause	Remedy
<div>Is resistance between M31 (female) (5) and chassis ground normal?</div> <div>• Turn starting switch OFF. • Disconnect M31. • 20 – 30 V</div>	1 YES	Is resistance between M21 (male) (6) and chassis ground normal?	2 YES	Wiring harness between M21 (female) (6) - M16 (2)(1) - M19 (9) - M31 (female) (3) short circuiting with chassis ground	Repair or replace
			NO	Defective outrigger panel power source system	Go to troubleshooting for outrigger panel power source system (E-201)
	1 NO	Is resistance between M31 (female) (3) and chassis ground normal when L08 is disconnected?	3 YES	Defective swing pump merge solenoid	Replace
			NO	Wiring harness between M31 (female) (5) - M19 (10) - LM10 (1) - L08 (female) (1) short circuiting with chassis ground	Repair or replace

Short circuit with chassis ground (When PTO switch is at Travel)

Short circuit with chassis ground (When P TO switch is at travel)

			Cause	Remedy	
<div>Is resistance between M31 (female) (5) and chassis ground normal?</div> <div><div>• Turn starting switch OFF.</div><div>• Disconnect M31.</div><div>• 20 – 30 V</div></div>	1	YES	Is resistance between L03 (male) (6) and chassis ground normal?		
			2 YES		Repair or replace
			NO	Defective PTO power source system	Go to trouble-shooting for PTO solenoid system (E-5)
		NO	3 YES	Defective swing pump merge solenoid	Replace
			NO	Wiring harness between M31 (female) (5) - M19 (10) - LM10 (1) - L08 (female) (1) short circuiting with chassis ground	Repair or replace

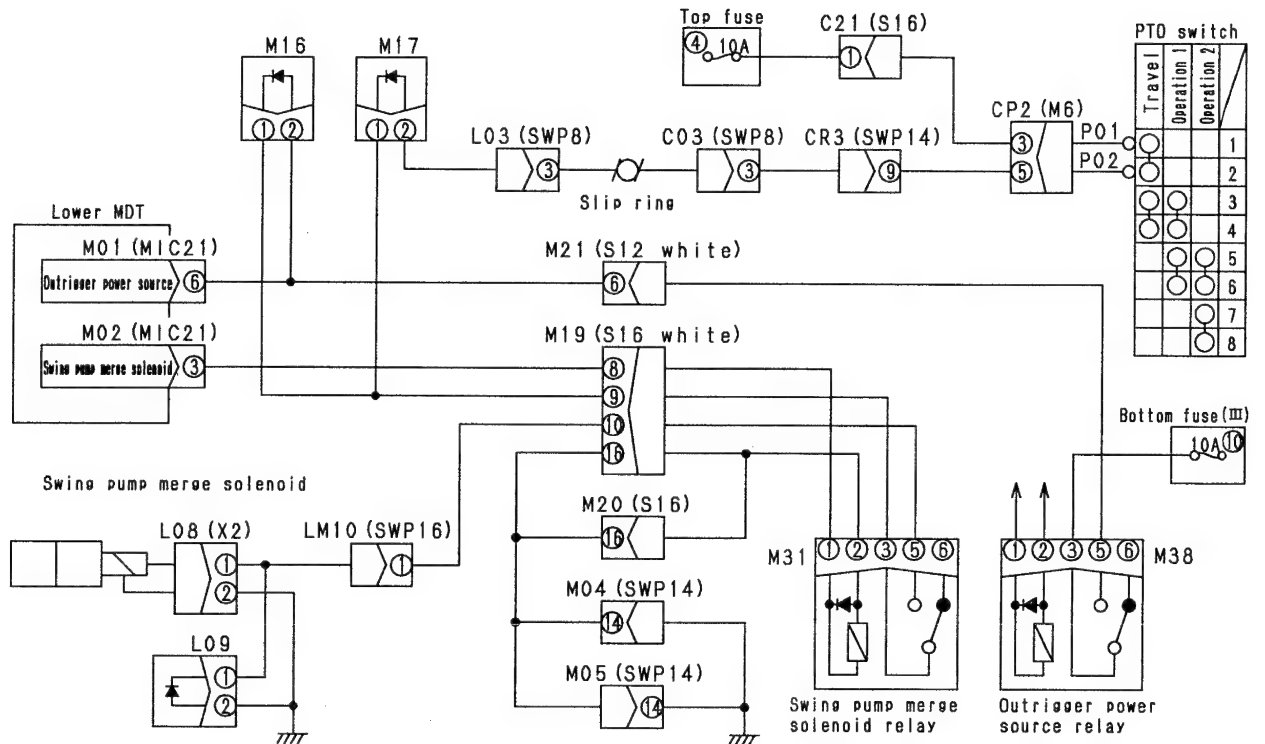
Short circuit with power source

Short circuit with power source

		Cause	Remedy	
<div>1</div> <div>Is voltage between M31 (female) (5) and chassis ground normal?</div> <div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div>	YES	Defective swing pump merge solenoid relay	Replace	
	<div>2</div> <div>Is voltage between M31 (female) (5) and chassis ground normal when L08 is disconnected?</div> <div><div>• Turn starting switch ON.</div><div>• Max. 1 V</div></div>	YES	Defective swing pump merge solenoid	Replace
	NO	NO	Wiring harness between M31 (female) (5) - M19 (10) - LM10 (1) - L08 (female) (1) short circuiting with power source	Repair or replace

023S02

EM-224 Related electric circuit diagram



TKL00599

023S02

TROUBLESHOOTING OF TRANSMISSION CONTROLLER SYSTEM (ET MODE)

Table of error codes and troubleshooting codes	20-1002
Action of controller and condition of machine when abnormality occurs	20-1010
Judgement table for transmission controller	20-1028
Transmission controller LED displays	20-1030
Transmission controller system electrical circuit diagram	20-1033
ET- 1 ATM error E11 (Disconnection in tachometer sensor) is displayed	20-1036
ET- 2 ATM error E12 (Disconnection in speed sensor 1) is displayed	20-1037
ET- 3 ATM error E13 (Disconnection in speed sensor 2) is displayed	20-1038
ET- 4 ATM error E14 (Disconnection in accelerator potentiometer) is displayed	20-1039
ET- 5 ATM error E17 (Disconnection in shift lever) is displayed	20-1040
ET- 6 ATM error E18 (Disconnection in F/R/N signal for interlock) is displayed	20-1041
ET- 7 ATM error E19 (Abnormality in input for transmission solenoid power source monitor) is displayed	20-1042
ET- 8 ATM error E24 (Accelerator potentiometer short circuited with ground) is displayed	20-1043
ET- 9 ATM error E25 (Abnormality in emergency gear shift switch or abnormality PTO switch) is displayed	20-1044
ET-10 ATM error E32 (Abnormality in speed sensor 1) is displayed	20-1045
ET-11 ATM error E33 (Abnormality in speed sensor 2) is displayed	20-1046
ET-12 ATM error E35 (Abnormality in interlock signal F/R [MDT at other than N with interlock signal N]) is displayed	20-1047
ET-13 ATM error E37 (Abnormality in shift lever (2 or more signals ON)) is displayed	20-1048
ET-14 ATM error E38 (Interlock F + R signals ON simultaneously) is displayed	20-1049
ET-15 ATM error E39 (Interlock signal F/R but lever signal N is input [MDT at N]) is displayed	20-1050
ET-16 ATM error E3F (Abnormality in S-NET is displayed	20-1051
ET-17 ATM error E53 (Overrun) is displayed	20-1052
ET-18 ATM error E55 (Drop in battery voltage) is displayed	20-1052
ET-19 ATM error E5A (Special steering system short circuited with ground) is displayed	20-1053
ET-20 ATM error E5B (Disconnection in special steering system) is displayed	20-1054
ET-21 ATM error E5C (Reverse steering system short circuited with ground) is displayed	20-1055
ET-22 ATM error E5D (Disconnection in reverse steering system) is displayed	20-1056
ET-23 ATM error E70 (Disconnection in R solenoid [ECMV] system) is displayed	20-1057
ET-24 ATM error E71 (Disconnection in F2 solenoid [ECMV] system) is displayed	20-1058
ET-25 ATM error E72 (Disconnection in F1 solenoid [ECMV] system) is displayed	20-1059
ET-26 ATM error E73 (Disconnection in F3 solenoid [ECMV] system) is displayed	20-1060
ET-27 ATM error E74 (Disconnection in lock-up solenoid [ECMV] system) is displayed	20-1061
ET-28 ATM error E78 (Disconnection in Lo solenoid system) is displayed	20-1062
ET-29 ATM error E79 (Disconnection in 4WD solenoid system) is displayed	20-1063
ET-30 ATM error E7B (Disconnection in reverse steering compensation relay system) is displayed	20-1064
ET-31 ATM error E7C (Disconnection in F2, R solenoid [ECMV] cut relay system) is displayed	20-1065
ET-32 ATM error E7D (Disconnection in back-up lamp relay) is displayed	20-1066
ET-33 ATM error E7E (Disconnection in F1, F3 solenoid [ECMV] cut relay system) is displayed	20-1067
ET-34 ATM error E7F (Disconnection in special steering relay system) is displayed	20-1068
ET-35 ATM error E80 (R solenoid [ECMV] system short circuited with ground) is displayed	20-1069
ET-36 ATM error E81 (F2 solenoid [ECMV] system short circuited with ground) is displayed	20-1070
ET-37 ATM error E82 (F1 solenoid [ECMV] system short circuited with ground) is displayed	20-1071
ET-38 ATM error E83 (F3 solenoid [ECMV] system short circuited with ground) is displayed	20-1072
ET-39 ATM error E84 (Lock-up solenoid [ECMV] system short circuited with ground) is displayed	20-1073
ET-40 ATM error E88 (Lo solenoid system short circuited with ground) is displayed	20-1074
ET-41 ATM error E89 (4WD solenoid system short circuited with ground) is displayed	20-1075
ET-42 ATM error E8B (Reverse steering relay system short circuited with ground) is displayed	20-1076
ET-43 ATM error E8C (F2, R solenoid [ECMV] cut relay system short circuited with ground) is displayed	20-1077
ET-44 ATM error E8D (Back-up lamp relay system short circuited with ground) is displayed	20-1078
ET-45 ATM error E8E (F1, F3 solenoid [ECMV] cut relay system short circuited with ground) is displayed	20-1079
ET-46 ATM error E8F (Special steering relay system short circuited with ground) is displayed	20-1080
ET-47 ATM error E90,E91 (R or F2 solenoid [ECMV] short circuited with power source) is displayed	20-1081
ET-48 ATM error E92,E93 (F3 or F1 solenoid [ECMV] short circuited with power source) is displayed	20-1082
ET-49 ATM error E94 (Lock-up solenoid [ECMV] short circuited with power source) is displayed	20-1083

TABLE OF ERROR CODES AND TROUBLESHOOTING CODES

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
(Upper MDT related)			
MDTU error E00	MDT system error	Action impossible, travel, operation stopped	EU- 1
MDTU error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EU- 2
MDTU error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EU- 3
MDTU error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EU- 4
MDTU error E21	Top, bottom selection warning	Action impossible, travel, operation stopped	EU- 5
MDTU error E24	Model doesn't match (application stopped)	Action impossible, travel, operation stopped	EU- 6
MDTU error E25	Model selection warning	Action impossible, travel, operation stopped	EU- 7
MDTU error E28	Abnormality in C-NET communication between MDTs (output stopped)	Action impossible, travel, operation stopped	EU- 8
MDTU error E29	Abnormality in S-NET communication between MDT and moment limiter	Travel, operation stopped	EU- 9
MDTU error E40	Swing flasher output short circuited with ground	Swing flasher does not flash	EU-10
MDTU error E41	Power source for outrigger panel short circuited with ground	Top outrigger cannot be operated	EU-11
MDTU error E43	Outrigger mode power source short circuited with ground	Outrigger cannot be operated	EU-13
MDTU error E44	Crab mode LED short circuited with ground	Crab mode LED does not light up	EU-14
MDTU error E45	Front wheel mode LED short circuited with ground	Front wheel mode LED does not light up	EU-15
MDTU error E46	Rear wheel mode LED short circuited with ground	Rear wheel mode LED does not light up	EU-16
MDTU error E47	4-wheel mode LED short circuited with ground	4-wheel mode LED does not light up	EU-17
MDTU error E48	Rear steering LOCK LED short circuited with ground	Rear steering LOCK LED does not light up	EU-18
MDTU error E49	Rear steering FREE LED short circuited with ground	Rear steering FREE LED does not light up	EU-19
MDTU error E4A	Rear steering CENTER LED short circuited with ground	Rear steering CENTER LED does not light up	EU-20
MDTU error E4B	Reverse steering display lamp short circuited with ground	Reverse steering display lamp does not light up	EU-21
MDTU error E4C	Winch rotation buzzer (main winch) short circuited with ground	Main winch buzzer does not sound	EU-22
MDTU error E4D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	EU-23
MDTU error E4E	Winch rotation buzzer (auxiliary winch) short circuited with ground	Auxiliary winch buzzer does not sound	EU-24
MDTU error E4F	Monitor central buzzer short circuited with ground	Monitor central buzzer does not sound	EU-25
MDTU error E50	Tachometer signal output short circuited	Tachometer does not work	EU-26
MDTU error E51	Speedometer signal output short circuited	Speedometer does not work	EU-27
MDTU error E52	Fuel level signal output short circuited	Fuel gauge does not work	EU-28
MDTU error E53	Engine water temperature signal output short circuited	Engine water temperature gauge does not work	EU-29
MDTU error E55	Torque converter oil temperature output short circuited	Torque converter overheat caution lamp does not light up	EU-30
MDTU error E56	Engine oil pressure output short circuited	Engine oil pressure caution lamp does not light up	EU-31
MDTU error E57	Preheating pilot output short circuited	Glow lamp (preheating pilot lamp) does not light up	EU-32
MDTU error E58	Parking brake actuation lamp output short circuited	Parking brake indicator lamp does not light up	EU-33

023S02

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTU error E59	Retarder lamp (opt) output short circuited	Magnetic retarder lamp does not light up	EU-34
MDTU error E5A	Hi beam pilot output short circuited with ground	Hi beam pilot lamp does not light up	EU-35
MDTU error E5B	Hourmeter output short circuited with ground	Service meter does not work	EU-36
MDTU error E5C	Charge lamp output short circuited with ground	Battery charge caution lamp does not light up	EU-37
MDTU error E5D	Brake oil level output short circuited with ground	Brake oil level lamp does not light up	EU-38
MDTU error E5E	Right turn pilot output short circuited with ground	Right turn pilot lamp does not flash	EU-39
MDTU error E5F	Left turn pilot output short circuited with ground	Left turn pilot lamp does not flash	EU-40
MDTU error E72	LED dimmer 1 short circuited with ground	Shift position LED is not dimmed when using night lighting (lamp ON)	EU-41
MDTU error E73	LED dimmer 1 short circuited with power source	Shift position LED goes out or becomes excessively dim	EU-42
MDTU error E74	LED dimmer 2 short circuited with ground	Rear steering LOCK LED is not dimmed when using night lighting (lamp ON)	EU-43
MDTU error E75	LED dimmer 2 short circuited with power source	Rear steering LOCK LED goes out or becomes excessively dim	EU-44
MDTU error E80	Swing flasher output short circuited with power source	Swing flasher lamp does not go out	EU-46
MDTU error E83	Outrigger mode power source short circuited with power source	Bottom outrigger operation possible at position other than Operation 1 (PTO 1)	EU-47
MDTU error EB3	Disconnection in outrigger mode power source	Outrigger cannot be operated	EU-48
MDTU error EE0	PTO mode doesn't match	Action impossible (controller at PTO 1) travel, operation stopped	EU-49
MDTU error EE1	Abnormality in 2WD Hi/4WD Hi/4WD Lo input	Action impossible (controller at 4WD Hi)	EU-50
MDTU error EE3	Abnormality in service brake input	Possible to apply parking brake	EU-51
MDTU error EE4	Abnormality in suspension lift switch	Impossible to use suspension lift	EU-52
MDTU error EE5	Abnormality in outrigger control switch	Top outrigger cannot be operated	EU-53
MDTU error EE6	Outrigger EXTEND + RETRACT input simultaneously, JACK + SLIDE input simultaneously	Top outrigger cannot be operated	EU-54
MDTU error EEA	Abnormality in steering mode switch input	Steering mode does not switch	EU-55
MDTU error EEC	Rear steering LOCK + FREE command input simultaneously	Rear steering LOCK/FREE cannot be operated	EU-56
(Lower MDT related)			
MDTL error E00	MDT system error	Action impossible, travel, operation stopped	EL- 1
MDTL error E10	Shut off when low voltage	Action impossible, travel, operation stopped	EL- 2
MDTL error E11	Shut off when high temperature	Action impossible, travel, operation stopped	EL- 3
MDTL error E18	Disconnection in tachometer sensor	Tachometer does not work	EL- 4
MDTL error E19	Disconnection in speedometer sensor	Speedometer does not work	EL- 5
MDTL error E20	Top, bottom don't match (application stopped)	Action impossible, travel, operation stopped	EL- 6
MDTL error E21	Top, bottom selection warning	Travel, operation stopped	EL- 7
MDTL error E24	Model doesn't match (application stopped)	Action impossible, travel, operation stopped	EL- 8
MDTL error E25	Model selection warning	Travel, operation stopped	EL- 9
MDTL error E28	Abnormality in C-NET communication between MDTs	Travel, operation stopped	EL-10
MDTL error E29	Abnormality in S-NET communication between MDT and transmission controller	Travel, operation stopped	EL-11

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E40	Outrigger jack RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-22
MDTL error E41	Outrigger jack FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-23
MDTL error E42	Outrigger jack RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-24
MDTL error E43	Outrigger jack FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-25
MDTL error E44	Outrigger slide RL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-26
MDTL error E45	Outrigger slide FL short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-27
MDTL error E46	Outrigger slide RR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-28
MDTL error E47	Outrigger slide FR short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-29
MDTL error E48	Outrigger selector EXTEND short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-30
MDTL error E49	Outrigger selector RETRACT short circuited with ground	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-31
MDTL error E4A	Rear steering LOCK solenoid short circuited with ground	Rear steering LOCK cannot be operated	EL-32
MDTL error E4B	Rear steering FREE solenoid short circuited with ground	Rear steering FREE cannot be operated	EL-33
MDTL error E4C	Service brake short circuited with ground	Auxiliary brake cannot be applied	EL-34
MDTL error E4D	Exhaust brake short circuited with ground	Exhaust brake cannot be applied	EL-35
MDTL error E4E	Retarder short circuited with ground	Retarder brake cannot be applied	EL-36
MDTL error E4F	Preheating short circuited with ground	Preheating does not work	EL-37
MDTL error E51	Retarder speed output short circuited with ground	Retarder brake cannot be applied	EL-39
MDTL error E5A	Head lamp Hi relay short circuited with ground	Hi beam does not work	EL-43
MDTL error E5B	Head lamp Lo relay short circuited with ground	Lo beam does not work	EL-44
MDTL error E5C	Side lamp relay short circuited with ground	Side lamp does not work	EL-45
MDTL error E5D	Service lamp relay short circuited with ground	Service lamp does not work	EL-46
MDTL error E5E	Right turn relay short circuited with ground	Turn signal indicator does not work	EL-47
MDTL error E5F	Left turn relay short circuited with ground	Turn signal indicator does not work	EL-48
MDTL error E60	Steering mode solenoid a short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-49
MDTL error E61	Steering mode solenoid c short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-50
MDTL error E62	Steering mode solenoid b short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-51
MDTL error E63	Steering mode solenoid d short circuited with ground	Rear steering set to LOCK, travel with front 2-wheel steering	EL-52
MDTL error E64	Pump merge solenoid short circuited with ground	Lack of speed when outrigger ALL switch is operated	EL-53
MDTL error E67	Suspension lift solenoid short circuited with ground	Impossible to use suspension lift	EL-55
MDTL error E76	5V output short circuited with ground	Outrigger cannot be set, possible to actuate in emergency setting	EL-56
MDTL error E80	Outrigger jack RL short circuited with power source	Abnormal telescoping of outrigger	EL-57
MDTL error E81	Outrigger jack FL short circuited with power source	Abnormal telescoping of outrigger	EL-58
MDTL error E82	Outrigger jack RR short circuited with power source	Abnormal telescoping of outrigger	EL-59
MDTL error E83	Outrigger jack FR short circuited with power source	Abnormal telescoping of outrigger	EL-60

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error E84	Outrigger slide RL short circuited with power source	Abnormal telescoping of outrigger	EL-61
MDTL error E85	Outrigger slide FL short circuited with power source	Abnormal telescoping of outrigger	EL-62
MDTL error E86	Outrigger slide RR short circuited with power source	Abnormal telescoping of outrigger	EL-63
MDTL error E87	Outrigger slide FR short circuited with power source	Abnormal telescoping of outrigger	EL-64
MDTL error E88	Outrigger selector EXTEND short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-65
MDTL error E89	Outrigger selector RETRACT short circuited with power source	Immediately stops travel, impossible to operate steering, impossible to use suspension lift	EL-66
MDTL error E8A	Rear steering LOCK solenoid short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-67
MDTL error E8B	Rear steering FREE solenoid short circuited with power source	Rear steering FREE (travel carefully)	EL-68
MDTL error E8C	Service brake short circuited with power source	Impossible to release auxiliary brake	EL-69
MDTL error E8D	Exhaust brake short circuited with power source	Impossible to release exhaust brake	EL-70
MDTL error E8E	Retarder short circuited with power source	Impossible to release retarder brake	EL-71
MDTL error E8F	Preheating short circuited with power source	Preheating continues, abnormal engine exhaust color, drop in horsepower	EL-72
MDTL error E9A	Head lamp Hi short circuited with power source	Stays lighted at Hi beam	EL-73
MDTL error E9B	Head lamp Lo short circuited with power source	Stays lighted at Lo beam	EL-74
MDTL error E9C	Side lamp short circuited with power source	Side lamp stays lighted up	EL-75
MDTL error E9E	Right turn relay short circuited with power source	Turn signal remains actuated	EL-76
MDTL error E9F	Left turn relay short circuited with power source	Turn signal remains actuated	EL-77
MDTL error EA0	Steering mode solenoid a short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-78
MDTL error EA1	Steering mode solenoid c short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-79
MDTL error EA2	Steering mode solenoid b short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-80
MDTL error EA3	Steering mode solenoid d short circuited with power source	Rear steering set to LOCK, travel with front 2-wheel steering	EL-81
MDTL error EA4	Pump merge solenoid short circuited with power source	Impossible to operate swing	EL-82
MDTL error EA7	Suspension lift solenoid short circuited with power source	Impossible to extend outrigger	EL-83
MDTL error EB0	Disconnection in outrigger jack RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-84
MDTL error EB1	Disconnection in outrigger jack FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-85
MDTL error EB2	Disconnection in outrigger jack RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-86
MDTL error EB3	Disconnection in outrigger jack FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-87
MDTL error EB4	Disconnection in outrigger slide RL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-88
MDTL error EB5	Disconnection in outrigger slide FL	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-89
MDTL error EB6	Disconnection in outrigger slide RR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-90
MDTL error EB7	Disconnection in outrigger slide FR	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-91
MDTL error EB8	Disconnection in outrigger selector EXTEND	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-92
MDTL error EB9	Disconnection in outrigger selector RETRACT	Top outrigger cannot be operated (in some cases, bottom outrigger also cannot be operated)	EL-93
MDTL error EBA	Disconnection in rear steering LOCK solenoid	Impossible to set rear steering to LOCK (when at LOCK, impossible to rear steering to FREE)	EL-94

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
MDTL error EBB	Disconnection in rear steering FREE solenoid	Impossible to set rear steering to FREE	EL- 95
MDTL error EBC	Disconnection in service brake	Impossible to operate auxiliary brake	EL- 96
MDTL error EBD	Disconnection in exhaust brake	Impossible to operate exhaust brake	EL- 97
MDTL error EBF	Disconnection in preheating	Impossible to operate preheating	EL- 98
MDTL error ECA	Disconnection in head lamp Hi relay	Impossible to operate Hi beam	EL- 99
MDTL error ECB	Disconnection in head lamp Lo relay	Impossible to operate Lo beam	EL-100
MDTL error ECC	Disconnection in side lamp relay	Impossible to operate side lamp	EL-101
MDTL error ECE	Disconnection in right turn relay	Impossible to operate turn signal	EL-102
MDTL error ECF	Disconnection in left turn relay	Impossible to operate turn signal	EL-103
MDTL error ED0	Disconnection in steering mode solenoid a	Rear steering set to LOCK, travel with front 2-wheel steering	EL-104
MDTL error ED1	Disconnection in steering mode solenoid c	Rear steering set to LOCK, travel with front 2-wheel steering	EL-105
MDTL error ED2	Disconnection in steering mode solenoid b	Rear steering set to LOCK, travel with front 2-wheel steering	EL-106
MDTL error ED3	Disconnection in steering mode solenoid d	Rear steering set to LOCK, travel with front 2-wheel steering	EL-107
MDTL error ED4	Disconnection in pump merge solenoid	Lack of speed when outrigger ALL switch is operated	EL-108
MDTL error ED7	Disconnection in suspension lift	Impossible to use suspension lift	EL-109
MDTL error EE7	Outrigger control signal short circuited with power source	Immediately stops travel, impossible to operate steering, actuates emergency steering	EL-110
MDTL error EE8	Outrigger control signal short circuited with ground, disconnection	Takes no particular action, impossible to detect occurrence of secondary problem	EL-111
MDTL error EE9	Disconnection in fuel sensor	Fuel level unknown	EL-112
MDTL error EEB	Abnormality in rear steering LOCK limit switch/FREE limit switch	Rear steering set to LOCK, travel with front 2-wheel steering	EL-113
MDTL error EEE	Failure of both speedometer sensors	No speedometer display, rear steering set to LOCK, travel with front 2-wheel steering	EL-114
MDTL error EEF	MDT speedometer sensor failure	Rear steering set to LOCK, travel with front 2-wheel steering	EL-115
MDTL error EF0	Special steering failure (emergency stop mode)	Immediately stops travel	EL-116
MDTL error EF1	Reverse steering failure (emergency stop mode)	Immediately stops travel	EL-117
MDTL error EF2	Special steering failure	Immediately stops travel, rear steering set to LOCK, travel with front 2-wheel steering	EL-118
MDTL error EF3	Reverse steering failure 1	Travels with normal steering, cannot set to reverse steering	EL-119
MDTL error EF4	Reverse steering failure 2	Immediately stops travel, rear steering set to LOCK, travel with normal steering	EL-120
MDTL error EFE	Abnormality in right turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-121
MDTL error EFF	Abnormality in left turn relay	Abnormal actuation of turn signal, or impossible to actuate turn signal	EL-122
(Moment limiter controller related)			
OSS error E00	Abnormality in panel communication	Impossible to change working mode	EM- 1
OSS error E01	Panel system error	Impossible to change working mode	EM- 2
OSS error E02	Abnormality in panel rotary switch	Impossible to change working mode	EM- 3
OSS error E10	Moment limiter system error	Action impossible, stops work	EM- 4
OSS error E20	Abnormality in S-NET (communication between MDTs)	Action impossible, stops work	EM- 5

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
OSS error E21	Abnormality in outrigger length sensor FL system	Outrigger cannot be set, outrigger emergency setting mode	ME- 6
OSS error E22	Abnormality in outrigger length sensor FR system	Outrigger cannot be set, outrigger emergency setting mode	ME- 7
OSS error E23	Abnormality in outrigger length sensor RL system	Outrigger cannot be set, outrigger emergency setting mode	ME- 8
OSS error E24	Abnormality in outrigger length sensor RR system	Outrigger cannot be set, outrigger emergency setting mode	ME- 9
OSS error E30	Abnormality in jib transmission module communication	Impossible to operate jib	ME-10
OSS error E31	Abnormality in tilt angle sensor system	Impossible to operate jib, jib angle unknown	ME-11
OSS error E41	Abnormality in boom angle sensor system	Impossible to operate boom, boom angle unknown, hook load unknown	ME-12
OSS error E43	Abnormality in boom length sensor system	Impossible to operate boom, boom length unknown, hook load unknown	ME-13
OSS error E44	Abnormality in bottom pressure sensor system	Impossible to operate boom, hook load unknown	ME-14
OSS error E45	Abnormality in head pressure sensor system	Impossible to operate boom, hook load unknown	ME-15
OSS error E46	Abnormality in swing angle sensor system	Impossible to operate boom, swing position unknown	ME-16
OSS error E48	Reverse rotation of hoist cylinder axis power	Boom hoist cylinder stroke end, impossible to operate boom, hook load unknown	ME-17
OSS error E50	Main unload solenoid short circuited with ground	Work equipment does not move	ME-18
OSS error E51	PPC unload solenoid short circuited with ground	Jib tilt does not work	ME-19
OSS error E52	Jib telescope selector solenoid short circuited with ground	Top telescope cylinder does not work	ME-20
OSS error E53	Automatic stop cancel prohibition relay short circuited with ground	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	ME-21
OSS error E58	Jib EXTEND/STOW relay short circuited with ground	Impossible to extend or stow jib	ME-26
OSS error E59	Jib rotation permission relay short circuited with ground	Impossible to extend or stow jib (impossible to rotate)	ME-27
OSS error E5C	Moment limiter buzzer short circuited with ground	Moment limiter buzzer does not sound	ME-30
OSS error E5D	Emergency alarm buzzer short circuited with ground	Emergency alarm buzzer does not sound	ME-31
OSS error E68	10 V power source short circuited with ground	Impossible to operate boom, hook load unknown	ME-32
OSS error E6A	15 V power source short circuited with ground	Impossible to operate boom, hook load unknown	ME-33
OSS error E70	Main unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop	ME-34
OSS error E71	PPC unload solenoid short circuited with power source	Impossible to use moment limiter automatic stop (jib LOWER only)	ME-35
OSS error E72	Jib telescope selector solenoid short circuited with power source	2nd boom telescope cylinder does not move	ME-36
OSS error E73	Automatic stop cancel prohibition relay short circuited with power source	Impossible to use automatic stop cancel	ME-37
OSS error E78	Jib EXTEND/STOW relay short circuited with power source	Impossible to operate jib	ME-41
OSS error E79	Jib rotation permission relay short circuited with power source	Impossible to extend or stow jib	ME-42
OSS error E88	Disconnection in main unload solenoid	Stays at automatic stop	ME-43
OSS error E89	Disconnection in PPC unload solenoid	Stays at automatic stop (jib LOWER only)	ME-44
OSS error E8A	Disconnection in jib telescope selector solenoid	Top boom telescope cylinder does not move	ME-45
OSS error E8B	Disconnection in automatic stop cancel prohibition relay	During automatic stop cancel, possible to cancel over-rear stability stop, work equipment moves even when lever stand is lowered	ME-46
OSS error EA0	Abnormality in over-front limit switch	For on-tire operation, traveling with raised load, over-front load table is not given	ME-47
OSS error EA1	Abnormality in top boom stow limit switch	Boom telescope abnormal, rated load limited	ME-48

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
OSS error EA2	Abnormality in boom selection switch	Manual telescope impossible	EM-49
OSS error EA3	Left lock pin input short circuited with power source	Abnormality in jib EXTEND/STOW	EM-50
OSS error EA5	Abnormality in PTO switch	Action impossible (controller at PTO 1 condition)	EM-52
OSS error EA6	H/X selection doesn't match (outrigger)	Action impossible (controller at X-shape condition)	EM-53
OSS error EA7	Specification selection rotary switch setting not available	Action impossible, stops work	EM-54
OSS error EA8	Boom RAISE PPC pressure switch short circuited with ground	Automatic stop	EM-55
OSS error EA9	Boom LOWER PPC pressure switch short circuited with ground	Automatic stop	EM-56
OSS error EAA	Boom EXTEND PPC pressure switch short circuited with ground	Automatic stop	EM-57
OSS error EAB	Boom RETRACT PPC pressure switch short circuited with ground	Automatic stop	EM-58
OSS error EAC	Jib RAISE PPC pressure switch short circuited with ground	Automatic stop	EM-59
OSS error EAD	Jib LOWER PPC pressure switch short circuited with ground	Automatic stop	EM-60
OSS error EB0	PPC pressure switch boom RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-61
OSS error EB1	PPC pressure switch boom EXTEND + RETRACT input simultaneously	Automatic stop reset impossible	EM-62
OSS error EB2	PPC pressure switch jib RAISE + LOWER input simultaneously	Automatic stop reset impossible	EM-63
OSS error EB3	PPC pressure switch swing left + right input simultaneously	Automatic stop reset impossible	EM-64
OSS error EB4	PPC pressure switch main winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-65
OSS error EB5	PPC pressure switch auxiliary winch WIND IN + WIND OUT input simultaneously	Automatic stop reset impossible	EM-66
(Transmission controller related)			
ATM error E11	Disconnection in tachometer sensor	Shock when shifting gear but travel possible	ET- 1
ATM error E12	Disconnection in speed sensor 1	Nothing in particular (emergency stop when secondary problem occurs)	ET- 2
ATM error E13	Disconnection in speed sensor 2	Nothing in particular (emergency stop when secondary problem occurs)	ET- 3
ATM error E14	Disconnection in accelerator potentiometer	Shock when shifting gear but travel possible	ET- 4
ATM error E17	Disconnection in shift lever	Time lag when shifting gear	ET- 5
ATM error E18	Disconnection in FR signal for interlock	Time lag when shifting gear	ET- 6
ATM error E19	No input for solenoid power source monitor	Normal travel possible (detection impossible when secondary problem occurs)	ET- 7
ATM error E24	Accelerator potentiometer short circuited	Shock when shifting gear but travel possible	ET- 8
ATM error E25	Abnormality in emergency gear shift switch or abnormality in PTO 2 switch	Emergency travel impossible, operate valve in emergency	ET- 9
ATM error E32	Abnormality in speed sensor 1	Normal travel possible (emergency stop when secondary problem occurs)	ET-10
ATM error E33	Abnormality in speed sensor 2	Normal travel possible (emergency stop when secondary problem occurs)	ET-11
ATM error E35	MDT at other than N with interlock signal N	Travel possible in emergency gear shift mode	ET-12
ATM error E37	Abnormality in shift lever (2 or more signals ON)	Travel possible in emergency gear shift mode from neutral	ET-13
ATM error E38	Interlock F + R signals ON simultaneously	Travel possible (time lag when shifting gear)	ET-14
ATM error E39	Interlock signal F or R but MDT at N	Travel possible in emergency gear shift mode	ET-15
ATM error E3F	Abnormality in S-NET (communication between MDTs)	Travel possible under certain conditions (★)	ET-16

Displayed code	Abnormal system and detail of abnormality	Problem on machine	Trouble-shooting code
ATM error E53	Overrun	Normal travel possible (overrun warning only)	ET-17
ATM error E55	Drop in battery voltage	Stop, travel possible with emergency gear shift mode	ET-18
ATM error E5A	Special steering system short circuited with ground	Normal travel possible	ET-19
ATM error E5B	Disconnection in special steering system	Impossible to change from front wheel mode	ET-20
ATM error E5C	Reverse steering system short circuited with ground	Normal travel possible	ET-21
ATM error E5D	Disconnection in reverse steering system	Impossible to change to reverse steering mode	ET-22
ATM error E70	Disconnection in R solenoid (ECMV) system	Cannot travel in reverse	ET-23
ATM error E71	Disconnection in F2 solenoid (ECMV) system	Cannot travel forward	ET-24
ATM error E72	Disconnection in F1 solenoid (ECMV) system	Cannot travel forward	ET-25
ATM error E73	Disconnection in F3 solenoid (ECMV) system	Cannot travel forward	ET-26
ATM error E74	Disconnection in lock-up solenoid (ECMV) system	Torque converter lock-up impossible	ET-27
ATM error E78	Disconnection in Lo solenoid system	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-28
ATM error E79	Disconnection in 4WD solenoid system	4WD travel impossible (travel possible in 2WD Hi)	ET-29
ATM error E7B	Disconnection in reverse steering compensation relay system	Travel possible except in reverse steering mode	ET-30
ATM error E7C	Disconnection in F2, R solenoid cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-31
ATM error E7D	Disconnection in back-up lamp relay	Back-up lamp does not light up in REVERSE	ET-32
ATM error E7E	Disconnection in F1, F3 solenoid (ECMV) cut relay system	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-33
ATM error E7F	Disconnection in special steering relay system	Travel possible in front wheel mode	ET-34
ATM error E80	R solenoid (ECMV) system short circuited	Cannot travel in reverse	ET-35
ATM error E81	F2 solenoid (ECMV) system short circuited	Cannot travel forward	ET-36
ATM error E82	F1 solenoid (ECMV) system short circuited	Cannot travel forward	ET-37
ATM error E83	F3 solenoid (ECMV) system short circuited	Cannot travel forward	ET-38
ATM error E84	Lock-up solenoid (ECMV) system short circuited	Torque converter lock-up impossible	ET-39
ATM error E88	Lo solenoid system short circuited	4WD Lo travel impossible (travel possible in 2WD Hi or 4WD Hi)	ET-40
ATM error E89	4WD solenoid system short circuited	4WD travel impossible (travel possible in 2WD Hi)	ET-41
ATM error E8B	Reverse steering compensation system short circuited	Travel possible except in reverse steering mode	ET-42
ATM error E8C	F2, R solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in R or F2 ECMV)	ET-43
ATM error E8D	Back-up lamp relay system short circuited	Back-up lamp does not light up in REVERSE	ET-44
ATM error E8E	F1, F3 solenoid (ECMV) cut relay system short circuited	Travel possible (but circuit cut-off impossible when there is short circuit with power source in F1 or F3 ECMV)	ET-45
ATM error E8F	Special steering mode relay system short circuited	Travel possible in front wheel mode	ET-46
ATM error E90,E91	R or F2 solenoid system short circuited with power source	Cannot travel	ET-47
ATM error E92,E93	F3 or F1 solenoid system short circuited with power source	Cannot travel forward	ET-48
ATM error E94	Lock-up solenoid system short circuited with power source	Torque converter lock-up impossible	ET-49

★ For "certain conditions" for ATM error E3F in the Problem on machine column, see the transmission controller related section in ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS (p. 20-915).

ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITY OCCURS

Error code	Abnormal system	Nature of abnormality
ATM error E11	Disconnection in tachometer sensor	1) Defective tachometer sensor 2) Defective contact or disconnection in wiring harness between M06 (female) (10) and E01 (female) (2) 3) Defective contact or disconnection in wiring harness between M06 (female) (7) and E01 (female) (1) 4) Defective transmission controller
ATM error E12	Disconnection in speed sensor 1	1) Defective speedometer sensor 2) Defective contact or disconnection in wiring harness between M15 (female) (12) – LM03 (12) – L104 (female) (2) 3) Defective contact or disconnection in wiring harness between M15 (female) (5) – LM03 (11) – L104 (female) (1) 4) Defective transmission controller
ATM error E13	Disconnection in speed sensor 2	1) Defective speed sensor 2 2) Defective contact or disconnection in wiring harness between M06 (female) (10) and L103 (female) (2) 3) Defective contact or disconnection in wiring harness between M06 (female) (15) and L103 (female) (1) 4) Defective lower MDT or transmission controller
ATM error E14	Disconnection in accelerator potentiometer	1) Short circuit with ground or disconnection in wiring harness between M14 (female) (10) – LM07 (15) – EL1 (5) – E02 (female) (3) 2) Defective contact or disconnection in wiring harness between M14 (female) (10) – LM07 (15) – EL1 (5) – E02 (female) (3) 3) Defective contact or disconnection in wiring harness between M15 (female) (9) – LM07 (16) – EL1 (4) – E02 (female) (1) 4) Defective accelerator potentiometer 5) Defective transmission controller
ATM error E17	Disconnection in shift lever	1) Defective emergency gear shift selector switch 2) Defective contact or disconnection in wiring harness between top fuse 23 – C20 (7) – C56 (female) (3) 3) Defective contact or disconnection in wiring harness between C56 (female) (4) – C82 (1) – C98 (female) (1) 4) Defective contact or disconnection in one of wiring harnesses between C98 (female) (1), (2), (3), (4), (5), (6) – C06 (female) (18), (17), (7), (16), (8) 5) Defective lower MDT or transmission controller
ATM error E18	Disconnection in F,N,R interlock signal	1) Defective contact or disconnection in one of wiring harnesses between M14 (female) (1), (2), (3) – L04 (8), (6), (7) – (slip ring) – R04 (8), (6), (7) – CR3 (2), (3), CR1 (6) – connecting point between C06 and C82 2) Defective slip ring 3) Defective lower MDT or transmission controller

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Resistance value: 100 – 500 Ω 2) Voltage between speed sensor pins (1) – (2): Min. 0.5 V	Sets engine speed to 2,100 rpm	Shock when shifting gear but travel possible	ET-1
1) Resistance value: 500 – 1,000 Ω 2) Voltage between speed sensor pins (1) – (2): Min. 0.5 V	Travels using speed sensor 2	Normal travel possible	ET-2
1) Resistance value: 500 – 1,000 Ω 2) Voltage between speed sensor pins (1) – (2): Min. 0.5 V	Travels using speed sensor 1	Normal travel possible	ET-3
1) Resistance value between accel- erator potentiometer (2) – (3): Approx. 5 k Ω Resistance value between accel- erator potentiometer (1) – (2): Max. 5 k Ω 2) Voltage between transmission con- troller M15 (9) – M14 (9): 0.5 – 4.75 V	Sets accelerator input data to "Full"	Travel possible (but there is shock when shifting gear)	ET-4
1) Voltage between gear shift lever C98 (1) – chassis ground: 20 – 30 V 2) According to gear shift lever posi- tion Between upper MDT C06 (18) – chassis (R) C06 (17) – chassis (N) C06 (7) – chassis (D) C06 (16) – chassis (2) C06 (8) – chassis (L) Voltage: 20 – 30 V	Judges shift position from in- terlock signal F, R, N	Travel possible but with time lag when operating gear shift lever (10 sec. when shifting N to F or R)	ET-5
1) Voltage between gear shift lever C98 (1) – chassis ground: 20 – 30 V 2) According to gear shift lever posi- tion Between transmission controller M14 (1) – chassis (R) M14 (3) – chassis (N) M14 (2) – chassis (F: D, 2, L) Voltage: 20 – 30 V	Judges shift position from le- ver signal	Travel possible but with time lag when operating gear shift lever (10 sec. when shifting N to F or R)	ET-6

Error code	Abnormal system	Nature of abnormality
ATM error E19	Abnormality in solenoid power source monitor	<ol style="list-style-type: none"> 1) Defective transmission solenoid power source relay 2) Defective contact or disconnection in wiring harness between bottom fuse III (9) and M34 (female) (3) or short circuit with chassis ground 3) Defective contact or disconnection in wiring harness between M14 (female) (4) and connecting point between M13 (female) (17) and M23 (female) (8)
ATM error E24	Accelerator potentiometer short circuited with ground	<ol style="list-style-type: none"> 1) Defective accelerator potentiometer 2) Defective contact or disconnection in wiring harness between M14 (female) (9) – LM07 (14) – EL1 (6) – E02 (female) (2) 3) Wiring harness between M15 (female) (9) – LM07 (16) – EL1 (4) – E02 (female) (1) in contact with wiring harness between M14 (female) (10) – LM07 (15) – EL1 (5) – E02 (female) (3) or wiring harness for power source 4) Defective transmission controller
ATM error E25	Abnormality in emergency gear shift switch or PTO 2 switch	<ol style="list-style-type: none"> 1) Defective emergency gear shift selector switch 2) Defective PTO mode switch 3) Wiring harness between CP2 (female) (6) – CR03 (7) – R03 (5) – (slip ring) – L03 (5) – LM03 (3) – M23 (7) – M50 (2),(1) – M34 (female) (1) or between C56 (female) (2) – CR03 (4) – R04 (5) – L04 (5) – LM03 (6) – M23 (1) – M51 (2),(1) – M34 (female) (1) 4) Defective transmission controller 5) Defective lower MDT
ATM error E32	Abnormality in speed sensor 1	<ol style="list-style-type: none"> 1) Defective speed sensor 1 2) Defective adjustment of speed sensor 1 3) Defective contact or disconnection in wiring harness between M15 (female) (5),(12) – LM03 (11), LM02 (12) – L104 (female) (1),(2) or contact with other wiring harness 4) Wiring harness between M15 (female) (5) – LM03 (11) – L104 (female) (1) short circuiting with chassis ground 5) Defective transmission controller
ATM error E33	Abnormality in speed sensor 2	<ol style="list-style-type: none"> 1) Defective speed sensor 2 2) Defective adjustment of speed sensor 2 3) Defective contact or disconnection in wiring harness between M06 (female) (15),(10) – LM02 (3),(4) – L103 (female) (1),(2) or short circuit with power source 4) Wiring harness between M06 (female) (15) – LM02 (3) – L103 (female) (1) short circuiting with chassis ground 5) Defective transmission controller
ATM error E35	Abnormality in interlock signal N	<ol style="list-style-type: none"> 1) Defective shift lever 2) Wiring harness between M14 (female) (3) – LM02 (5) – L04 (7) – (slip ring) – R04 (7) – CR1 (6) – C55 (female) (2), C06 (female) (17), C82 (3) – C98 (female) (3) short circuiting with power source 3) Defective lower MDT or transmission controller

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Voltage between transmission controller M14 (4) – chassis ground: 20 – 30 V (PTO switch: Travel or Operation 1) Max. 1 V (PTO switch: Operation 2)	Judges switch input signal to be abnormal	Normal travel possible	ET-7
1) Resistance value between accelerator potentiometer (2) – (3): Approx. 5 k Ω Resistance value between accelerator potentiometer (1) – (2): Max. 5 k Ω 2) Voltage between transmission controller M15 (9) – M14 (9): 0.5 – 4.75 V 4.3 \pm 0.3 V (low idling) Voltage between M14 (10) – M14 (9): 4.75 – 5.25 V	Sets accelerator input data to “Full”	Travel possible (but there is shock when shifting gear)	ET-8
1) According to position of switch Voltage between PTO switch – upper MDT, between emergency gear shift selector switch – lower MDT: 20 – 30 V	Judges input signal to be abnormal	Normal travel possible	ET-9
1) Resistance value: 500 – 1,000 Ω	Detects travel speed with speed sensor 2 when traveling	Normal travel possible (but only when speed sensor 2 is normal; if speed sensors 1 and 2 are both abnormal, travel is impossible)	ET-10
1) Resistance value: 500 – 1,000 Ω	Detects travel speed with speed sensor 1 when traveling	Normal travel possible (but only when speed sensor 1 is normal; if speed sensors 1 and 2 are both abnormal, travel is impossible)	ET-11
1) Voltage between transmission controller M14 (3) – chassis ground: When gear shift lever is not at N: Max. 1 V When gear shift lever is at N: 20 – 30 V	Neutral condition	Travel possible in emergency gear shift mode	ET-12

023S02

Error code	Abnormal system	Nature of abnormality
ATM error E37	Abnormality in shift lever (2 or more signals ON)	<ol style="list-style-type: none"> 1) Wiring harness between C98 (female) (1), (2), (3), (4), (5), (6) – C82 (1), (2), (3), (4), (5), (6) – C06 (female) (18), (17), (7), (16), (8) short circuiting with power source 2) Defective shift lever 3) Defective upper MDT or transmission controller
ATM error E38	Abnormality in interlock F, R signals	<ol style="list-style-type: none"> 1) Defective shift lever 2) Wiring harness between M14 (female) (1) – M23 (3) – M35 (female) (1) – LM03 (4) – L04 (8) – (slip ring) – R04 (8) – CR3 (2) – C58 (female) (1),(2) – C57 (male) (4) – C06 (female) (18) – C82 (2) – C98 (female) (2) short circuiting with power source 3) Wiring harness between M14 (female) (2) – M23 (2) – M35 (female) (3) – LM03 (5) – L04 (6) – (slip ring) – R04 (6) – CR3 (3) – C55 (female) (1),(2) – C57 (male) (3) – C06 (female) (8), (16), (7) – C82 (4), (5), (6) – C98 (female) (4), (5), (6) short circuiting with power source 4) Defective slip ring 5) Defective transmission controller
ATM error E39	Interlock signal F/R but MDT at N	<ol style="list-style-type: none"> 1) Defective shift lever 2) Defective contact or disconnection in wiring harness between M14 (female) (3) – LM02 (5) – L04 (7) – (slip ring) – R04 (7) – CR1 (6) – connecting point of C06 (female) (7) and C82 (3) 3) Wiring harness between C06 (female) (17) – C82 (3) – C98 (female) (3) – C55 (female) (2) – CR1 (6) – R04 (7) – (slip ring) – L04 (7) – LM02 (5) – M14 (female) (3) short circuiting with power source 4) Defective transmission controller
ATM error E3F	Abnormality in network	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between M06 (female) (4) and M13 (female) (1) 2) Wiring harness between M06 (female) (4) and M13 (female) (1) short circuiting with chassis ground 3) Defective contact or disconnection in wiring harness between M06 (female) (12) and M13 (female) (12) 4) Defective lower MDT or transmission controller
ATM error E53	Overrun	<ol style="list-style-type: none"> 1) Engine speed > 2700 rpm, or travel speed > 62 km/h
ATM error E55	Drop in battery voltage	<ol style="list-style-type: none"> 1) Defective contact or disconnection in wiring harness between bottom fuse III – (9) – M23 (10) – M13 (female) (8), (18) 2) Defective transmission controller

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Only 1 system ON	Judges shift position from lever signal and inter	Travel possible in emergency gear shift mode from neutral	ET-13
1) Between transmission controller M14 (1) – chassis (R) M14 (2) – chassis (F: D, 2, L) Voltage when lever is at other positions: Max. 1 V	Judges shift position from lever signal	Travel possible but with time lag (2 sec.) when operating gear shift lever	ET-14
1) According to gear shift lever position Between transmission controller M14 (1) – chassis (R) M14 (3) – chassis (N) M14 (2) – chassis (F: D, 2, L) Voltage: 20 – 30 V	Neutral condition (maximum priority)	Travel possible in emergency gear shift mode	ET-15
1) Voltage between transmission controller M13 (1) – (9): 4 - 8 V	Judges shift position from interlock signal Holds travel, steering mode Does not accept OSS forced neutral	Travel possible under conditions on left	ET-16
	Sounds buzzer and displays message	Normal travel possible	ET-17
1) Voltage between M13 (8),(18) – (9),(19): 20 – 30 V	All controller outputs: OFF, neutral safety (except S-NET)	Stops, travel possible in emergency gear shift mode	ET-18

Error code	Abnormal system	Nature of abnormality
ATM error E5A	Special steering system short circuited with ground	1) Defective special steering relay 2) Wiring harness between M14 (female) (8) – M65 (female) (1) – M67 (female) (1) – M19 (14) – M33 (female) (5) short circuiting with chassis ground 3) Defective transmission controller
ATM error E5B	Disconnection in special steering system	1) Defective special steering relay 2) Defective contact or disconnection in wiring harness between M14 (female) (8) – M19 (14) – M33 (female) (5) 3) Defective contact or disconnection in wiring harness between M33 (female) (3) – M19 (16), M20 (16) – LM04 (14), LM05 (14) – chassis 4) Defective transmission controller
ATM error E5C	Reverse steering compensation system short circuited with ground	1) Defective reverse steering relay 2) Wiring harness between M14 (female) (7) – {LM06 (14) – L146 (female) (1) – M66 (female) (1) –} M19 (12) – M32 (female) (5) short circuiting with chassis ground 3) Defective transmission controller
ATM error E5D	Disconnection in reverse steering compensation system monitor	1) Defective reverse steering relay 2) Defective contact or disconnection in wiring harness between M14 (female) (7) – M19 (12) – M32 (female) (5) 3) Defective contact or disconnection in wiring harness between M32 (female) (3) and chassis 4) Defective transmission controller
ATM error E70	Disconnection in R solenoid (ECMV) system	1) Defective R solenoid (ECMV) 2) Defective R, F2 solenoid (ECMV) cut relay 3) Defective contact or disconnection in wiring harness between L97 (female) (2) – LM08 (12) – M22 (11) – M39 (female) (6) 4) Defective contact or disconnection in wiring harness between M13 (female) (16) – M22 (10) – M39 (female) (3) 5) Defective contact or disconnection in wiring harness between M13 (female) (7) – LM08 (16) – L98 (2), (1) – L97 (1) 6) Defective transmission controller
ATM error E71	Disconnection in F2 solenoid (ECMV) system	1) Defective F2 solenoid (ECMV) 2) Defective R, F2 solenoid (ECMV) cut relay 3) Defective contact or disconnection in wiring harness between L95 (female) (2) – LM08 (12) – M22 (11) – M39 (female) (6) 4) Defective contact or disconnection in wiring harness between M13 (female) (16) – M22 (10) – M39 (female) (3) 5) Defective contact or disconnection in wiring harness between M13 (female) (6) – LM08 (11) – L96 (2), (1) – L95 (1) 6) Defective transmission controller

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Special steering mode relay: When OFF (for 1.5 sec. after switch is turned ON) Resistance value in wiring harness be- tween transmission controller M14 (8) - chassis ground: Min. 1 M Ω 2) Voltage between M14 (8) - chassis ground: For 2 sec. immediately after starting switch is turned ON: 15 - 30 V More than 2 sec. after starting switch is turned ON: Max. 1 V	Special steering mode relay output: ON	Normal travel possible	ET-19
1) Special steering mode relay: When ON Resistance value in wiring harness be- tween transmission controller M14 (8) - chassis ground: Max. 1 Ω 2) Voltage between M14 (8) - chassis ground: For 2 sec. immediately after starting switch is turned ON: 15 - 30 V More than 2 sec. after starting switch is turned ON: Max. 1 V	Special steering mode relay output: OFF	Impossible to switch from front wheel mode	ET-20
1) Reverse steering compensation mode relay: When OFF (for 1.5 sec. after switch is turned ON) Resistance value in wiring harness be- tween transmission controller M14 (7) - chassis ground: Min. 1 M Ω 2) Voltage between M14 (7) - chassis ground: For 2 sec. immediately after starting switch is turned ON: 15 - 30 V More than 2 sec. after starting switch is turned ON: Max. 1 V	Reverse steering compensa- tion mode relay output: ON	Normal travel possible	ET-21
1) Reverse steering compensation mode relay: When ON Resistance value in wiring harness be- tween transmission controller M14 (7) - chassis ground: Max. 1 Ω 2) Voltage between M14 (7) - chassis ground: For 2 sec. immediately after starting switch is turned ON: 15 - 30 V More than 2 sec. after starting switch is turned ON: Max. 1 V	Reverse steering compensa- tion mode relay output: OFF	Impossible to switch to re- verse steering mode	ET-22
1) Solenoid resistance value: 10 - 20 Ω 2) Resistance value in wiring harness between solenoid L97 (1), (2) - transmission controller M13 (7), (16): Max. 1 Ω	R ECMV output: OFF	Cannot travel in reverse	ET-23
1) Solenoid resistance value: 10 - 20 Ω 2) Resistance value in wiring harness between solenoid L95 (1), (2) - transmission controller M13 (6), (16): Max. 1 Ω	F2 ECMV output: OFF	Cannot travel forward	ET-24

023S02

Error code	Abnormal system	Nature of abnormality
ATM error E72	Disconnection in F1 solenoid (ECMV) system	1) Defective F1 solenoid (ECMV) 2) Defective F1, F3 solenoid (ECMV) cut relay 3) Defective contact or disconnection in wiring harness between L93 (female) (2) – LM08 (8) – M22 (14) – M40 (female) (6) 4) Defective contact or disconnection in wiring harness between M13 (female) (15) – M22 (13) – M40 (female) (3) 5) Defective contact or disconnection in wiring harness between M13 (female) (5) – LM08 (7) – L93 (1) 6) Defective transmission controller
ATM error E73	Disconnection in F3 solenoid (ECMV) system	1) Defective F3 solenoid (ECMV) 2) Defective F1, F3 solenoid (ECMV) cut relay 3) Defective contact or disconnection in wiring harness between L94 (female) (2) – LM08 (8) – M22 (14) – M40 (female) (6) 4) Defective contact or disconnection in wiring harness between M13 (female) (15) – M22 (13) – M40 (female) (3) 5) Defective contact or disconnection in wiring harness between M13 (female) (4) – LM08 (9) – L94 (1) 6) Defective transmission controller
ATM error E74	Disconnection in lock-up solenoid (ECMV) system	1) Defective lock-up solenoid (ECMV) 2) Defective contact or disconnection in wiring harness between M13 (female) (14) – LM08 (5) – L92 (2) 3) Defective contact or disconnection in wiring harness between M13 (female) (3) – LM08 (4) – L92 (1) 4) Defective transmission controller
ATM error E78	Disconnection in Lo solenoid system	1) Defective Lo solenoid 2) Defective contact or disconnection in wiring harness between L99 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between M13 (female) (21) – LM08 (13) – L99 (1) 4) Defective transmission controller
ATM error E79	Disconnection in 4WD solenoid system	1) Defective 4WD solenoid 2) Defective contact or disconnection in wiring harness between L101 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between M13 (female) (20) – LM08 (15) – L101 (1) 4) Defective transmission controller
ATM error E7B	Disconnection in reverse steering compensation relay system	1) Defective reverse steering relay 2) Defective contact or disconnection in wiring harness between M32 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between M13 (female) (10) – M19 (11) – M32 (1) 4) Defective transmission controller

023502

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Solenoid resistance value: 10 – 20Ω 2) Resistance value in wiring harness between solenoid L93 (1), (2) – transmission controller M13 (5), (15): Max. 1 Ω	F1 ECMV output: OFF	Cannot travel forward	ET-25
1) Solenoid resistance value: 10 – 20Ω 2) Resistance value in wiring harness between solenoid L94 (1), (2) – transmission controller M13 (4), (15): Max. 1 Ω	F3 ECMV output: OFF	Cannot travel forward	ET-26
1) Resistance value in wiring harness between solenoid L92 (1), (2) – transmission controller M13 (3), (14): Max. 1 Ω	Lock-up ECMV output: OFF	Torque converter lock-up im- possible	ET-27
1) Solenoid resistance value: 30 – 80Ω 2) Resistance value in wiring harness between solenoid L99 (1) – trans- mission controller M13 (21): Max. 1 Ω	Lo solenoid output: OFF	Possible to travel in 4WD or 2WD Hi mode	ET-28
1) Solenoid resistance value: 30 – 80Ω 2) Resistance value in wiring harness between solenoid L101 (1) – trans- mission controller M13 (20): Max. 1 Ω	4WD solenoid output: OFF	Possible to travel in 2WD Hi mode	ET-29
1) Relay coil resistance value: 200 – 400 Ω 2) Resistance value in wiring harness between relay M32 (1) – transmis- sion controller M13 (10): Max. 1 Ω	Reverse steering compensa- tion relay output: OFF	Possible to travel in any mode except reverse steering mode	ET-30

023S02

Error code	Abnormal system	Nature of abnormality
ATM error E7C	Disconnection in F2, R solenoid (ECMV) cut relay system	<ol style="list-style-type: none"> 1) Defective R, F2 solenoid cut relay 2) Defective contact or disconnection in wiring harness between M39 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between M15 (female) (7) – M22 (8) – M39 (female) (1) 4) Defective transmission controller
ATM error E7D	Disconnection in back-up lamp relay	<ol style="list-style-type: none"> 1) Defective back-up lamp relay 2) Defective contact or disconnection in wiring harness between M36 (female) (2) – M19 (16), M20 (16) – LM04 (14), LM05 (14) – chassis 3) Defective contact or disconnection in wiring harness between M15 (female) (8) – M48 (2), (1) – M36 (female) (1) 4) Defective transmission controller
ATM error E7E	Disconnection in F1, F3 solenoid (ECMV) cut relay system	<ol style="list-style-type: none"> 1) Defective F1, F3 solenoid cut relay 2) Defective contact or disconnection in wiring harness between M40 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between M15 (female) (15) – M22 (13) – M40 (female) (1) 4) Defective transmission controller
ATM error E7F	Disconnection in special steering relay system	<ol style="list-style-type: none"> 1) Defective special steering relay 2) Defective contact or disconnection in wiring harness between M33 (female) (2) and chassis 3) Defective contact or disconnection in wiring harness between M15 (female) (16) – M19 (13) – M33 (1) 4) Defective transmission controller
ATM error E80	R solenoid (ECMV) system short circuited	<ol style="list-style-type: none"> 1) Defective R solenoid (ECMV) 2) Wiring harness between M13 (female) (7) – LM08 (16) – L98 (2), (1) – L97 (female) (1) {including wiring harness between intermediate connecting point between L97 (female) (1) and L98 (female) (1) – LM08 (2) – M23 (5) – M47 (female) (1)} short circuiting with chassis ground 3) Defective R, F2 solenoid (ECMV) cut relay 4) Wiring harness between M13 (female) (16) – M22 (10) – M39 (3) or between M39 (female) (6) – M22 (11) – LM08 (12) – L97 (female) (2) short circuiting with chassis ground 5) Defective transmission controller
ATM error E81	F2 solenoid (ECMV) system short circuited	<ol style="list-style-type: none"> 1) Defective F2 solenoid (ECMV) 2) Wiring harness between M13 (female) (6) – LM08 (16) – L98 (2), (1) – L97 (female) (1) {including wiring harness between intermediate connecting point between L95 (female) (1) and L96 (female) (1) – LM08 (1) – M46 (female) (1)} short circuiting with chassis ground 3) Defective R, F2 solenoid (ECMV) cut relay 4) Wiring harness between M13 (female) (16) – M22 (10) – M39 (3) or between M39 (female) (6) – M22 (11) – LM08 (12) – L95 (female) (2) short circuiting with chassis ground 5) Defective transmission controller

023502

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Relay coil resistance value: 200 – 400 Ω 2) Resistance value in wiring harness between relay M39 (1) – transmis- sion controller M15 (7): Max. 1 Ω	R, F2 ECMV cut relay output: OFF	Travel possible (however, it is impossible to cut off circuit when R or F2 are short circuit- ing with power source)	ET-31
1) Relay coil resistance value: 200 – 400 Ω 2) Resistance value in wiring harness between relay M36 (1) - transmis- sion controller M15 (15): Max. 1 Ω	Back-up lamp relay output: OFF	Back-up lamp does not light up when traveling in reverse	ET-32
1) Relay coil resistance value: 200 – 400 Ω 2) Resistance value in wiring harness between relay M40 (1) – transmis- sion controller M15 (15): Max. 1 Ω	F1, F3 ECMV cut relay output: OFF	Travel possible (however, it is impossible to cut off circuit when F1 or F3 are short circuit- ing with power source)	ET-33
1) Relay coil resistance value: 200 – 400 Ω 2) Resistance value in wiring harness between relay M33 (1) – transmis- sion controller M15 (16): Max. 1 Ω	Special steering relay output: OFF	Possible to travel in front wheel mode	ET-34
1) Resistance value between trans- mission controller M13 (7) – (16): 10 – 20 Ω 2) Resistance value between trans- mission controller M13 (7) – chas- sis ground: Min. 1 M Ω 3) Resistance value between trans- mission controller M13 (16) – chas- sis ground: Min. 1 M Ω	R ECMV output: OFF	Cannot travel in reverse	ET-35
1) Resistance value between trans- mission controller M13 (6) – (16): 10 – 20 Ω 2) Resistance value between trans- mission controller M13 (6) – chas- sis ground: Min. 1 M Ω 3) Resistance value between trans- mission controller M13 (16) – chas- sis ground: Min. 1 M Ω	F2 ECMV output: OFF	Cannot travel forward	ET-36

Error code	Abnormal system	Nature of abnormality
ATM error E82	F1 solenoid (ECMV) system short circuited	1) Defective F1 solenoid (ECMV) 2) Wiring harness between M13 (female) (5) – LM08 (7) – L93 (1) short circuiting with chassis ground 3) Defective F1, F3 solenoid (ECMV) cut relay 4) Wiring harness between M13 (female) (15) – M22 (13) – M40 (3) or between M40 (female) (6) – M22 (14) – LM08 (8) – L93 (female) (2) short circuiting with chassis ground 5) Defective transmission controller
ATM error E83	F3 solenoid (ECMV) system short circuited	1) Defective F3 solenoid (ECMV) 2) Wiring harness between M13 (female) (4) – LM08 (9) – L94 (1) short circuiting with chassis ground 3) Defective F1, F3 solenoid (ECMV) cut relay 4) Wiring harness between M13 (female) (15) – M22 (13) – M40 (3) or between M40 (female) (6) – M22 (14) – LM08 (8) – L94 (female) (2) short circuiting with chassis ground 5) Defective transmission controller
ATM error E84	Lock-up solenoid (ECMV) system short circuited	1) Defective lock-up solenoid (ECMV) 2) Wiring harness between M13 (female) (3) – LM08 (4) – L92 (female) (1) short circuiting with chassis ground 3) Wiring harness between M13 (female) (14) – LM08 (5) – L92 (female) (2) short circuiting with chassis ground 4) Defective transmission controller
ATM error E88	Lo solenoid system short circuited	1) Defective Lo solenoid 2) Wiring harness between M13 (female) (21) – LM08 (13) – L99 (female) (1) short circuiting with chassis ground 3) Defective transmission controller
ATM error E89	4WD solenoid system short circuited	1) Defective 4WD solenoid 2) Wiring harness between M13 (female) (20) – LM08 (15) – L101 (1) short circuiting with chassis ground 3) Defective transmission controller
ATM error E8B	Reverse steering compensation system short circuited	1) Defective reverse steering relay 2) Wiring harness between M13 (female) (10) – M19 (11) – M32 (1) short circuiting with chassis ground 3) Defective transmission controller

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Resistance value between transmis- sion controller M13 (5) – (15): 10 – 20 Ω 2) Resistance value between transmis- sion controller M13 (5) – chas- sis ground: Min. 1 M Ω 3) Resistance value between transmis- sion controller M13 (15) – chas- sis ground: Min. 1 M Ω	F1 ECMV output: OFF	Cannot travel forward	ET-37
1) Resistance value between transmis- sion controller M13 (4) – (15): 10 – 20 Ω 2) Resistance value between transmis- sion controller M13 (4) – chas- sis ground: Min. 1 M Ω 3) Resistance value between transmis- sion controller M13 (15) – chas- sis ground: Min. 1 M Ω	F3 ECMV output: OFF	Cannot travel forward	ET-38
1) Resistance value between transmis- sion controller M13 (3) – (14): 10 – 20 Ω 2) Resistance value between transmis- sion controller M13 (3) – chas- sis ground: Min. 1 M Ω 3) Resistance value between transmis- sion controller M13 (14) – chas- sis ground: Min. 1 M Ω	Lock-up ECMV output: OFF	Torque converter lock-up im- possible	ET-39
1) Solenoid resistance value: 30 – 80 Ω 2) Resistance value in wiring harness between solenoid L99 (1) – chassis ground: Min. 30 Ω	Lo solenoid output: OFF	Possible to travel in 4WD or 2WD Hi mode	ET-40
1) Solenoid resistance value: 30 – 80 Ω 2) Resistance value in wiring harness between solenoid L101 (1) – chas- sis ground: Min. 30 Ω	4WD solenoid output: OFF	Possible to travel in 2WD Hi mode	ET-41
1) Resistance value in wiring harness between transmission controller M13 (10) – chassis ground: 200 – 400 Ω	Reverse steering compensa- tion relay output: OFF	Possible to travel in any mode except reverse steering mode	ET-42

023S02

Error code	Abnormal system	Nature of abnormality
ATM error E8C	F2, R solenoid (ECMV) cut relay system short circuited	1) Defective R, F2 solenoid cut relay 2) Wiring harness between M15 (female) (7) – M22 (8) – M39 (female) (1) short circuiting with chassis ground 3) Defective transmission controller
ATM error E8D	Back-up lamp relay system short circuited	1) Defective back-up lamp relay 2) Wiring harness between M15 (female) (8) – M23 (6) – M48 (2), (1) – M36 (female) (1) short circuiting with chassis ground 3) Defective transmission controller
ATM error E8E	F1, F3 solenoid (ECMV) cut relay system short circuited	1) Defective F1, F3 solenoid cut relay 2) Wiring harness between M15 (female) (15) – M22 (13) – M40 (female) (1) short circuiting with chassis ground 3) Defective transmission controller
ATM error E8F	Special steering mode relay system short circuited	1) Defective special steering relay 2) Wiring harness between M15 (female) (16) – M19 (13) – M33 (1) short circuiting with chassis ground 3) Defective transmission controller
ATM error E90,E91	R or F2 solenoid short circuiting with power source	1) Wiring harness between M13 (female) (7) – LM08 (16) – L98 (2), (1) – L97 (female) (1) {including wiring harness between intermediate connecting point between L97 (female) (1) and L98 (female) (1) – LM08 (2) – M23 (5) – M47 (1) – M45 (1), (2) – M35 (female) (2)} short circuiting with power source 2) Wiring harness between M13 (female) (6) – LM08 (16) – L98 (2), (1) – L95 (female) (1) {including wiring harness between intermediate connecting point between L95 (female) (1) and L96 (female) (1) – LM08 (1) – M23 (4) – M46 (1), (2) – M35 (female) (4)} short circuiting with power source 3) Defective transmission controller
ATM error E92,E93	F3 or F1 solenoid short circuiting with power source	1) Wiring harness between M13 (female) (5) – LM08 (7) – L93 (1) short circuiting with power source 2) Wiring harness between M13 (female) (4) – LM08 (9) – L94 (1) short circuiting with power source 3) Defective transmission controller

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Resistance value in wiring harness between transmission controller M15 (7) – chassis ground: 200 – 400 Ω	R, F2 ECMV cut relay output: OFF	Travel possible (however, it is impossible to cut off circuit when R or F2 are short circuit- ing with power source)	ET-43
1) Resistance value in wiring harness between transmission controller M15 (8) - chassis ground: 200 – 400 Ω	Back-up lamp relay output: OFF	Back-up lamp does not light up when traveling in reverse	ET-44
1) Resistance value in wiring harness between transmission controller M15 (15) – chassis ground: 200 – 400 Ω	F1, F3 ECMV cut relay output: OFF	Travel possible (however, it is impossible to cut off circuit when F1 or F3 are short circuit- ing with power source)	ET-45
1) Resistance value in wiring harness between transmission controller M15 (16) – chassis ground: 200 – 400 Ω	Special steering relay output: OFF	Possible to travel in front wheel mode	ET-46
1) Voltage between transmission con- troller M13 (7), (6) and chassis ground at neutral: Max. 1 V	R, F2 ECMV output: OFF and cut relay ON	Cannot travel (impossible to travel even in emergency gear shift)	ET-47
1) Voltage between transmission con- troller M13 (5), (4) and chassis ground at neutral: Max. 1 V	F1, F3 ECMV output: OFF and cut relay ON	Cannot travel (impossible to travel even in emergency gear shift)	ET-48

023S02

TROUBLESHOOTING

Error code	Abnormal system	Nature of abnormality
ATM error E94	Lock-up solenoid short circuiting with power source	1) Wiring harness between M13 (female) (3) – LM08 (4) – L92 (1) short circuiting with power source 2) Defective transmission controller

023S02

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality	Trouble- shooting code
1) Voltage between transmission controller M13 (3) and chassis ground at neutral: Max. 1 V	Lock-up ECMV output: OFF and cut relay ON	Torque converter lock-up impossible	ET-49

023S02

JUDGEMENT TABLE FOR TRANSMISSION SYSTEM (1/1)

Location of failure Failure mode Error code			Self-diagnostic display(abnormality display)																					
			ATM errors																					
			E 11	E 12	E 13	E 14	E 17	E 18	E 19	E 24	E 25	E 32	E 33	E 35	E 37	E 38	E 39	E 3F	E 53	E 55	E 5A	E 5B	E 5C	E 5D
1	Machine does not move off: gear shift lever	In any position																						
		In position D																						
		In position 2																						
		In position L																						
		In position R																						
2	Does not accelerate or does not decelerate	Does not accelerat									▲	▲												
		Does not decelerate										▲	▲											
3	Travel speed is slow or lacks power																							
4	Torque converter lock-up	Does not engage																						
		Does not disengage																						
5	Excessive time lag when starting off or shifting gear (shift-up is slow) or there is shock when shifting gear		○			○	○	○		○						○								
6	Torque converter oil temperature becomes high																							
7	Brakes have no effect (braking effect is poor), brakes pull to one side or cannot be released (drag)																							
8	Exhaust brake	Cannot be applied																						
		Cannot be released																						
9	Air pressure does not rise or is low																							
10	Impossible to switch between 2-wheel drive and 4-wheel drive																							
11	Impossible to switch between Hi and Lo																							
12	Steering mode does not switch																					○		○
13	Back-up lamp does not light up																							
Troubleshooting code when error code is displayed			ET -1	ET -2	ET -3	ET -4	ET -5	ET -6	ET -7	ET -8	ET -9	ET -10	ET -11	ET -12	ET -13	ET -14	ET -15	ET -16	ET -17	ET -18	ET -19	ET -20	ET -21	ET -22

▲ When error occurs simultaneously for speed sensors 1 and 2 (maintains present speed, so does not accelerate or decelerate)

● Travel possible under certain conditions

Impossible to switch from front wheel mode →

Impossible to switch from reverse steering mode →

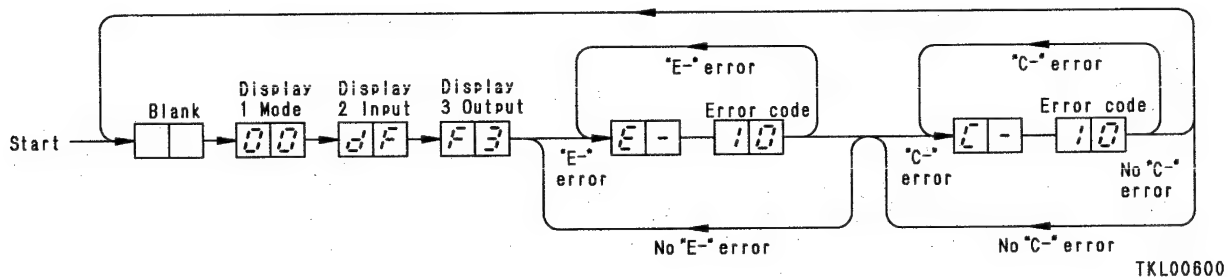
023S02

023S02

Self-diagnostic display(abnormality display)																																Troubleshooting code when there is no abnormality display					
Disconnection in R solenoid system																																					
Disconnection in F2 solenoid system																																					
Disconnection in F1 solenoid system																																					
Disconnection in F3 solenoid system																																					
Disconnection in lock-up solenoid system																																					
Disconnection in Lo solenoid system																																					
Disconnection in 4WD solenoid system																																					
Disconnection in reverse steering relay																																					
Disconnection in F2, R solenoid cut relay																																					
Disconnection in back-up lamp relay																																					
Disconnection in F1, F3 solenoid cut relay																																					
Disconnection in special steering relay																																					
R solenoid short circuited																																					
F2 solenoid short circuited																																					
F1 solenoid short circuited																																					
F3 solenoid short circuited																																					
Lock-up solenoid short circuited																																					
Lo solenoid short circuited																																					
4WD solenoid short circuited																																					
Reverse steering relay short circuited																																					
F2, R solenoid cut relay short circuited																																					
Back-up lamp relay system short circuited																																					
F1, F3 solenoid cut relay short circuited																																					
Special steering relay short circuited																																					
R or F2 solenoid short circuited with power source																																					
F3 or F1 solenoid short circuited with power source																																					
Lock-up solenoid short circuited with power source																																					
Exhaust brake short circuited with ground																																					
Exhaust brake solenoid short circuited with ground																																					
Disconnection in exhaust brake solenoid																																					
ATM errors																								ATM errors													
E70	E71	E72	E73	E74	E78	E79	E7B	E7C	E7D	E7E	E7F	E80	E81	E82	E83	E84	E88	E89	E8B	E8C	E8D	E8E	E8F	E90	E91	E92	E93	E94	E4D	E70	E97						
																																	E-6, H-101				
																																	H-101				
																																	H-101				
																																	H-101				
																																	H-101				
																																	H-102 a)				
																																	H-102 b)				
																																	H-103				
																																	H-104 a)				
																																	H-104 b)				
																																	H-105				
																																	H-106				
																																	E-6, H-107				
																																	H-108 a)				
																																	H-108 b)				
																																	H-107				
																																	H-110				
																																	H-111				
																																	H-111				
																																	E-17				
ET-23	ET-24	ET-25	ET-26	ET-27	ET-28	ET-29	ET-30	ET-31	ET-32	ET-33	ET-34	ET-35	ET-36	ET-37	ET-38	ET-39	ET-40	ET-41	ET-42	ET-43	ET-44	ET-45	ET-46	ET-47	ET-48	ET-49	EL-35	EL-70	EL-97								
Does not switch to re-										Possible to travel in										Possible to travel in front wheel mode										Does not switch to reverse steering mode							
verse steering mode										front wheel mode																											

TRANSMISSION CONTROLLER LED DISPLAY

The transmission controller uses 2 7-segment LEDs to display the internal condition of the controller and to give the input and output errors. The display shows two characters at the same time for one second, and switches the display in turn. The sequence of the display is as shown below.



The following is an explanation of the displays at each stage.

- Blank** : Both LEDs go out to show the beginning of the display sequence.
- Mode** : This shows the gear shift mode determined by the combination of transmission controller input. For details, see Table 1.
- Input** : If the transmission controller is issuing any warning, it displays the type; in other cases, it displays the condition of the gear shift lever and throttle. For details, see Table 2.
- Output** : This shows the gear shift range output by the transmission controller. For details, see Table 3.
- "E-" error** : This shows any abnormalities that are occurring at present. If any abnormality is detected, no "E-" error display is given. If multiple abnormalities are detected, the "E-" error display is repeated in turn until all of the abnormalities are displayed. For details, see ACTION OF CONTROLLER AND CONDITION OF MACHINE WHEN ABNORMALITIES OCCURS.
- "C-" error** : This shows abnormalities that occurred in the past. If no abnormalities have occurred, no "C-" error display is given. If multiple abnormalities have occurred, the "C-" error display is repeated until all of the abnormalities have been displayed.

023S02

Table 1 (mode)

Display	Name	Condition
Hd	Hi mode	Hi: ON, lever D
H2	Hi mode	Hi: ON, lever 2
HL	Hi mode	Hi: ON, lever L
0b	Reverse	Lever R
Ad	Hi, brake mode	Hi: ON, lever D, exhaust brake: ON
A2	Hi, brake mode	Hi: ON, lever 2, exhaust brake: ON
AL	Hi, brake mode	Hi: ON, lever L, exhaust brake: ON
HP	Hi, PTO mode	Hi: ON, PTO: ON
Pb	PTO mode, reverse	PTO: ON, lever R
H6	Hi, speed limit mode	Hi: ON, speed limit: ON
Ld	Lo mode	Lo: ON, lever D
L2	Lo mode	Lo: ON, lever 2
LL	Lo mode	Lo: ON, lever L
LP	Lo, PTO mode	Lo: ON, PTO: ON
L6	Lo, speed limit mode	Lo: ON, speed limit: ON
PP	PTO 2 mode	PTO 2
E	Emergency gear shift mode	Emergency gear shift

Table 2 (input)

Display	Name	Condition
C1	Neutral safety	When power is ON and shift lever is at position other than N
C2	FR inhibit	When traveling at above 5 km/h and the direction of travel (FORWARD/REVERSE) is changed
C3	H/L inhibit	When traveling at above 3 km/h or when the gear shift lever is at a position other than N and Hi/Lo is shifted
C4	Key ON when traveling	More than 5 km/h with key ON (Travel or Operation 1)
C5	PTO 2 (forced neutral)	Forced neutral for emergency gear shift or PTO 2
XY	No warning condition	Condition shown below using upper digit x and lower digit y

Upper digit x

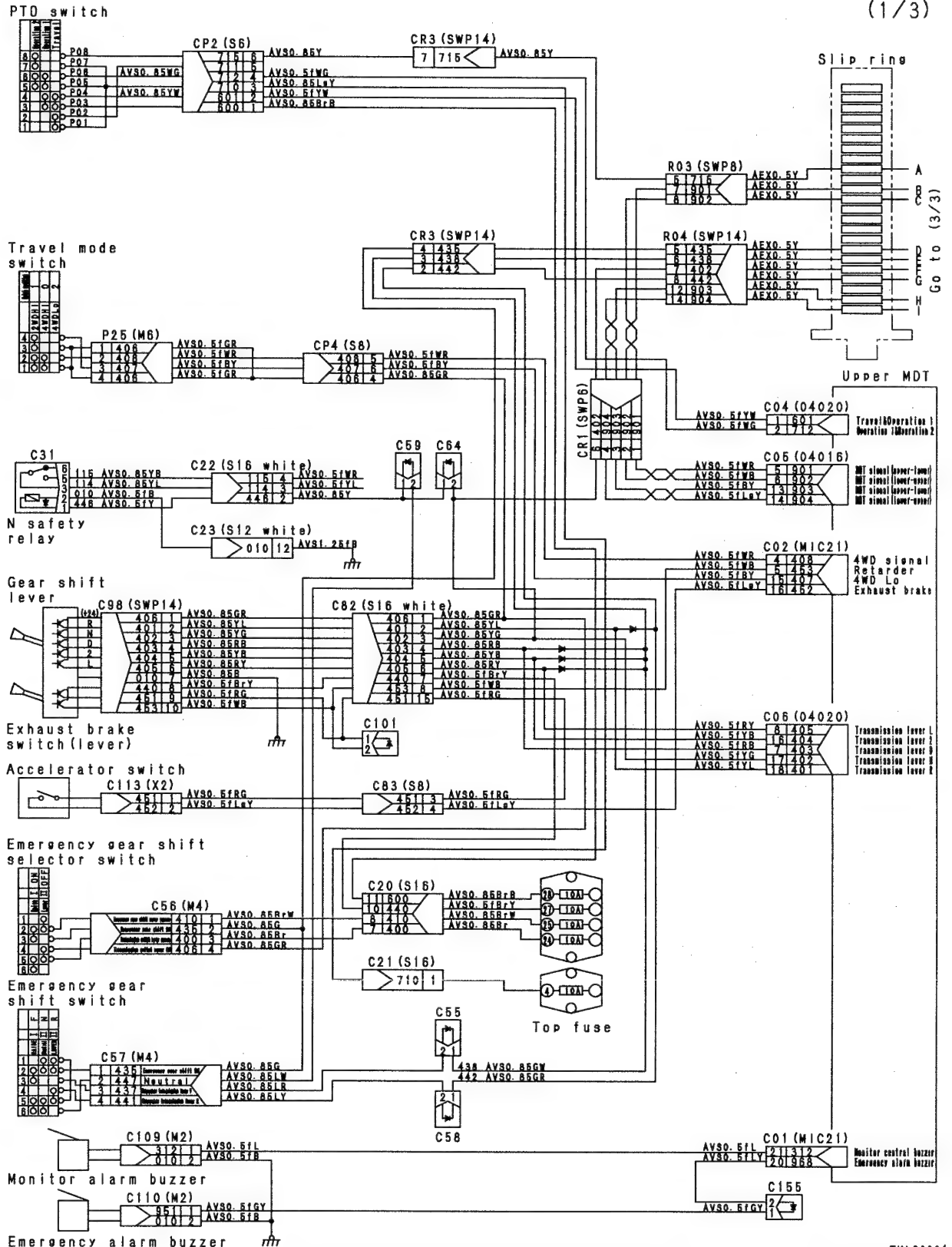
Display	Name	Condition
b	Shift lever R	Shift lever at position R
0	Shift lever N	Shift lever at position N
d	Shift lever D	Shift lever at position D
2	Shift lever 2	Shift lever at position 2
L	Shift lever L	Shift lever at position L

Lower digit y

Display	Name	Condition
L	Throttle idling	When throttle is in idling range
1	Throttle partial 1	When throttle is in partial 1 range
2	Throttle partial 2	When throttle is in partial 2 range
3	Throttle partial 3	When throttle is in partial 3 range
F	Throttle full	When throttle is at full position

Table 3 (output)

Display	Name	Condition
0 0	N	All modulating solenoids: OFF
F 1	F1 torque converter	F1 modulating solenoid: ON
F.1.	F1 lock-up	F1, lock-up modulating solenoid: ON
F 2	F2 torque converter	F2 modulating solenoid: ON
F.2.	F2 lock-up	F2, lock-up modulating solenoid: ON
F 3	F3 torque converter	F3 modulating solenoid: ON
F.3.	F3 lock-up	F3, lock-up modulating solenoid: ON
b 1	R torque converter	R modulating solenoid: ON

TRANSMISSION CONTROLLER SYSTEM ELECTRICAL CIRCUIT
DIAGRAM

TKL00601



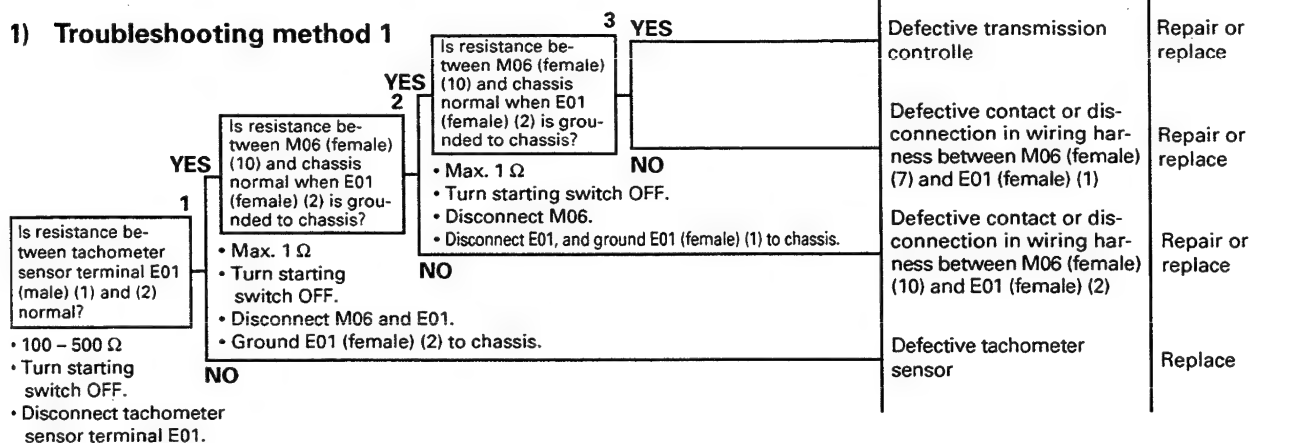
023S02



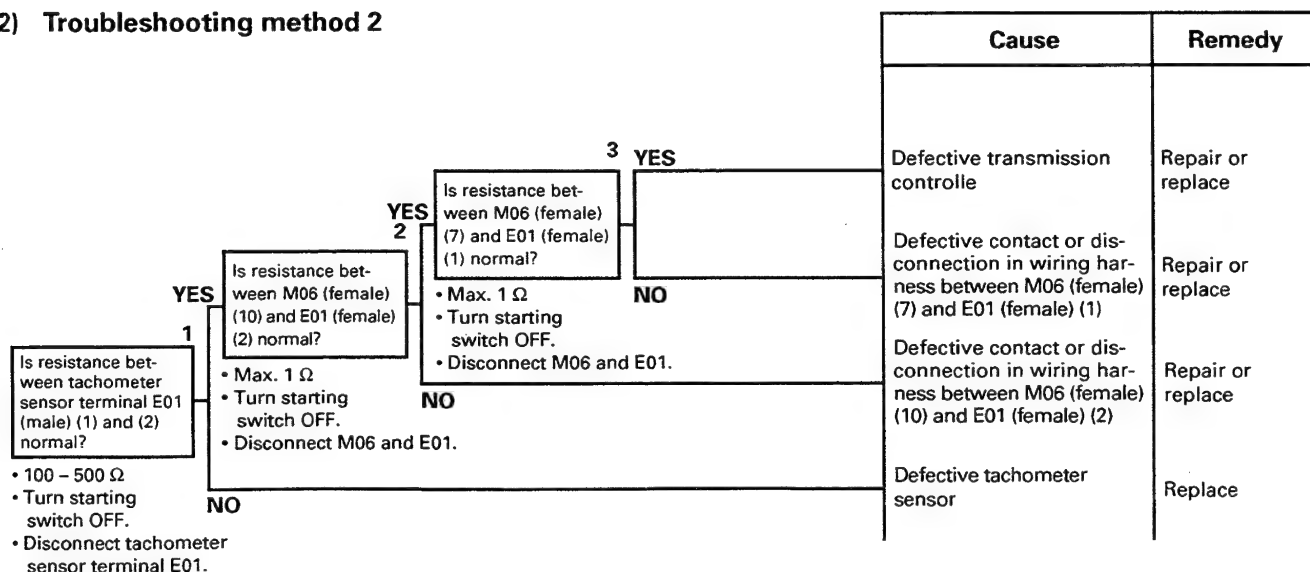
ET-1 ATM error E11 (Disconnection in tachometer sensor) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

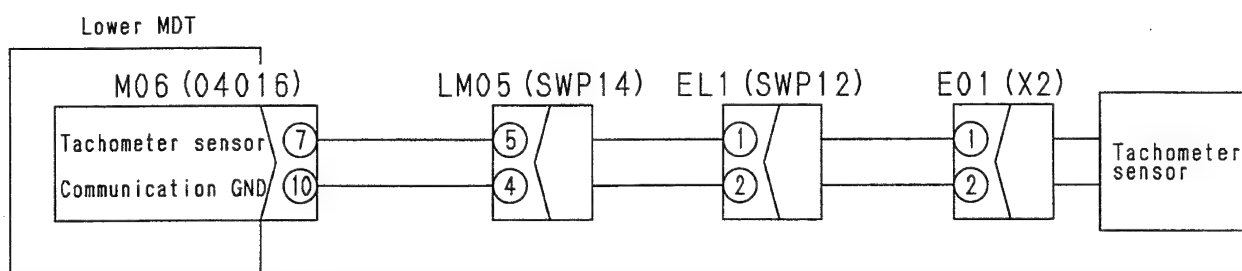
1) Troubleshooting method 1



2) Troubleshooting method 2



ET-1 Related electric circuit diagram



TKL00604

ET-2 ATM error E12 (Disconnection in speed sensor 1) is displayed

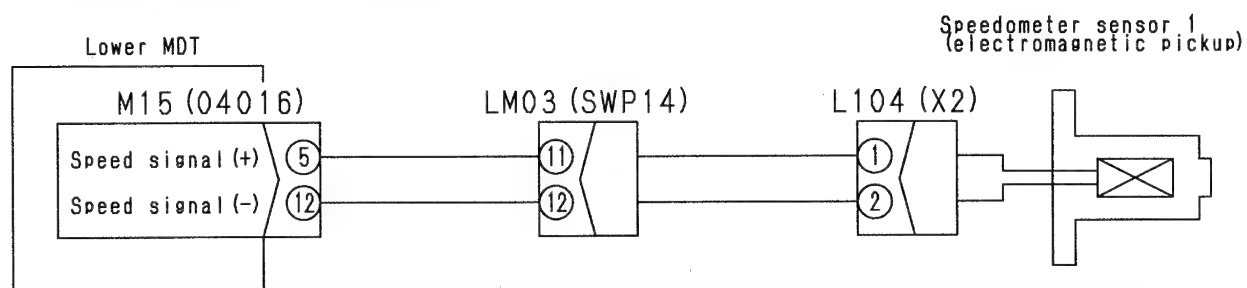
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 Is resistance between speedometer sensor 1 terminal L104 (female) (1) and (2) normal?</p> <p>• 500 – 1,000 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect speedometer sensor 1 terminal.</p> <p>YES</p> <p>2 Is resistance between M15 (female) (12) and chassis normal when L104 (female) (2) is grounded to chassis?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M15.</p> <p>• Disconnect L104, and ground L104 (female) (2) to chassis.</p> <p>YES</p> <p>3 Is resistance between M15 (female) (5) and chassis normal when L104 (female) (1) is grounded to chassis?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M15.</p> <p>• Disconnect L104, and ground L104 (female) (1) to chassis.</p> <p>YES</p> <p>NO</p>	<p>YES</p> <p>NO</p>	Defective transmission controle	Repair or replace
		Defective contact or disconnection in wiring harness between M15 (female) (5) – LM03 (11) – L104 (female) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between M15 (female) (12) – LM03 (12) – L104 (female) (2)	Repair or replace
		Defective speedometer sensor 1	Replace

2) Troubleshooting method 2

		Cause	Remedy
<p>1 Is resistance between speedometer sensor 1 terminal L104 (female) (1) and (2) normal?</p> <p>• 500 – 1,000 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect speedometer sensor 1 terminal L104.</p> <p>YES</p> <p>2 Is resistance between M15 (female) (12) and L104 (female) (2) normal?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M15 and L104.</p> <p>YES</p> <p>3 Is resistance between M15 (female) (5) and L104 (female) (1) normal?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M15 and L104.</p> <p>YES</p> <p>NO</p>	<p>YES</p> <p>NO</p>	Defective transmission controle	Repair or replace
		Defective contact or disconnection in wiring harness between M15 (female) (5) – LM03 (11) – L104 (female) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between M15 (female) (12) – LM03 (12) – L104 (female) (2)	Repair or replace
		Defective speedometer sensor 1	Replace

ET-2 Related electric circuit diagram

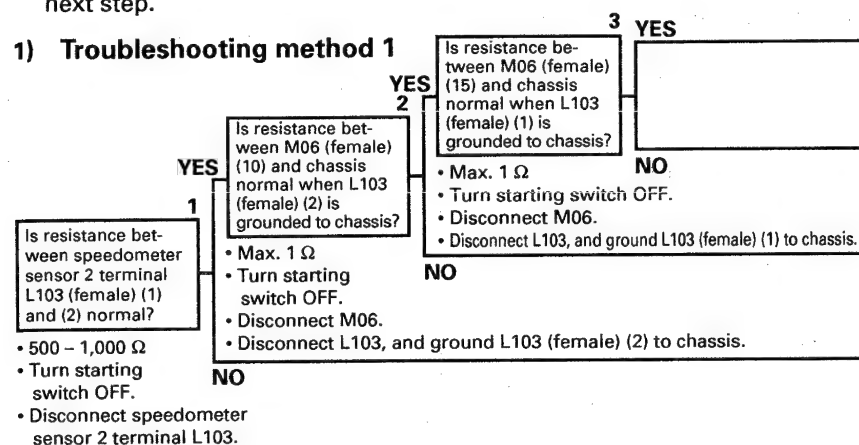


TKL00605

ET-3 ATM error E13 (Disconnection in speed sensor 2) is displayed

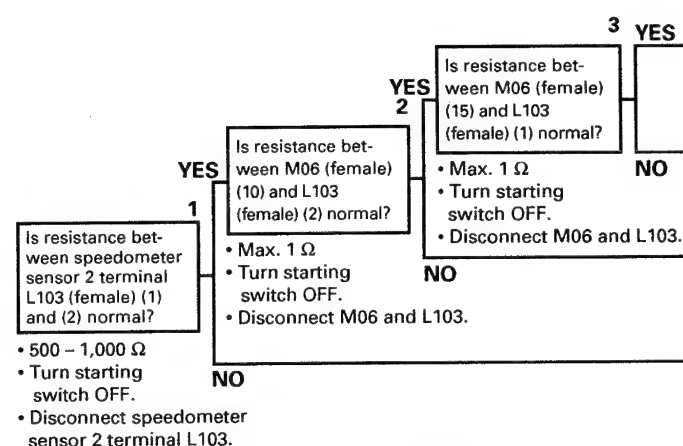
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
 - ★ When there is no S-NET error.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
| | |

1) Troubleshooting method 1



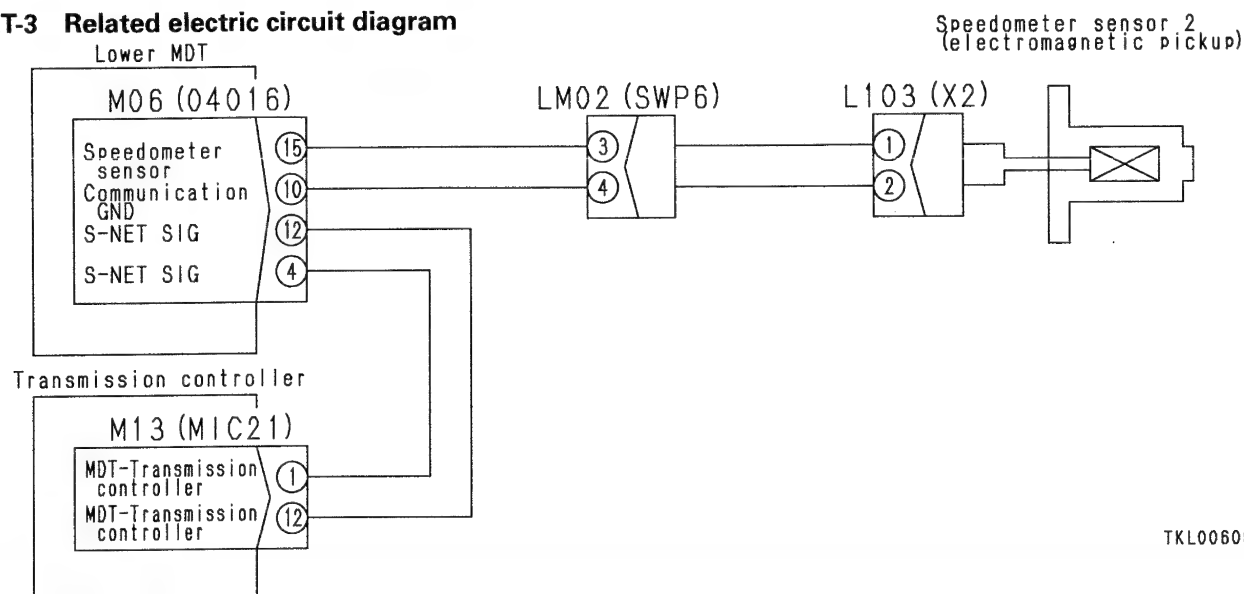
Cause	Remedy
Defective transmission controller	Repair or replace
Defective contact or disconnection in wiring harness between M06 (female) (15) and L103 (female) (1)	Repair or replace
Defective contact or disconnection in wiring harness between M06 (female) (10) and L103 (female) (2)	Repair or replace
Defective speedometer sensor 2	Replace

2) Troubleshooting method 2



Cause	Remedy
Defective lower MDT or transmission controller	Repair or replace
Defective contact or disconnection in wiring harness between M06 (female) (15) and L103 (female) (1)	Repair or replace
Defective contact or disconnection in wiring harness between M06 (female) (10) and L103 (female) (2)	Repair or replace
Defective speedometer sensor 2	Replace

ET-3 Related electric circuit diagram



ET-4 ATM error E14 (Disconnection in accelerator potentiometer) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adaptor is inserted, or when the T-adaptor is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ If this error is displayed when the accelerator is depressed fully, the installation of the accelerator potentiometer is defective (the voltage when the accelerator is at low idling must be as shown in Table 1).

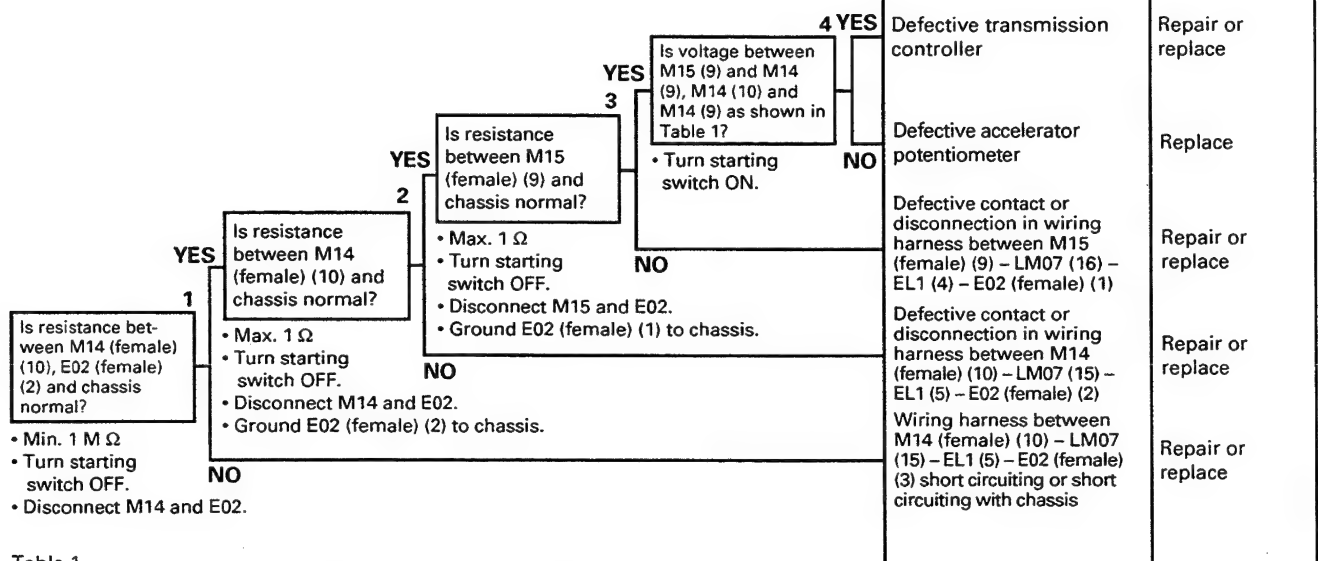


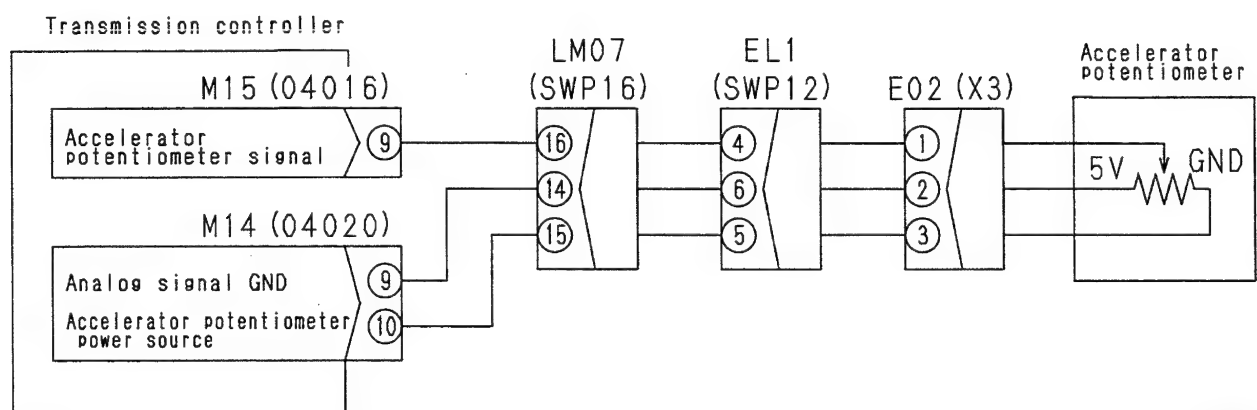
Table 1

M14, M15	E02	Voltage
		0.5 - 4.75 V
Between M15 (9) - M14 (9)	Between (1) - (3)	4.3 - 4.75 V (accelerator at low idling)
		0.5 - [low idling voltage - 2.1V] (accelerator at high idling)
Between M14 (10) - M14 (9)	Between (2) - (3)	4.75 - 5.25 V

The table above shows the standard value for the potentiometer voltage where the controller can recognize the throttle range normally. When adjusting the potentiometer, leave a margin for the error judgment range.

In particular, the error judgment range is close at low idling, so adjust it at 4.3 - 4.6 V.

ET-4 Related electric circuit diagram



TVL00942

ET-5 ATM error E17 (Disconnection in shift lever) is displayed

★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.

★ When there is no S-NET error.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

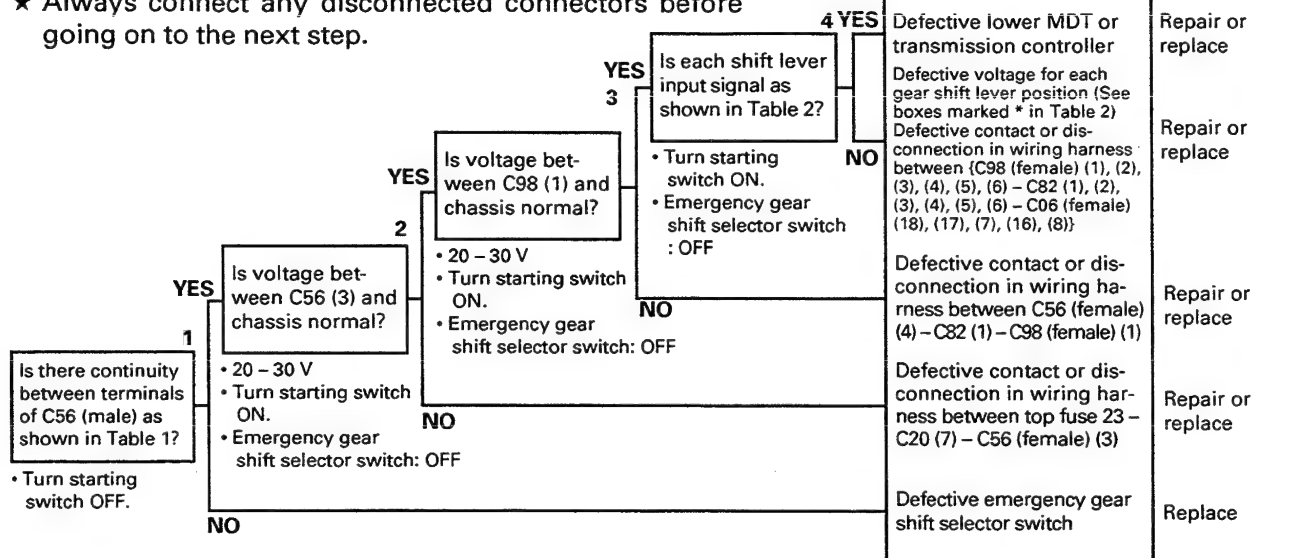


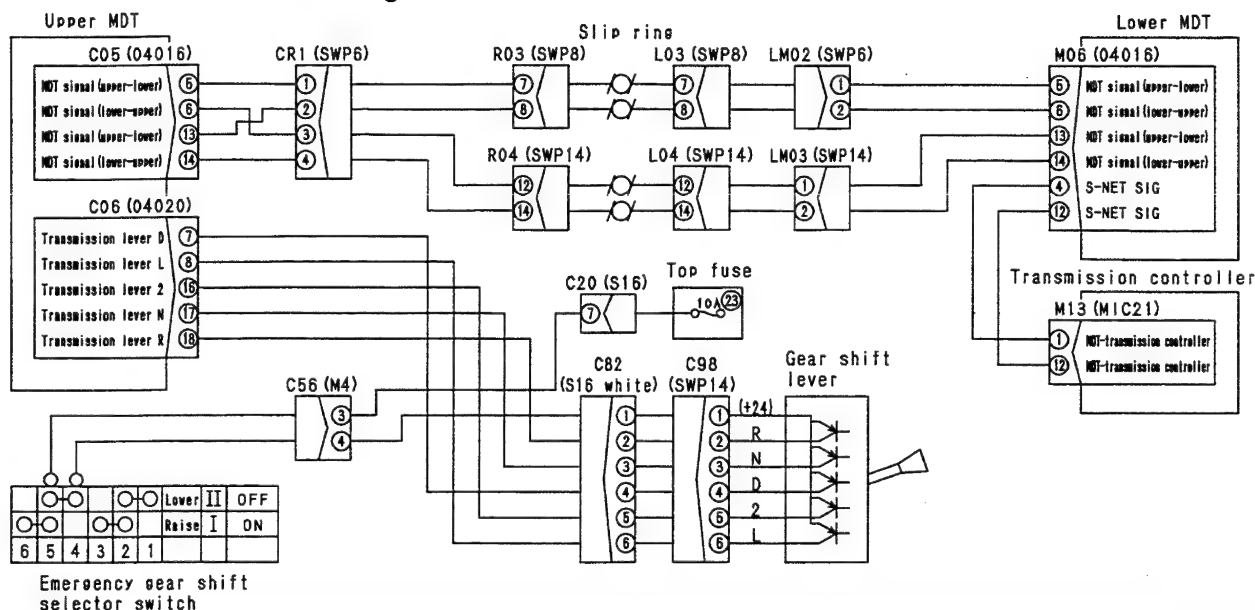
Table 1 Continuity between terminals of C56 (male) and emergency gear shift selector switch

6	5	4	3	2	1	Switch position
○	○		○	○		Raise I ON
	○	○		○		Lower II OFF
④	③	②	①			C56 (male)

Table 2 Each shift lever input signal (voltage)

Terminal	Shift lever position	R	N	D	2	L
Between C06 (18) – chassis		20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (17) – chassis		Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (7) – chassis		Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V
Between C06 (16) – chassis		Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V
Between C06 (8) – chassis		Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)

ET-5 Related electric circuit diagram



TKL00608

ET-6 ATM error E18 (Disconnection in F/R/N signal for interlock) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ When there is no shift lever disconnection error (ATM error E17).
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1 YES

Is voltage between M14 (1),(2),(3) – chassis for each gear shift lever position as shown in Table 1?

NO

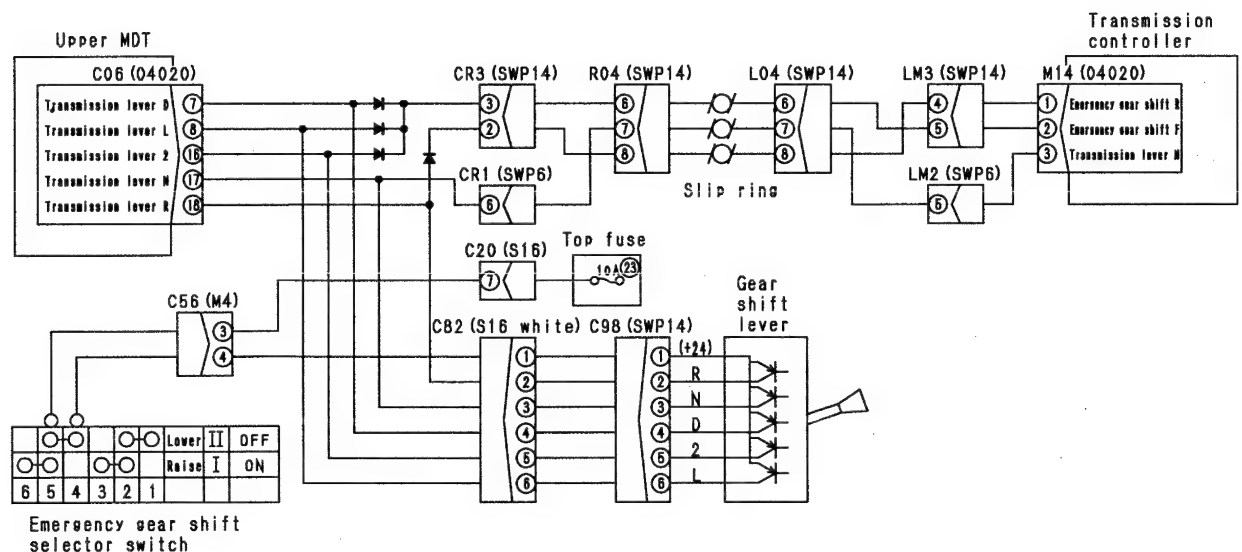
- Turn starting switch ON.
- Emergency gear shift selector switch: OFF

Cause	Remedy
Defective lower MDT or transmission controller	Repair or replace
Defective voltage for each gear shift lever position (See boxes marked ★ in Table 1)	Repair or replace
Defective contact or disconnection in wiring harness (from M14 (female) (1), (2), (3) – L04 (8), (6), (7) – (slip ring) – R04 (8), (6), (7) – CR3 (2), (3), CR1 (6) up to connecting point between C06 and C82)	Repair or replace

Table 2 Each shift lever input signal (voltage)

Terminal \ Shift lever position	R	N	D	2	L
Between M14 (1) – chassis	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V
Between M14 (2) – chassis	Max. 1 V	Max. 1 V	20 – 30 V (★)	20 – 30 V (★)	20 – 30 V (★)
Between M14 (3) – chassis	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V

ET-6 Related electric circuit diagram



TKL00609

ET-7 ATM error E19 (Abnormality in input for transmission solenoid power source monitor) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ When there is no PTO mode not-matching error (MDTL error EE0) or transmission solenoid system disconnection error (ATM error E80 - E84, 88 - 89).
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that bottom fuse III-(9) is normal.
- ★ If it is impossible to travel in the travel mode, transmission solenoid power source (M13 (17)) is not being supplied.

Is ATM error E19 displayed when transmission solenoid power source relay M34 is interchanged with other relay of same type?

1 YES

• Turn starting switch ON.

• PTO switch: Travel or Operation 1

Is voltage between M14 (4) and chassis normal? with

- 20 – 30 V
- Turn starting switch ON.
- PTO switch: Travel or Operation 1

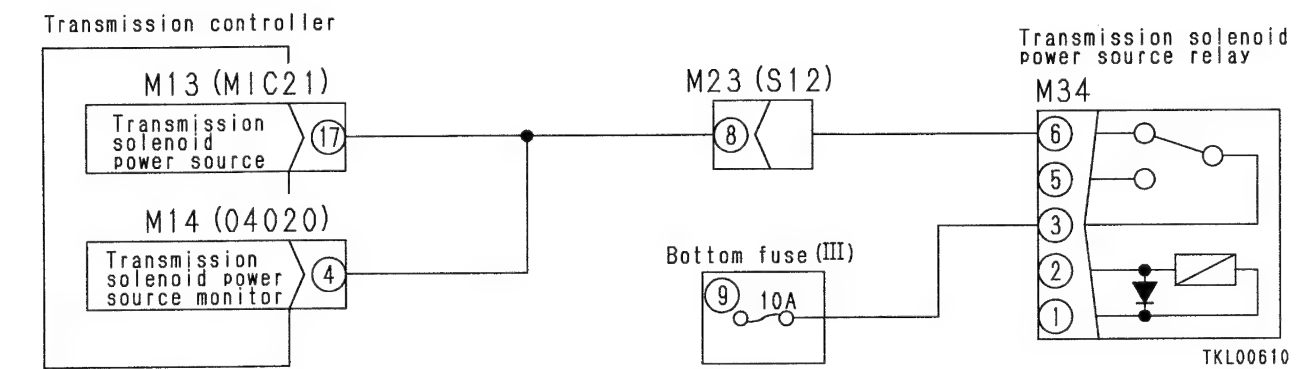
2 YES

NO

Cause	Remedy
Defective contact or disconnection in wiring harness between M14 (female) (4) and connecting point of M13 (female) (17) and M23 (female) (8)	Repair or replace
Defective contact or disconnection in wiring harness between bottom fuse III (9) and M34 (female) (3)	Repair or replace
Defective transmission solenoid power source relay	Replace

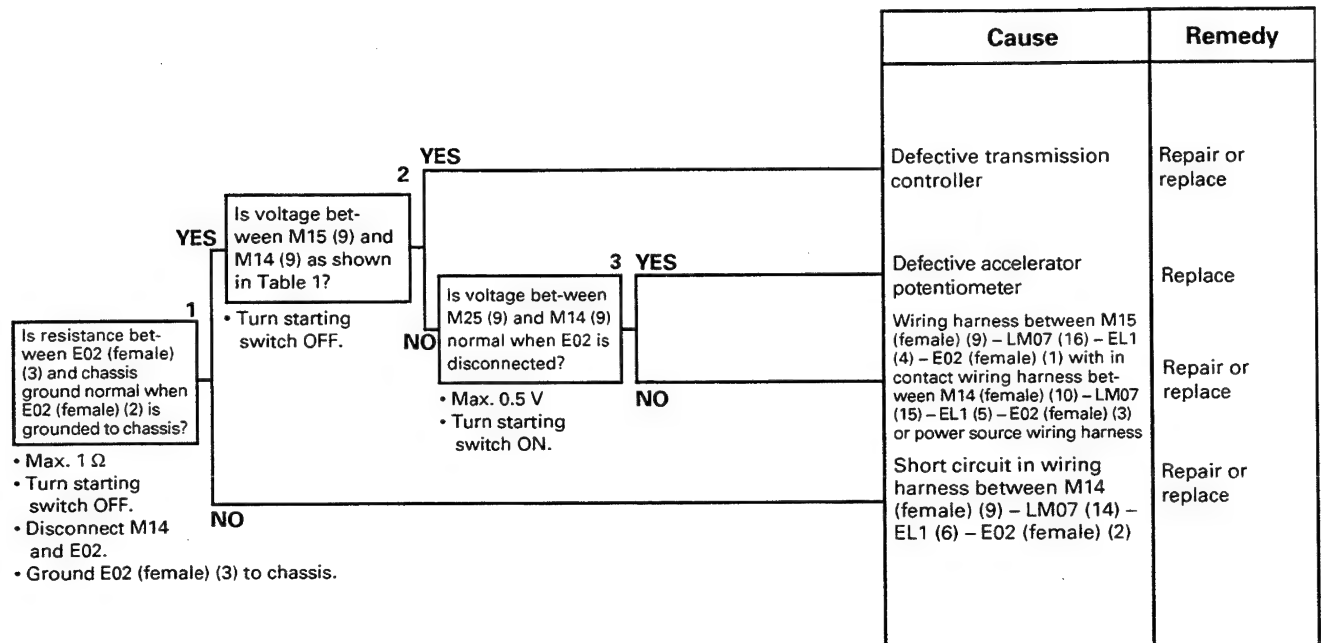
023S02

ET-7 Related electric circuit diagram

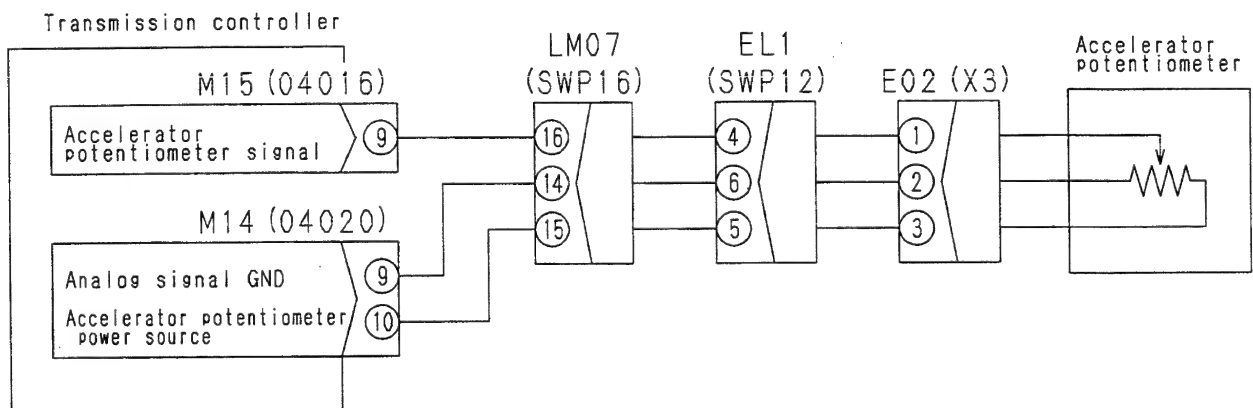


ET-8 ATM error E24 (Accelerator potentiometer short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error code is given when an accelerator potentiometer input signal of 4.75 V or more is detected.



ET-8 Related electric circuit diagram



TKL00607

ET-9 ATM error E25 (Abnormality in emergency gear shift switch or abnormality in PTO switch) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ When there is no PTO mode not-matching error (MDTL error EE0).
- ★ (1) If it is detected in the travel mode: Defective emergency gear shift switch or Operation 2 (PTO 2) switch
- ★ (2) If it is detected in the emergency gear shift mode or Operation 2 (PTO 2) mode: Defective transmission power source system (See ATM error E19.)

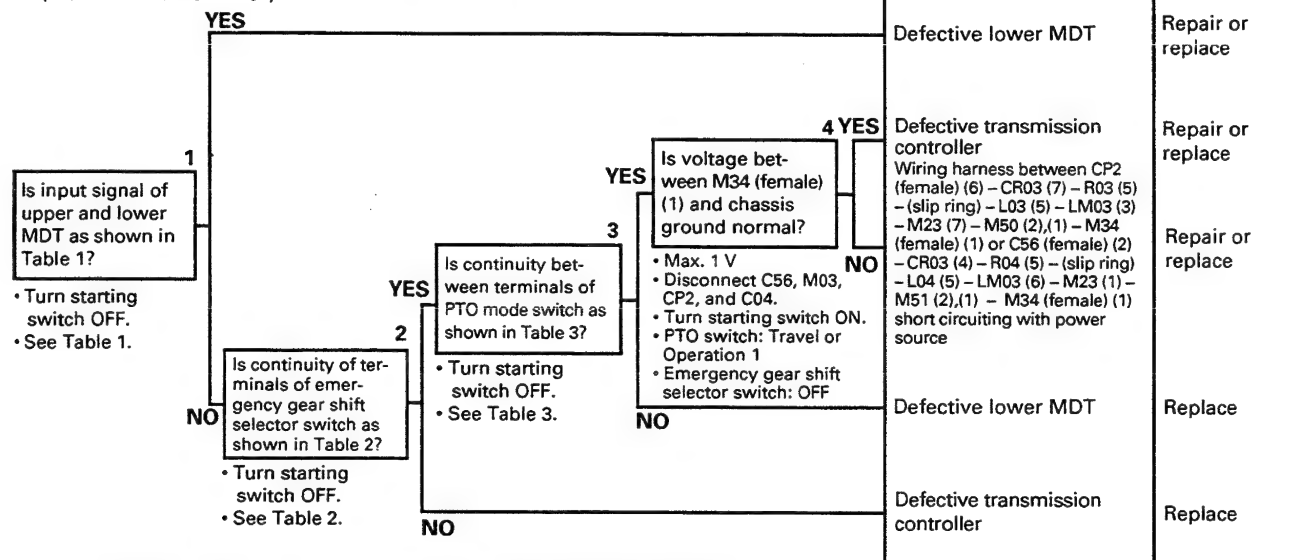


Table 1 Input signal of upper and lower MDT (voltage)

Table 2 Continuity between terminals of C56 (male) and emergency gear shift selector switch

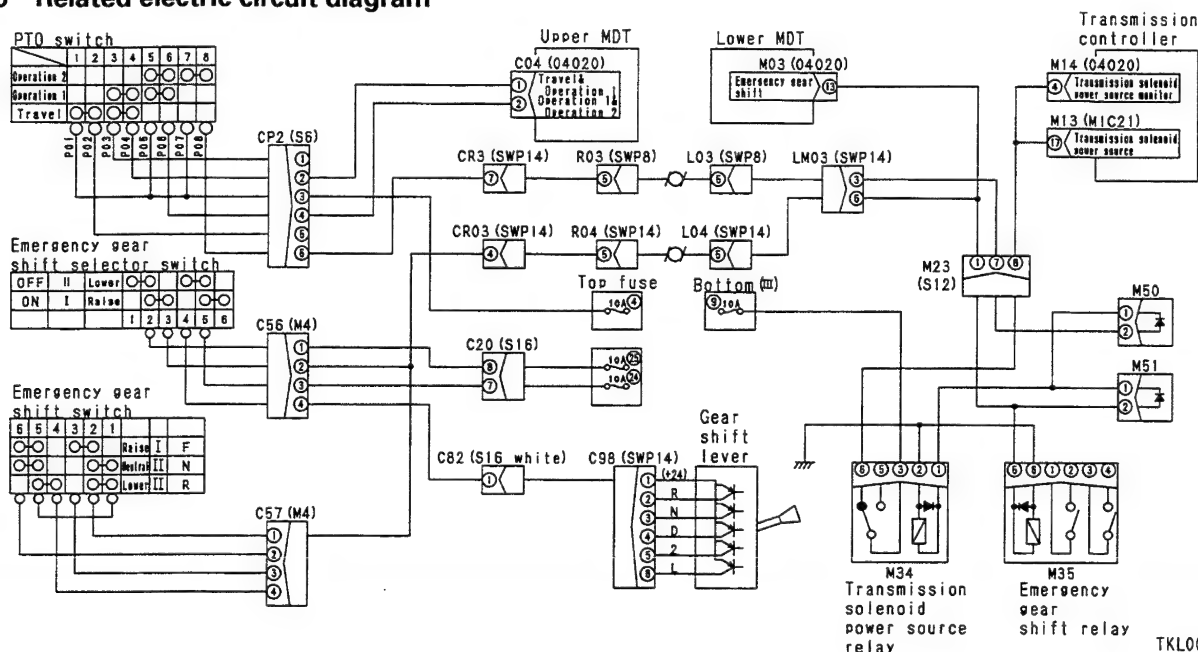
Table 3 (Resistance value between terminals of PTO mode switch)

	Between C04 (1) – chassis	Between C04 (2) – chassis	Between M03 (13) – chassis
PTO switch: Travel or Operation 1	20–30 V	20–30 V	—
Emergency gear shift selector switch: OFF	—	—	Max. 1V

6	5	4	3	2	1	Switch position
○			○			Raise I ON
	○			○		Lower II OFF
③	④	②	①			C56 (male)

Terminal	P01	P02	P03	P04	P05	P06	P07	P08
Operation 2					○			○
Operation 1			○		○			
Travel	○		○					
Switch terminal	①	②	③	④	⑤	⑥	⑦	⑧

ET-9 Related electric circuit diagram



ET-10 ATM error E32 (Abnormality in speed sensor 1) is displayed

⚠ Check carefully that there is no one in the surrounding area before starting troubleshooting.

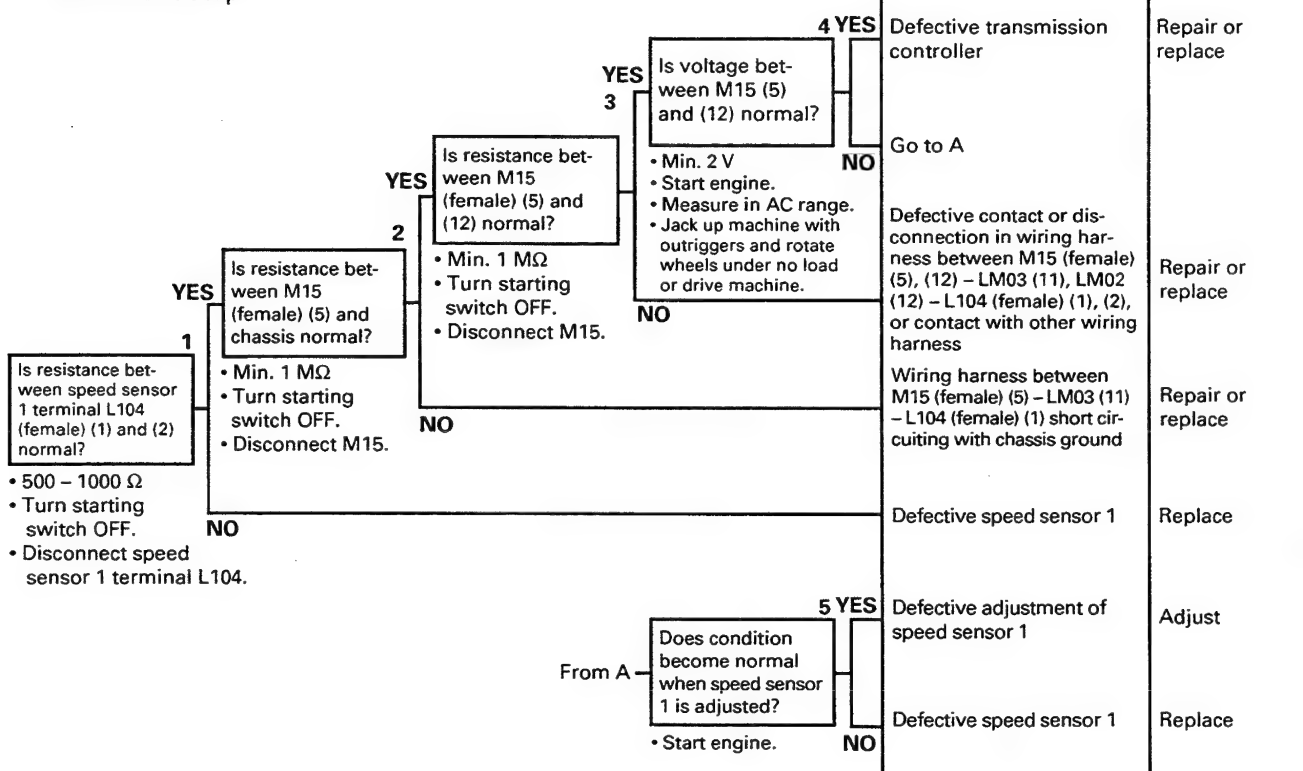
★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.

★ For disconnection, see other error code (ATM error E12).

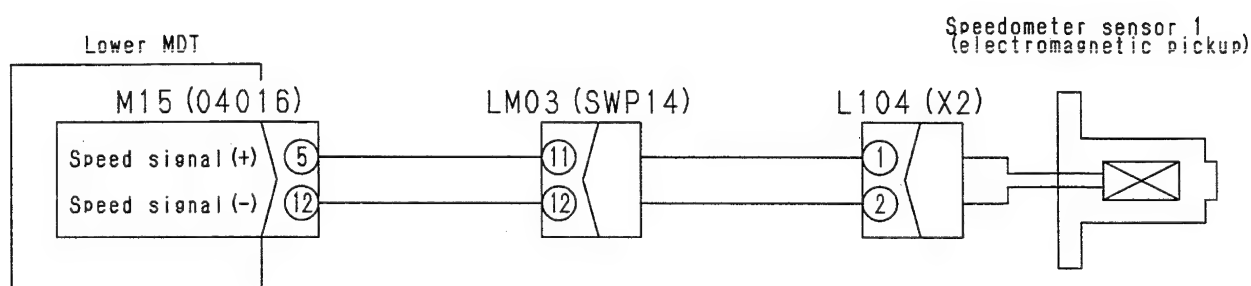
★ When there is no S-NET error.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.



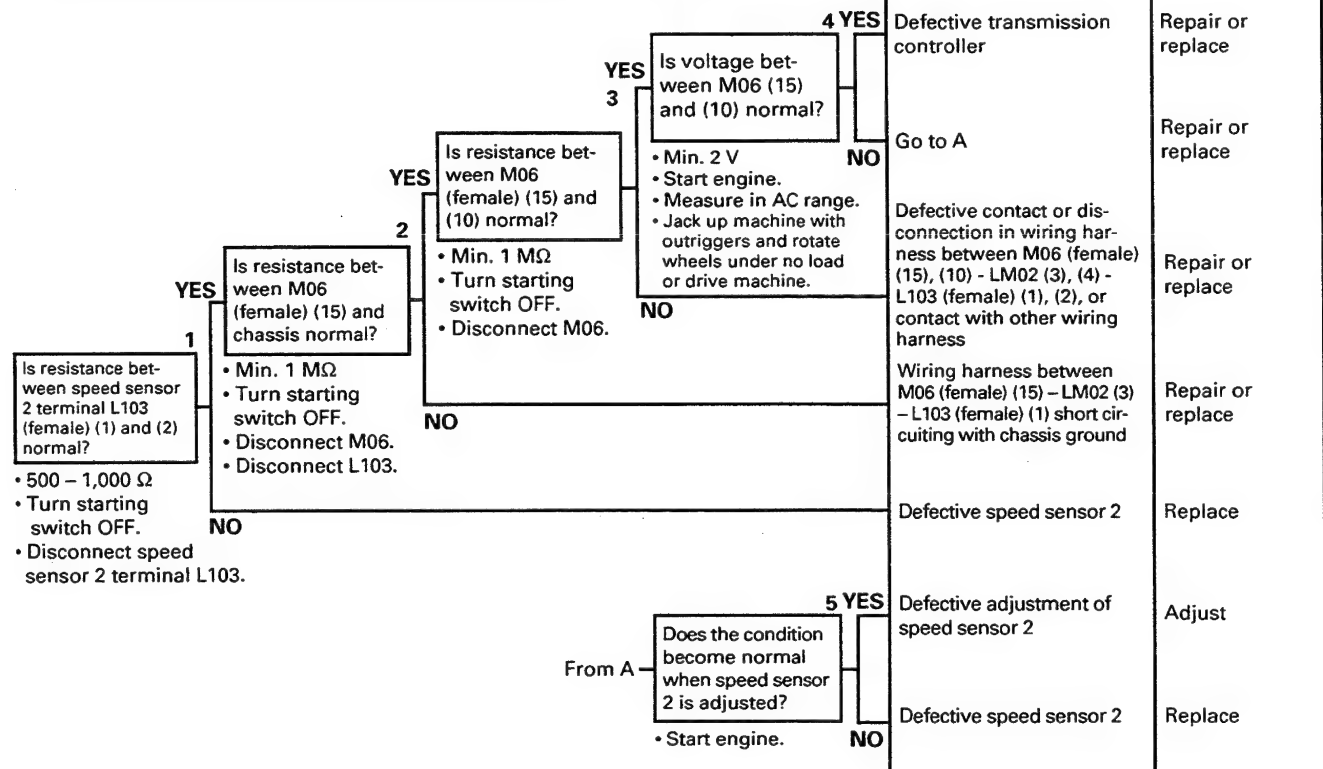
ET-10 Related electric circuit diagram



TKL00605

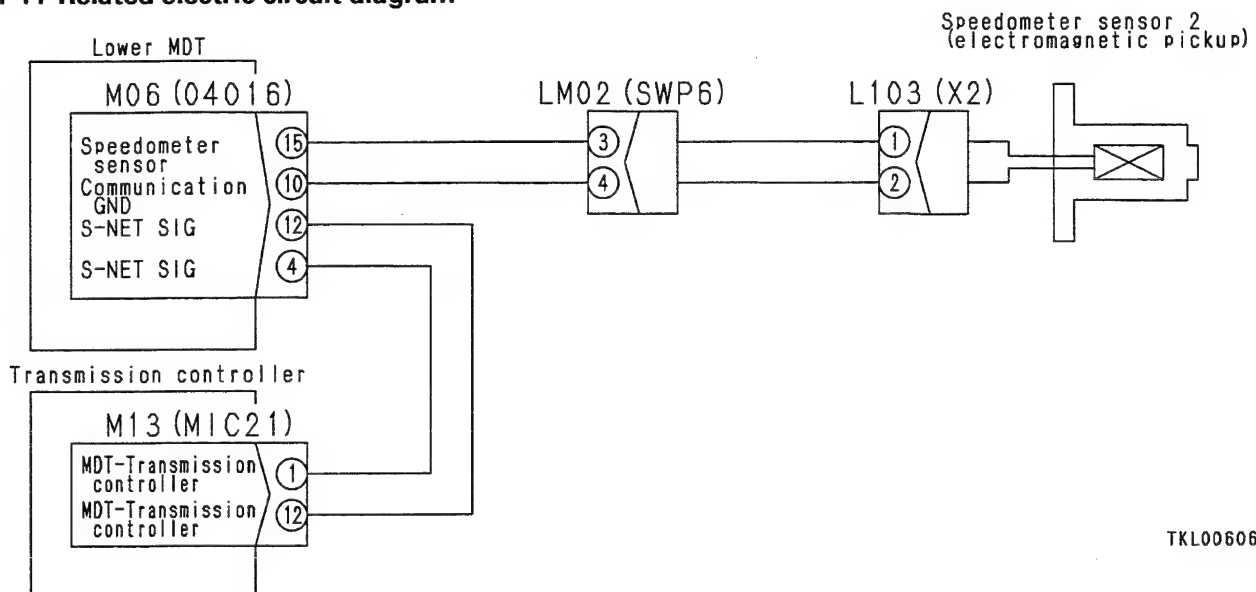
ET-11 ATM error E33 (Abnormality in speed sensor 2) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adaptor is inserted, or when the T-adaptor is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ For disconnection, see other error code (ATM error E13).
- ★ When there is no S-NET error.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Speed sensor signal 2 is received by the lower MDT and is sent to the transmission controller through the S-NET.



023S02

ET-11 Related electric circuit diagram



TKL00606

ET-12 ATM error E35 (Abnormality in interlock signal F,R [MDT at other than N with interlock signal N]) is displayed

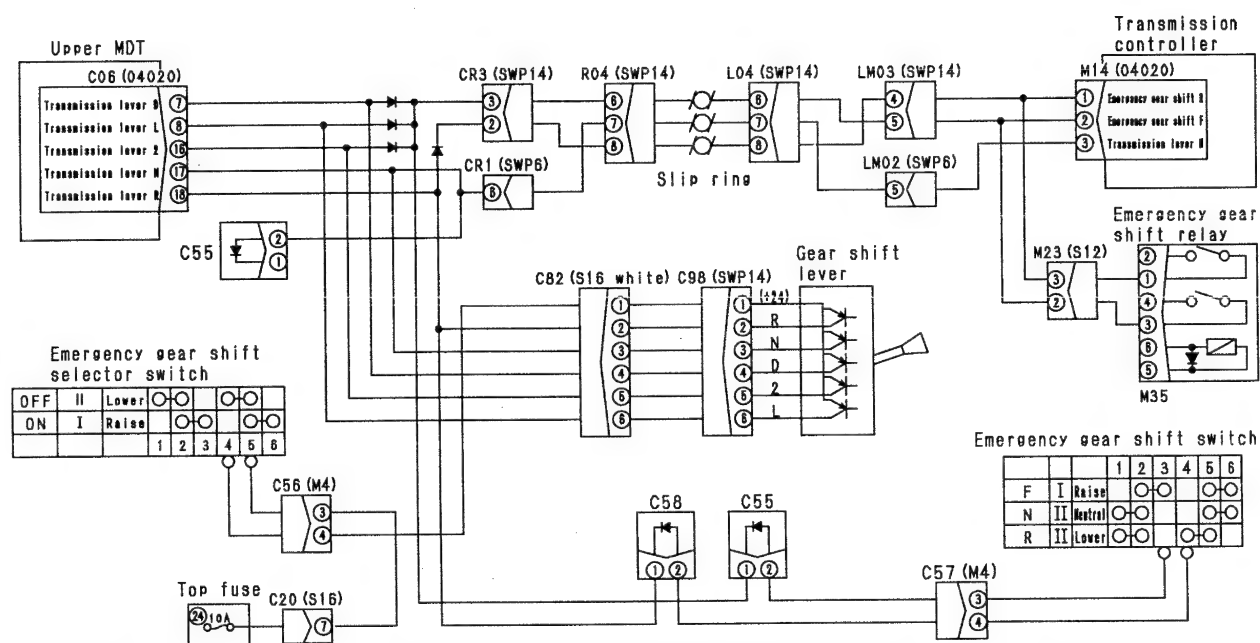
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ If this error code is displayed, the interlock signal N is given maximum priority, so it becomes Neutral (output).

		Cause	Remedy
<p>Is each shift lever input signal as shown in Table 1?</p> <p>YES</p> <p>1</p> <p>Is voltage between M14 (3) and chassis normal?</p> <p>NO</p> <p>• Max. 1 V</p> <p>• Shift lever: Any position except N</p> <p>• Turn starting switch ON.</p> <p>• Disconnect C06, C98, and M14.</p> <p>NO</p> <p>• Turn starting switch ON.</p> <p>• Emergency gear shift selector switch: OFF</p>	2 YES	Defective lower MDT or transmission controller	Repair or replace
	2 NO	Defective shift lever	Replace

Table 1 Each shift lever input signal (voltage)

Terminal \ Shift lever position	R	N	D	2	L
Between C06 (18) – chassis	20–30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (17) – chassis	Max. 1 V	20–30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (7) – chassis	Max. 1 V	Max. 1 V	20–30 V (★)	Max. 1 V	Max. 1 V
Between C06 (16) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	20–30 V (★)	Max. 1 V
Between C06 (8) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V	20–30 V (★)

ET-12 Related electric circuit diagram



TKL00612

ET-13 ATM error E37 (Abnormality in shift lever [2 or more signals ON]) is displayed

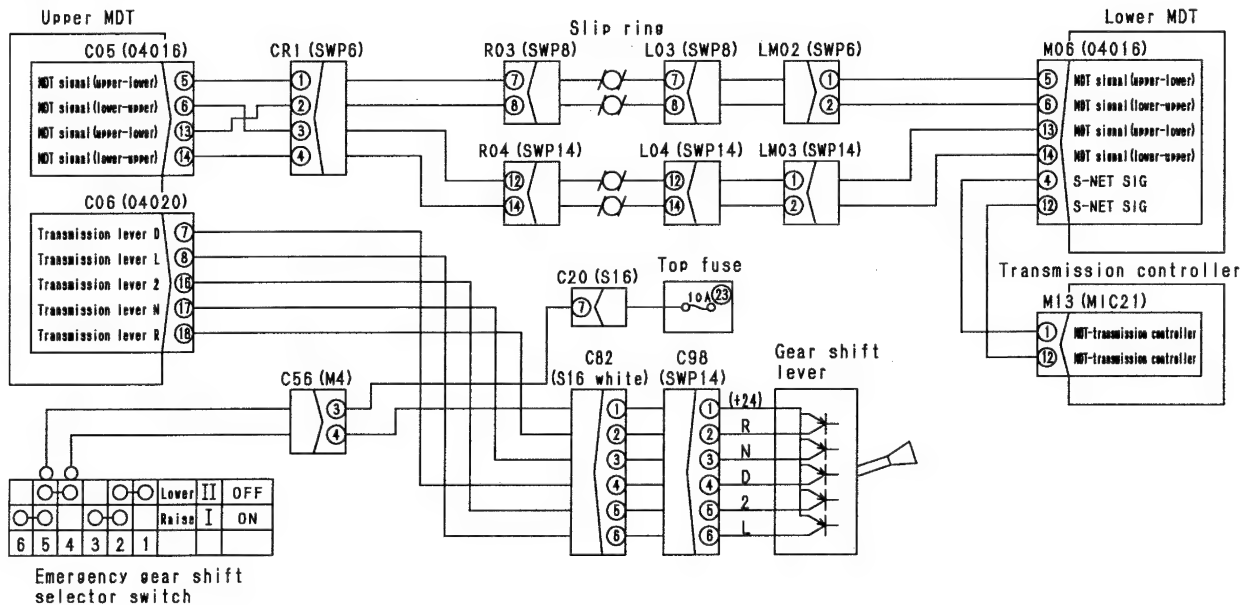
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ For disconnection, see other error code (ATM error E17).
- ★ When there is no C-NET error or S-NET error.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This error code is given when the upper MDT receives 2 or more gear shift lever signals.

	Cause	Remedy
<div> <div>1 YES</div> <div>Is each shift lever input signal as shown in Table 1?</div> </div>	<div>Defective lower MDT or transmission controller</div> <div>Defective voltage for each gear shift lever position (See boxes marked ★ in Table 1)</div> <div>Wiring harness between (C98 (female) (1), (2), (3), (4), (5), (6) – C82 (1), (2), (3), (4), (5), (6) – C06 (female) (18), (17), (7), (16), (8)) short circuiting with power source or defective shift lever</div>	<div>Repair or replace</div> <div>Repair or replace</div>
<div> <div>NO</div> <div> • Turn starting switch ON. • Emergency gear shift selector switch: OFF • Except for the boxes marked ★, there should be no voltage. </div> </div>		

Table 1 Each shift lever input signal (voltage)

Terminal \ Shift lever position	R	N	D	2	L
Between C06 (18) – chassis	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (17) – chassis	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (7) – chassis	Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V
Between C06 (16) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V
Between C06 (8) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)

ET-13 Related electric circuit diagram



TKL00608

ET-14 ATM error E38 (Interlock F + R signals input simultaneously) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ If this error code is generated, it is possible to judge only from the lever signal from the MDT, and to drive the machine.

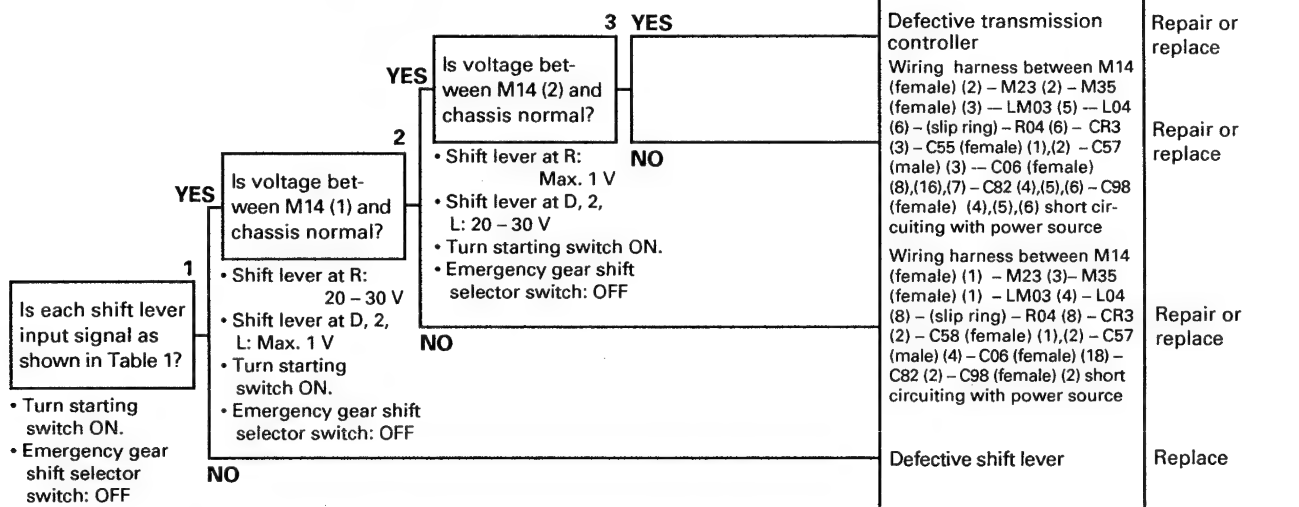
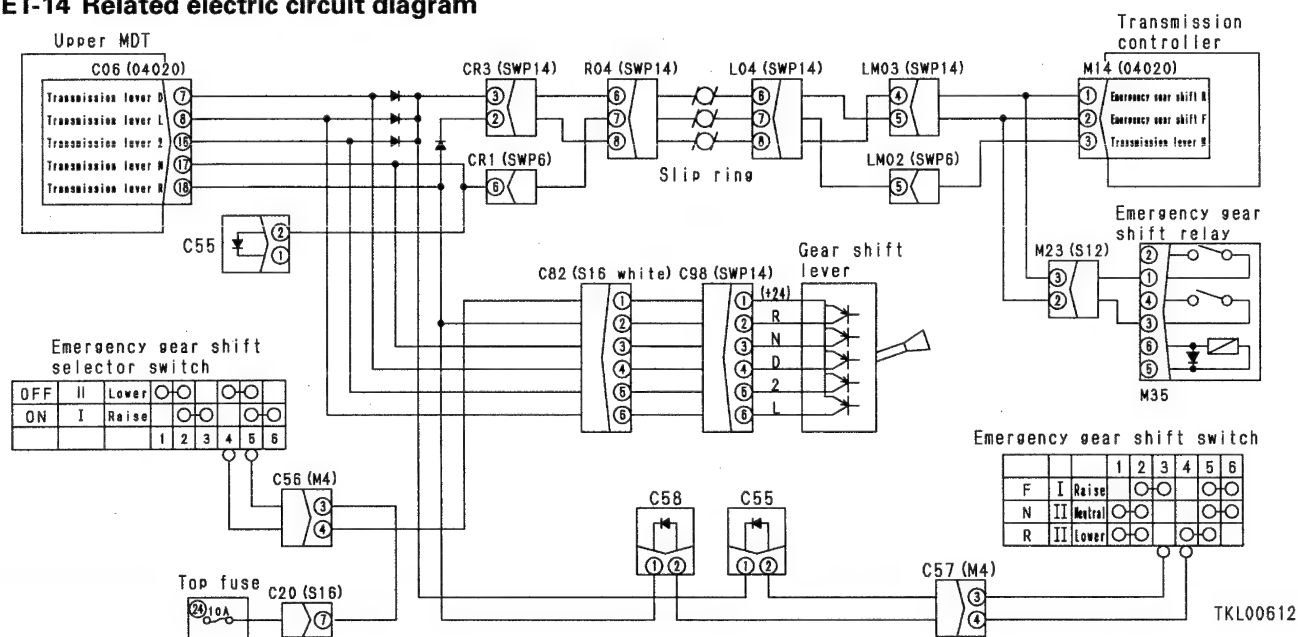


Table 1 Each shift lever input signal (voltage)

Terminal \ Shift lever position	R	N	D	2	L
Between C06 (18) – chassis	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (17) – chassis	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (7) – chassis	Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V
Between C06 (16) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V
Between C06 (8) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)

ET-14 Related electric circuit diagram



ET-15 ATM error E39 (Interlock signal F/R but lever signal N is input [MDT at N]) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
| | |

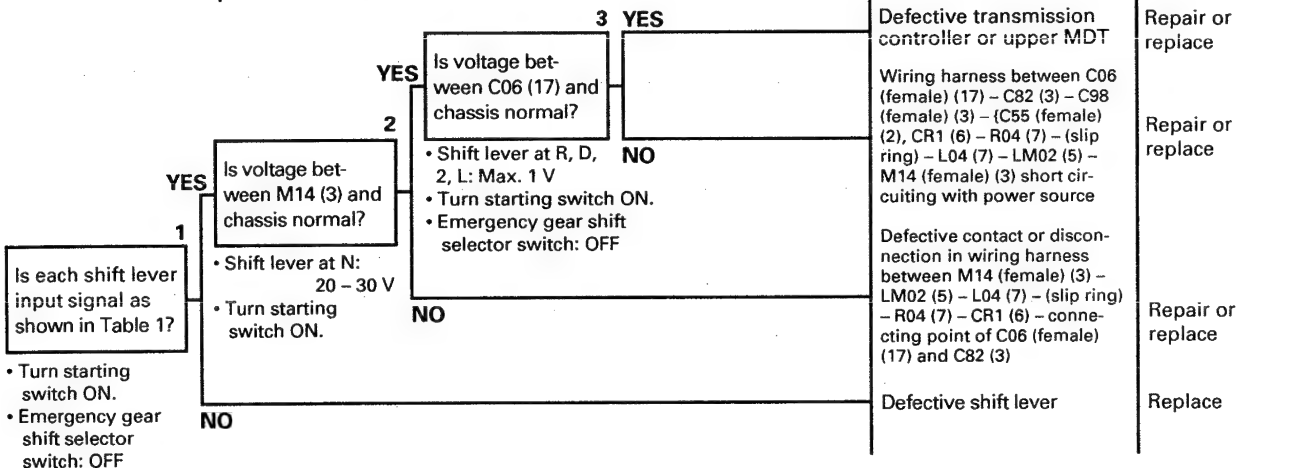
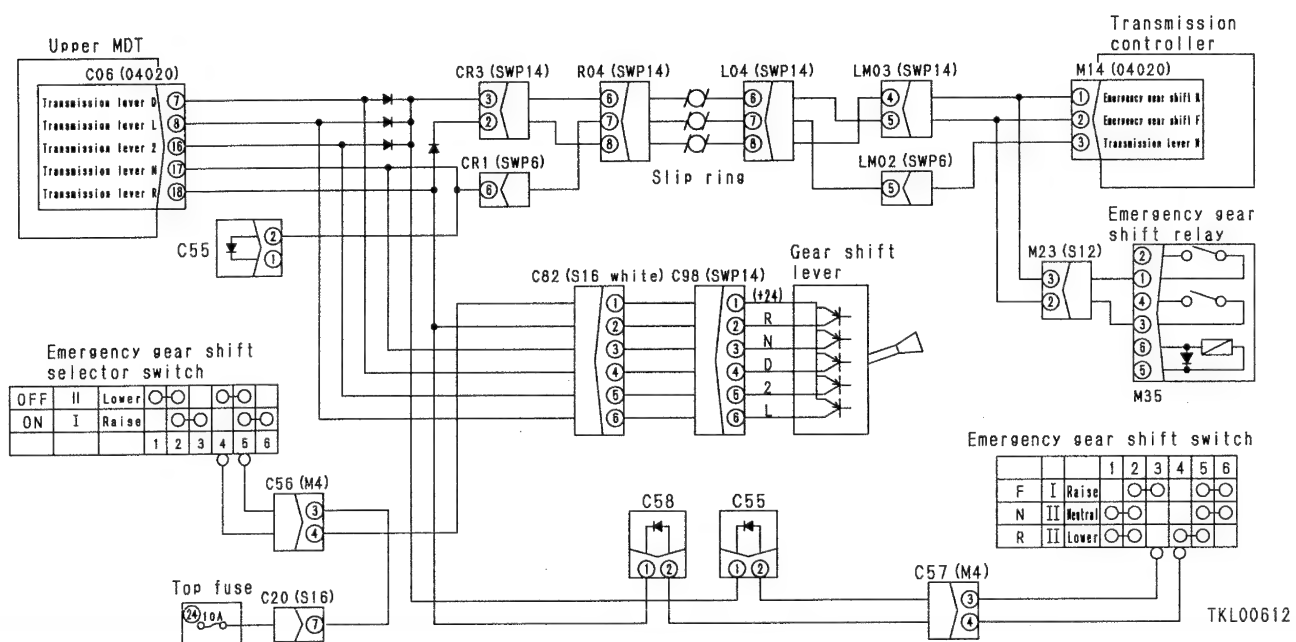


Table 1 Each shift lever input signal (voltage)

Terminal \ Shift lever position	R	N	D	2	L
Between C06 (18) – chassis	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (17) – chassis	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V	Max. 1 V
Between C06 (7) – chassis	Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V	Max. 1 V
Between C06 (16) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)	Max. 1 V
Between C06 (8) – chassis	Max. 1 V	Max. 1 V	Max. 1 V	Max. 1 V	20 – 30 V (★)

ET-15 Related electric circuit diagram

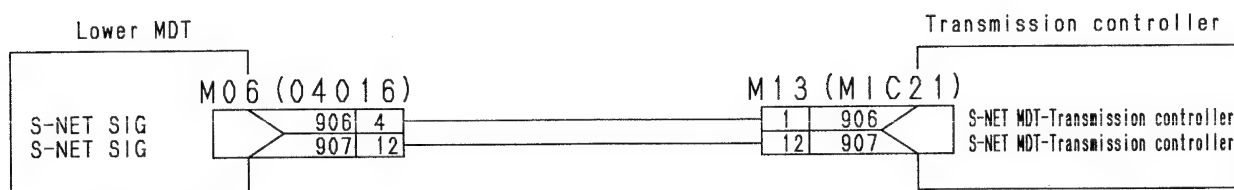


ET-16 ATM error E3F (Abnormality in S-NET) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
023S02	1	Is resistance between M06 (female) (4) and M13 (female) (1) normal?	
	YES	• Max. 1 Ω • Turn starting switch OFF. • Disconnect M06 and M13.	
	NO		
	2	Is resistance between M06 (female) (12), M13 (female) (12) and chassis normal?	
	YES	• Min. 1 MΩ • Turn starting switch OFF. • Disconnect M06 and M13.	
	NO		
	3	Is resistance between M06 (female) (12), M13 (female) (12) and chassis normal?	
	YES		Defective lower MDT or transmission controller
	NO		Wiring harness between M06 (female) (12) and M13 (female) (12) short circuiting with chassis ground
			Wiring harness between M06 (female) (4) and M13 (female) (1) short circuiting with chassis ground
			Defective contact or disconnection in wiring harness between M06 (female) (4) – M13 (female) (1) or M06 (female) (12) – M13 (female) (12)
			Repair or replace
			Repair or replace
			Repair or replace
			Repair or replace

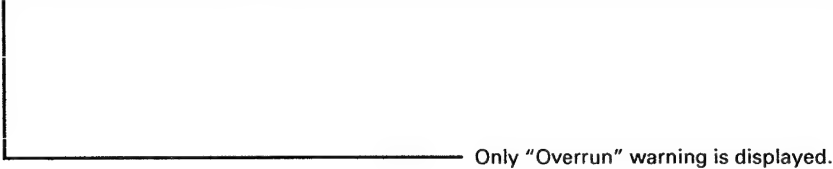
ET-15 Related electric circuit diagram



TKL00613

ET-17 ATM error E53 (Overrun) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

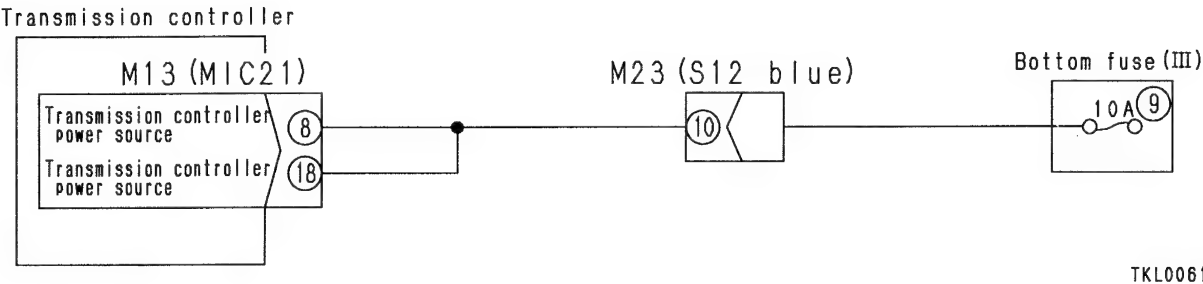


ET-18 ATM error E55 (Drop in battery voltage) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that bottom fuse III-(9) is normal.

		Cause	Remedy
<div> <div>1 YES</div> <div>Is voltage between M13 (8), (18) – (9) normal?</div> <div>• 20 – 30 V</div> </div>	YES	Defective transmission controller	Repair or replace
	NO	Defective contact or disconnection in wiring harness between bottom fuse III-(9) – M23 (10) – M13 (female) (8),(18)	Repair or replace

ET-18 Related electric circuit diagram



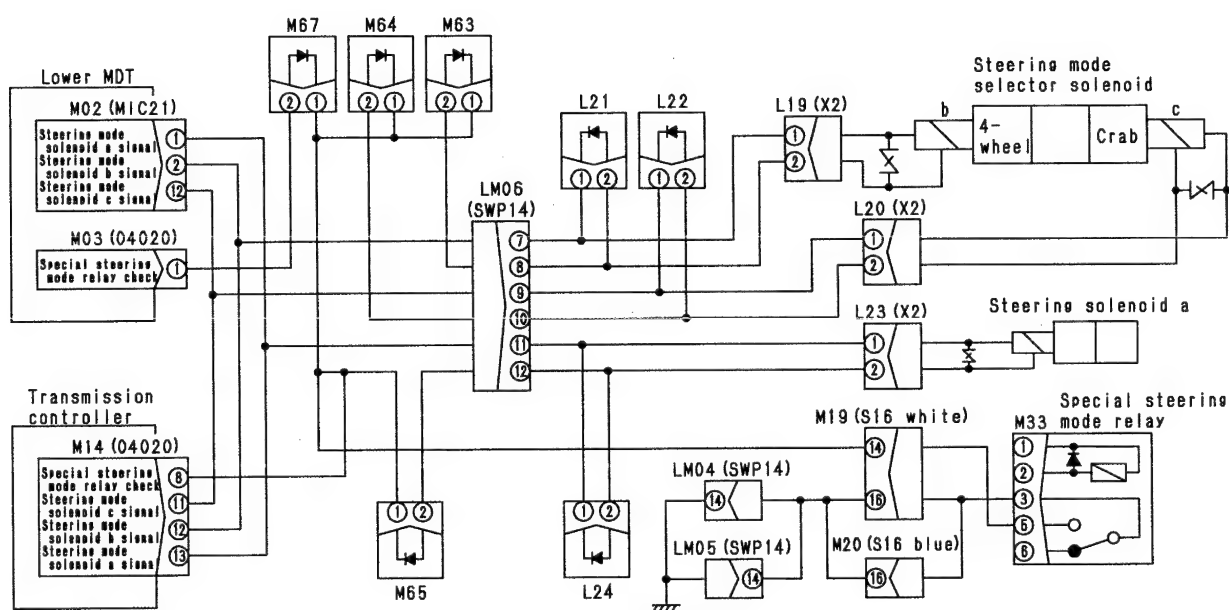
TKL00614

ET-19 ATM error E5A (Special steering system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This is detected in the 1.5 sec. immediately after the starting switch is turned ON.

		Cause	Remedy
<p>Is ATM error E5A displayed when interchanged with other relay and wiring harness of same type?</p> <p>1 YES</p> <p>2 YES</p> <p>Is resistance between M14 (female) (8), M33 (female) (5) and chassis normal?</p> <p>• Min. 1 MΩ</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M14, M33, and M03.</p> <p>NO</p> <p>NO</p> <p>• Turn starting switch OFF.</p> <p>• Interchange with other relay and wiring harness of same type.</p> <p>• Turn starting switch ON.</p>	YES	Defective upper MDT	Repair or replace
	NO	Wiring harness between M14 (female) (8) – M65 (female) (1) – M67 (female) (1) – M19 (14) – M33 (female) (5) short circuiting with chassis ground	Repair or replace
	NO	Defective special steering relay	Replace

ET-19 Related electric circuit diagram



TKL00615

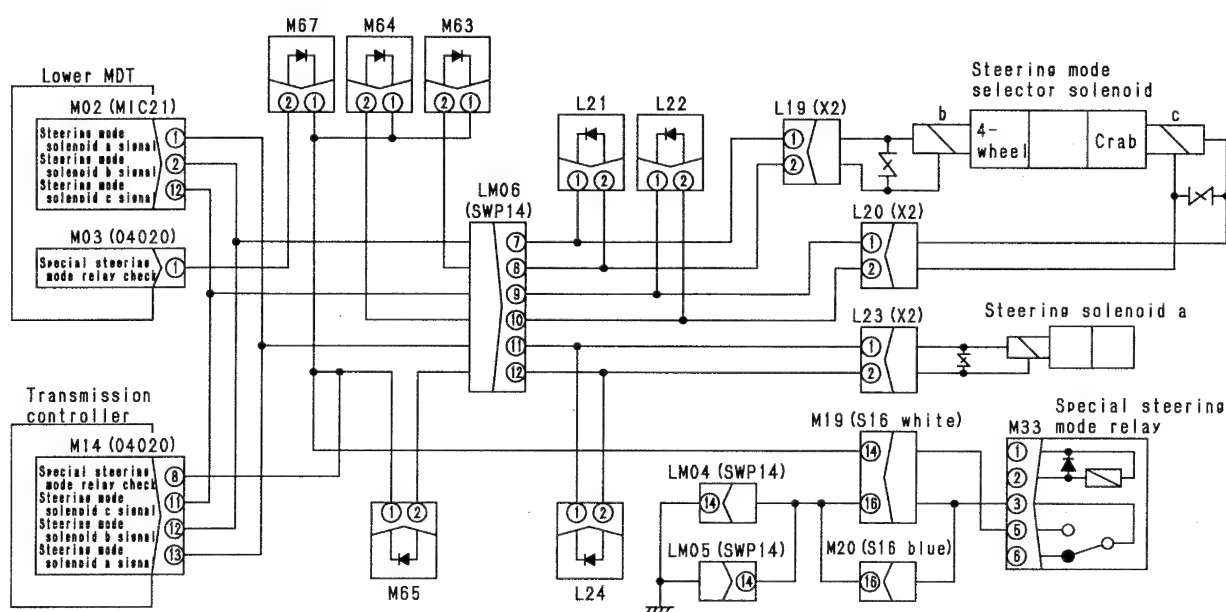
ET-20 ATM error E5B (Disconnection in special steering system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<p>1 YES</p> <p>Is ATM error E5B displayed when interchanged with other relay and wiring harness of same type?</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Interchange with other relay and wiring harness of same type. • Turn starting switch ON. <p>NO</p> <p>2 YES</p> <p>Is voltage between M14 (female) (8) and chassis normal?</p> <ul style="list-style-type: none"> • Max. 1 V • Turn starting switch ON. <p>NO</p> <p>3 YES</p> <p>Is resistance between M33 (female) (3) and chassis normal?</p> <ul style="list-style-type: none"> • Max. 1 Ω • Turn starting switch OFF. • Disconnect M33. <p>NO</p>	<p>Defective transmission controller</p> <p>Defective contact or disconnection in wiring harness between M33 (female) (3) and chassis</p> <p>Defective contact or disconnection in wiring harness between M14 (female) (8) – M19 (14) – M33 (female) (5)</p> <p>Defective special steering relay</p>	<p>Repair or replace</p> <p>Repair or replace</p> <p>Repair or replace</p> <p>Replace</p>

023S02

ET-20 Related electric circuit diagram



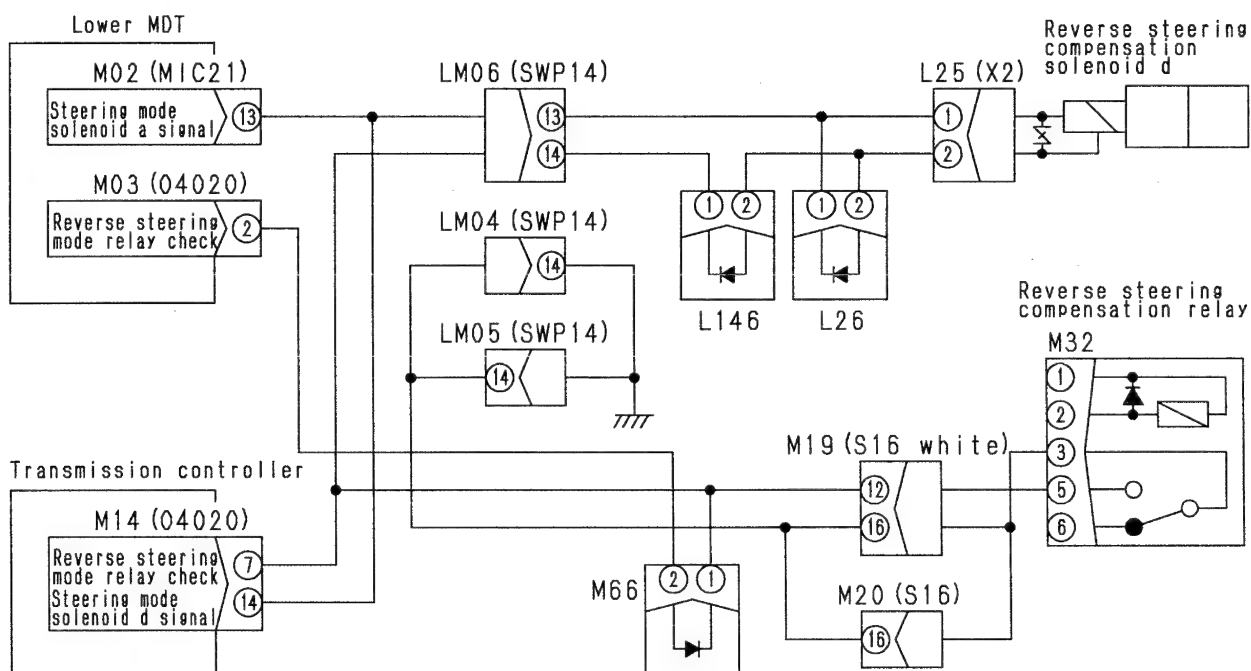
TKL00615

ET-21 ATM error E5C (Reverse steering system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ This is detected in the 1.5 sec. immediately after the starting switch is turned ON.

		Cause	Remedy
<p>1 YES</p> <p>Is ATM error E5C displayed when interchanged with other relay and wiring harness of same type?</p> <p>• Turn starting switch OFF.</p> <p>• Interchange with other relay and wiring harness of same type.</p> <p>• Turn starting switch ON.</p>	<p>2 YES</p> <p>Is resistance between M14 (female) (7), M32 (female) (5) and chassis normal?</p> <p>• Min. 1 MΩ</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect M14, M32, and M03.</p>	Defective upper MDT	Repair or replace
	NO	Wiring harness between M14 (female) (7) – (LM06 (14) – L146 (female) (1) – M66 (female) (1) – M19 (12) – M32 (female) (5) short circuiting with chassis ground	Repair or replace
	NO	Defective reverse steering relay	Replace

ET-21 Related electric circuit diagram



TKL00616

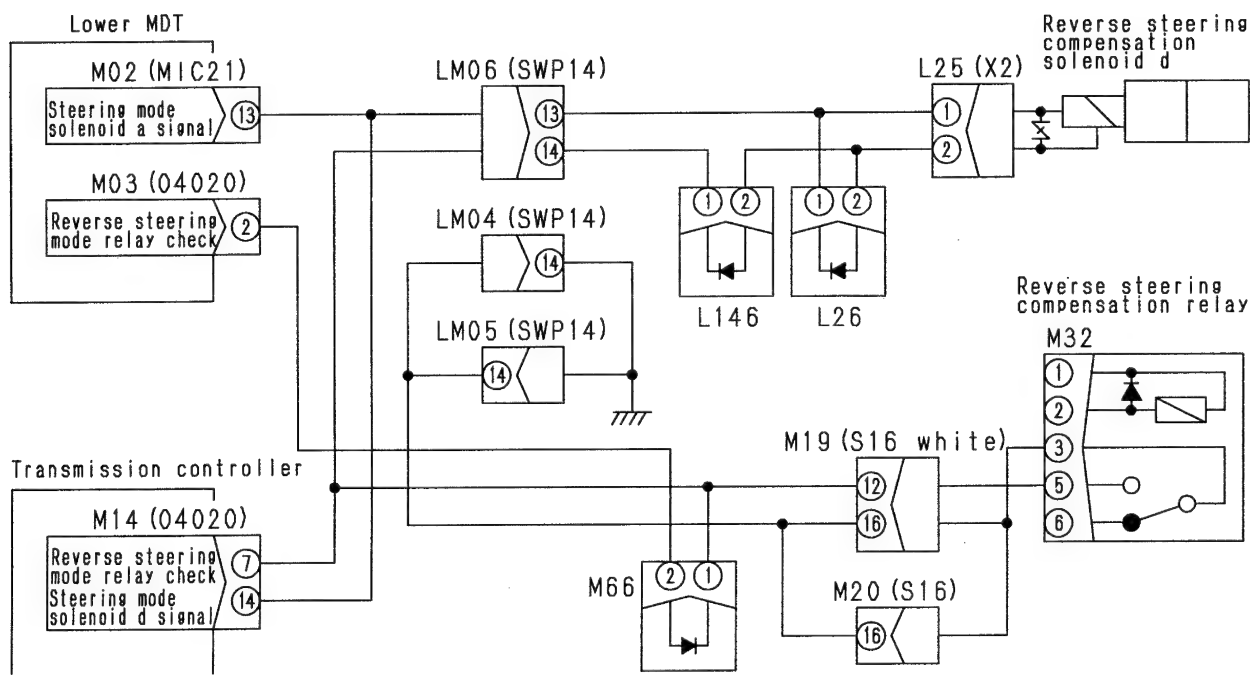
ET-22 ATM error E5D (Disconnection in reverse steering system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

			Cause	Remedy		
<div>1</div> <div>Is ATM error E5D displayed when interchanged with other relay and wiring harness of same type?</div> <div><div>YES</div><div><ul style="list-style-type: none">• Turn starting switch OFF.• Interchange with other relay and wiring harness of same type.• Turn starting switch ON.</div></div> <div>NO</div>			<div>2</div> <div>Is voltage between M14 (female) (7) and chassis normal?</div> <div><div>YES</div><div><ul style="list-style-type: none">• Max. 1 V• Turn starting switch ON.</div></div> <div>NO</div>	<div>3</div> <div>Is resistance between M32 (female) (3) and chassis normal?</div> <div><div>YES</div><div><ul style="list-style-type: none">• Max. 1 Ω• Turn starting switch OFF.• Disconnect M32.</div></div> <div>NO</div>	Defective transmission controller	Repair or replace
			Defective contact or disconnection in wiring harness between M32 (female) (3) and chassis	Repair or replace		
			Defective contact or disconnection in wiring harness between M14 (female) (7) – M19 (12) – M32 (female) (5)	Repair or replace		
			Defective reverse steering relay	Replace		

023S02

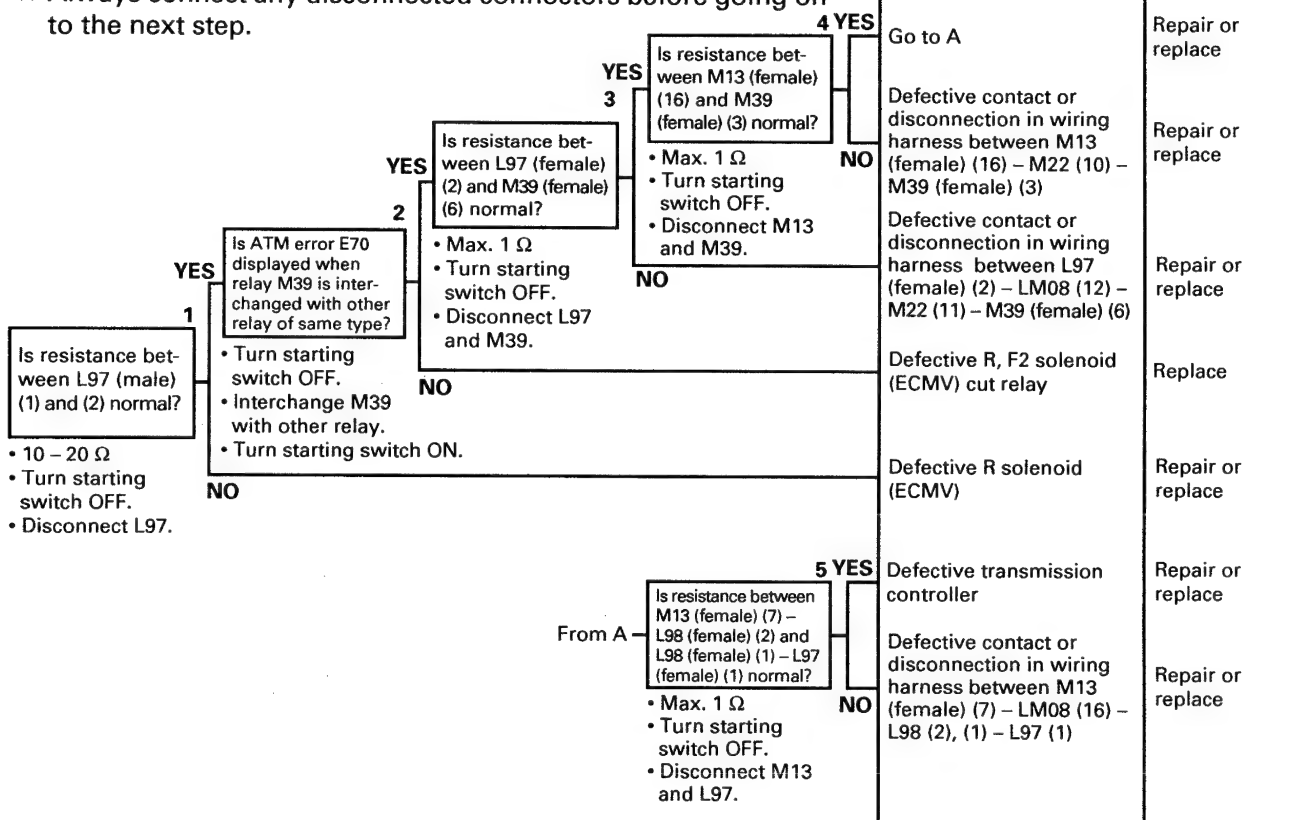
ET-22 Related electric circuit diagram



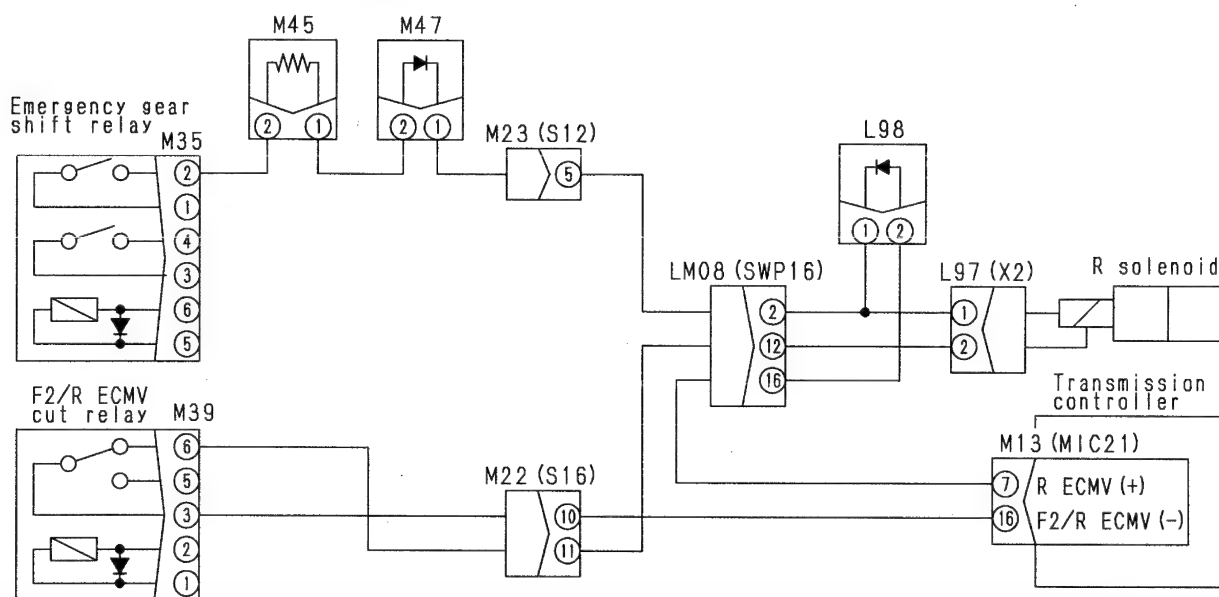
TKL00616

ET-23 ATM error E70 (Disconnection in R solenoid (ECMV) system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



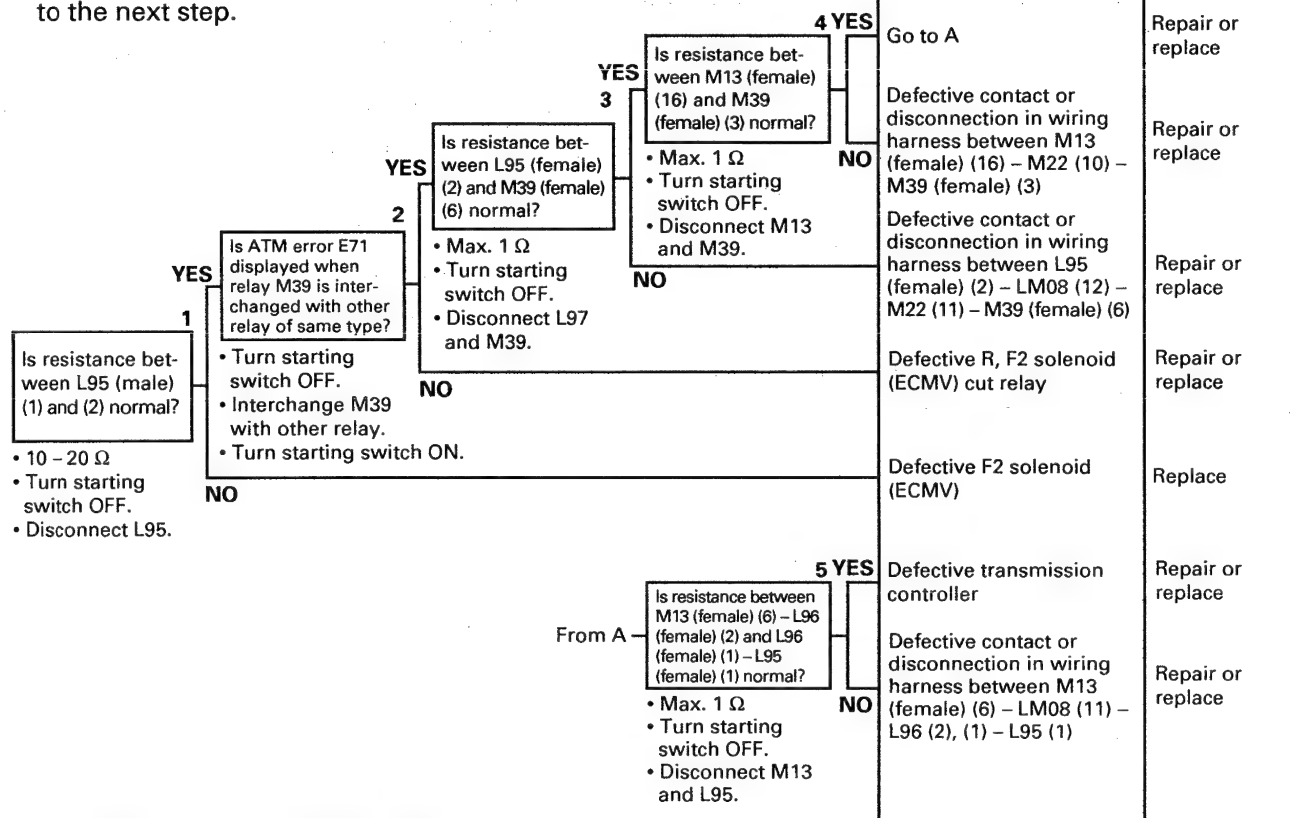
ET-23 Related electric circuit diagram



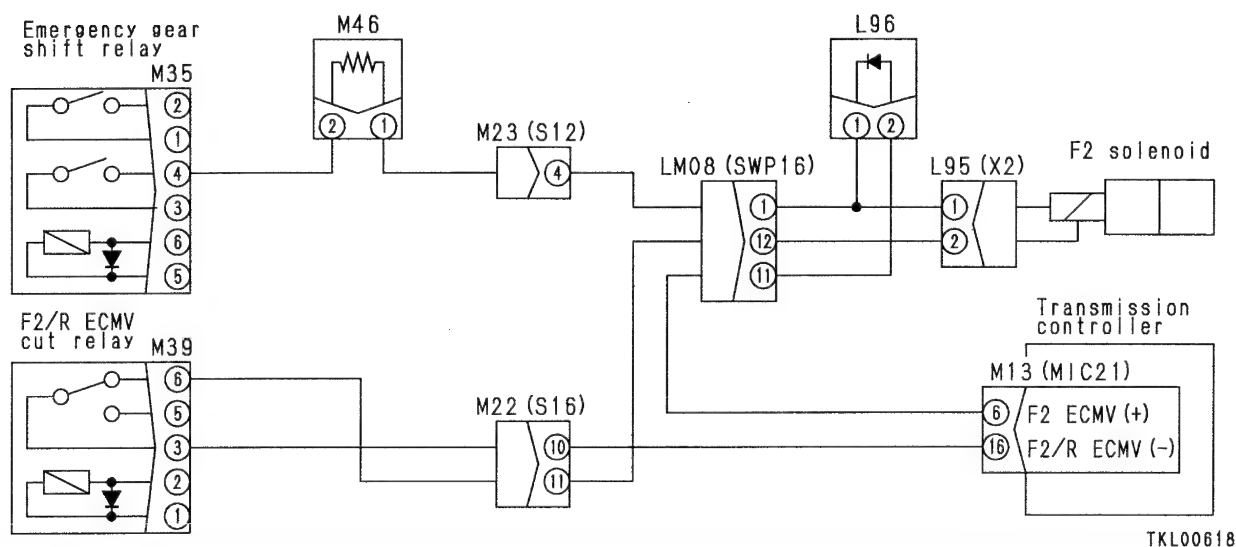
TKL00617

ET-24 ATM error E71 (Disconnection in F2 solenoid (ECMV) system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|-----------|
| | Repair or |



ET-24 Related electric circuit diagram

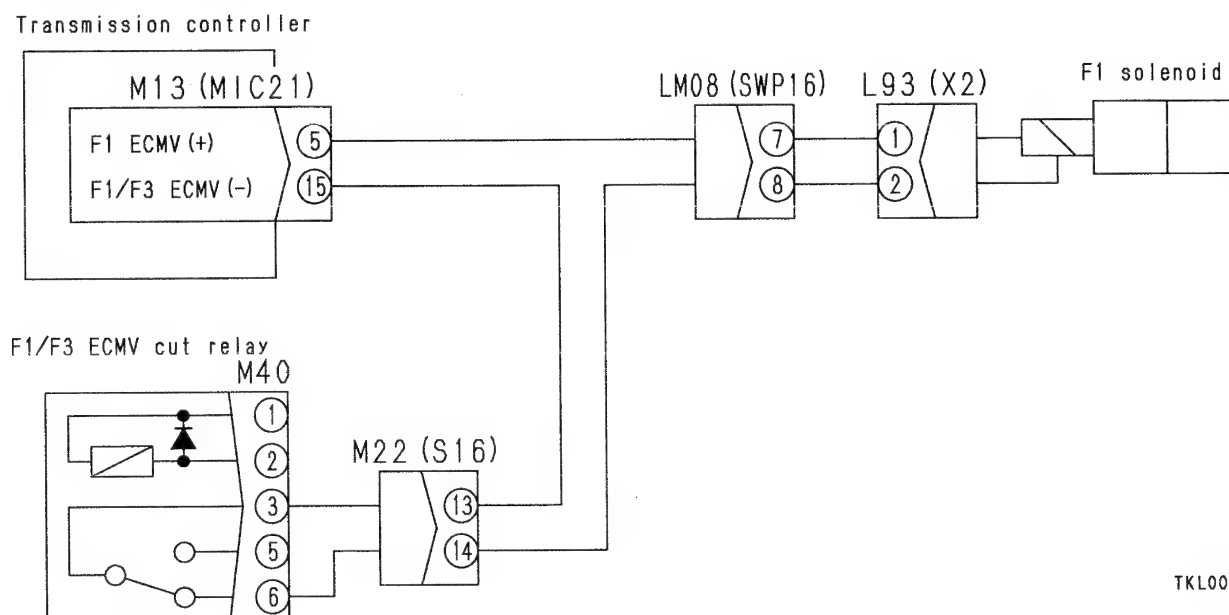


ET-25 ATM error E72 (Disconnection in F1 solenoid (ECMV) system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Cause	Remedy
Go to YES line of trouble-shooting item 6	
Go to A	Repair or replace
Defective contact or disconnection in wiring harness between L93 (female) (2) – LM08 (8) – M22 (14) – M40 (female) (6)	Repair or replace
Defective F1, F3 solenoid (ECMV) cut relay	Repair or replace
Defective F1 solenoid (ECMV)	Replace
Defective transmission controller	Repair or replace
Defective contact or disconnection in wiring harness between M13 (female) (5) – LM08 (7) – L93 (1)	Repair or replace
Defective contact or disconnection in wiring harness between M13 (female) (15) – M22 (13) – M40 (female) (3)	Repair or replace

ET-25 Related electric circuit diagram



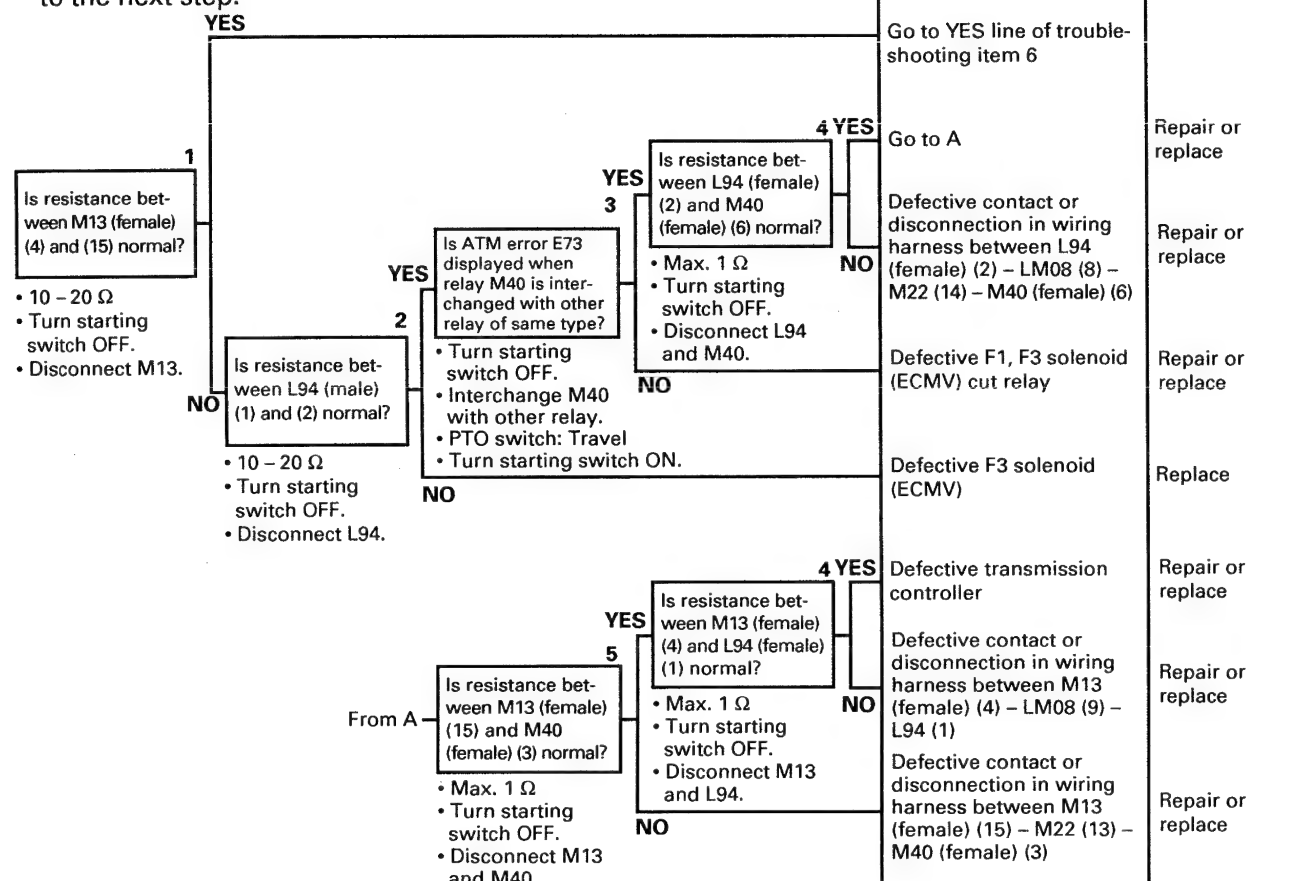
TKL00619

ET-26 ATM error E73 (Disconnection in F3 solenoid (ECMV) system) is displayed

★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.

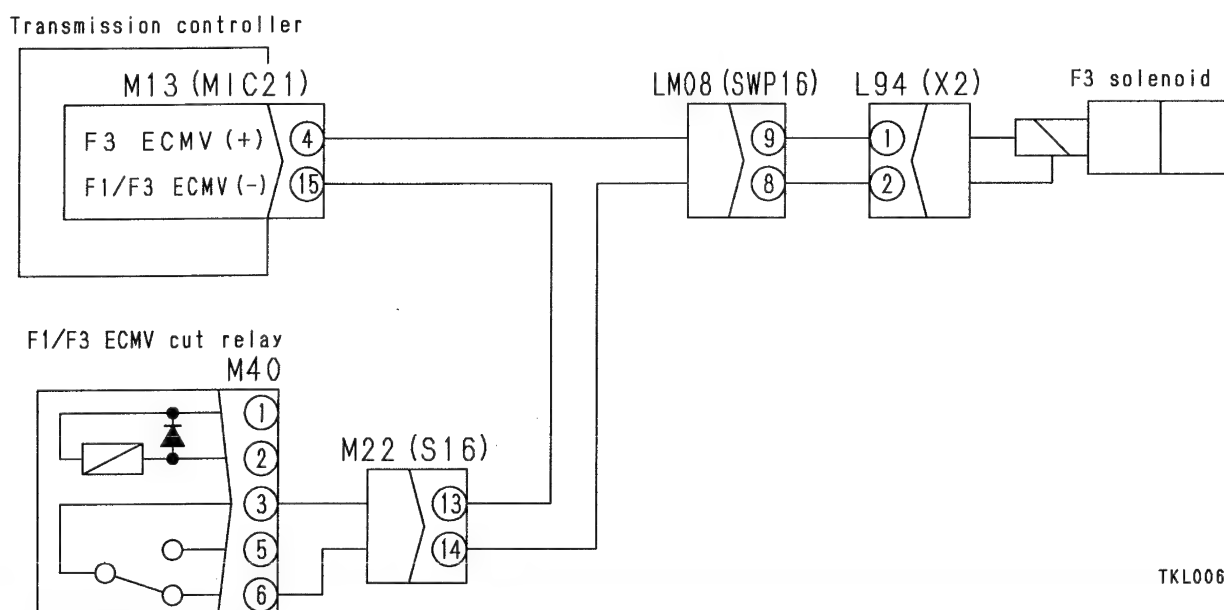
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.



023S02

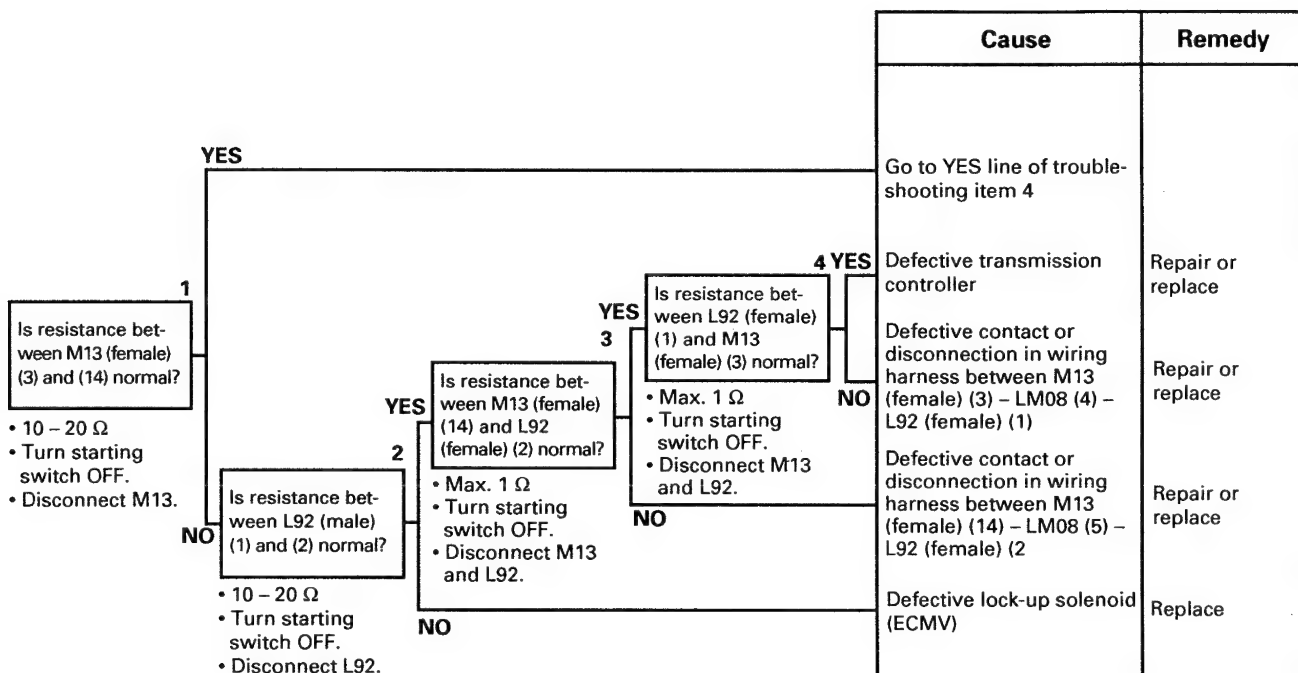
ET-26 Related electric circuit diagram



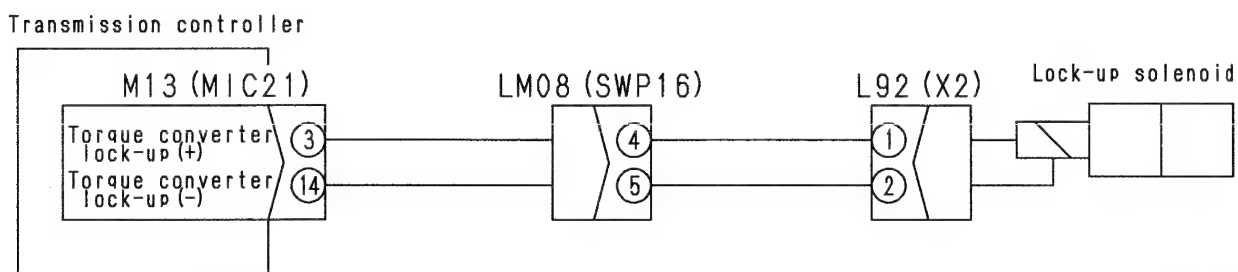
TKL00620

ET-27 ATM error E74 (Disconnection in lock-up solenoid (ECMV) system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



ET-27 Related electric circuit diagram



TKL00621

ET-28 ATM error E78 (Disconnection in Lo solenoid system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Is ATM error E78 displayed when interchanged with other ECMV (solenoid) and wiring harness?

YES

- Turn starting switch OFF.
- Interchange with other ECMV (solenoid) and wiring harness.
- Turn starting switch ON.
- Travel mode switch: 2WD Hi

2

Is resistance between L99 (female) (2) and chassis normal?

YES

- Max. 1 V
- Turn starting switch ON.
- Disconnect L99.

3

Is resistance between M13 (female) (21) and chassis normal?

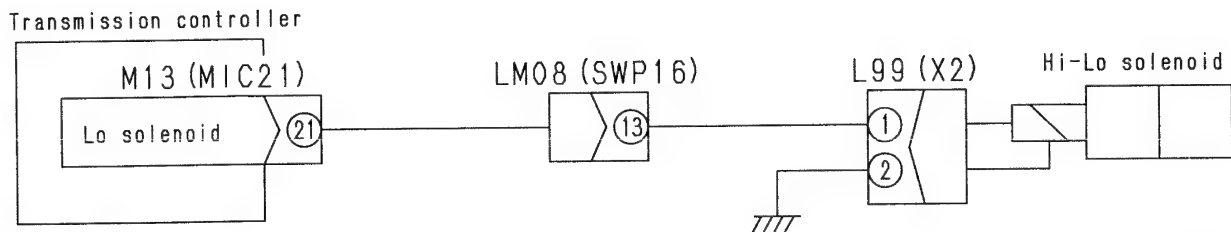
YES

- 30 – 80 Ω
- Turn starting switch OFF.
- Disconnect M13.

Cause	Remedy
Defective transmission controller	Repair or replace
Defective contact or disconnection in wiring harness between M13 (female) (21) – LM08 (13) – L99 (1)	Repair or replace
Defective contact or disconnection in wiring harness between L99 (female) (2) and chassis	Repair or replace
Defective reverse steering relay	Replace

023S02

ET-28 Related electric circuit diagram



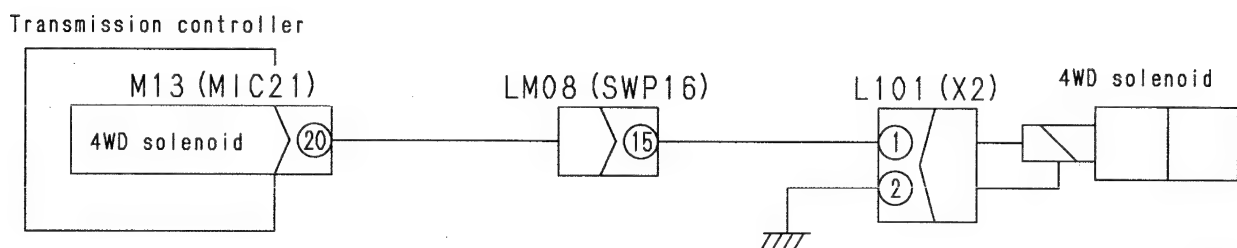
TKL00622

ET-29 ATM error E79 (Disconnection in 4WD solenoid system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

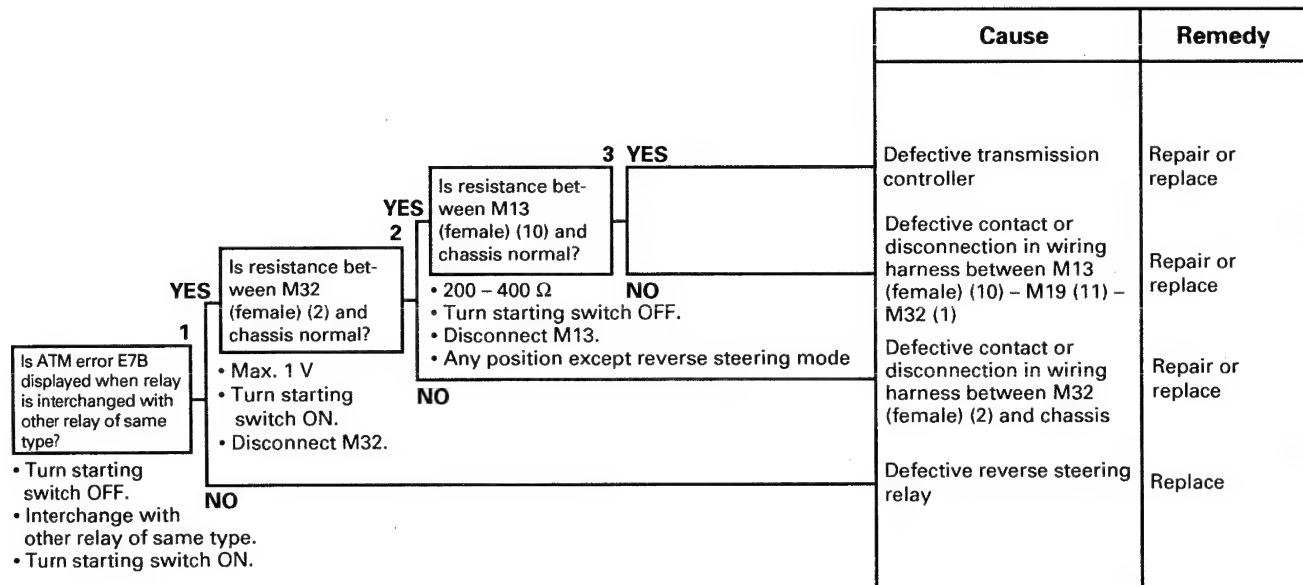
		Cause	Remedy
<p>023S02</p> <p>1</p> <p>Is ATM error E79 displayed when interchanged with other ECMV (solenoid) and wiring harness?</p> <p>YES</p> <ul style="list-style-type: none"> • Turn starting switch OFF. • Interchange with other ECMV (solenoid) and wiring harness. • Turn starting switch ON. • Travel mode switch: 2WD Hi 	2	Is resistance between L101 (female) (2) and chassis normal?	
	YES	<ul style="list-style-type: none"> • Max. 1 V • Turn starting switch ON. • Disconnect L101. 	
	NO		
	3	Is resistance between M13 (female) (20) and chassis normal?	
	YES	<ul style="list-style-type: none"> • 30 – 80 Ω • Turn starting switch OFF. • Disconnect M13. 	Defective transmission controller
	NO		Defective contact or disconnection in wiring harness between M13 (female) (20) – LM08 (15) – L101 (1)
			Defective contact or disconnection in wiring harness between L101 (female) (2) and chassis
			Defective 4WD solenoid

ET-29 Related electric circuit diagram

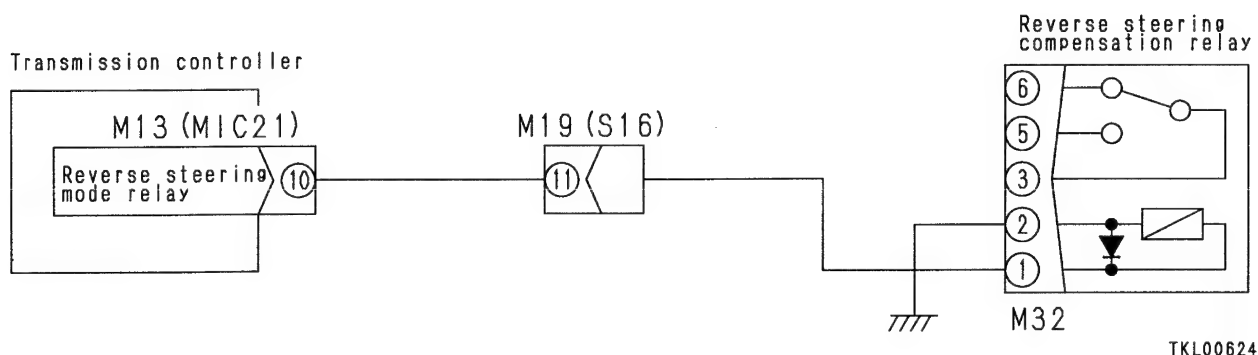


ET-30 ATM error E7B (Disconnection in reverse steering compensation relay system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

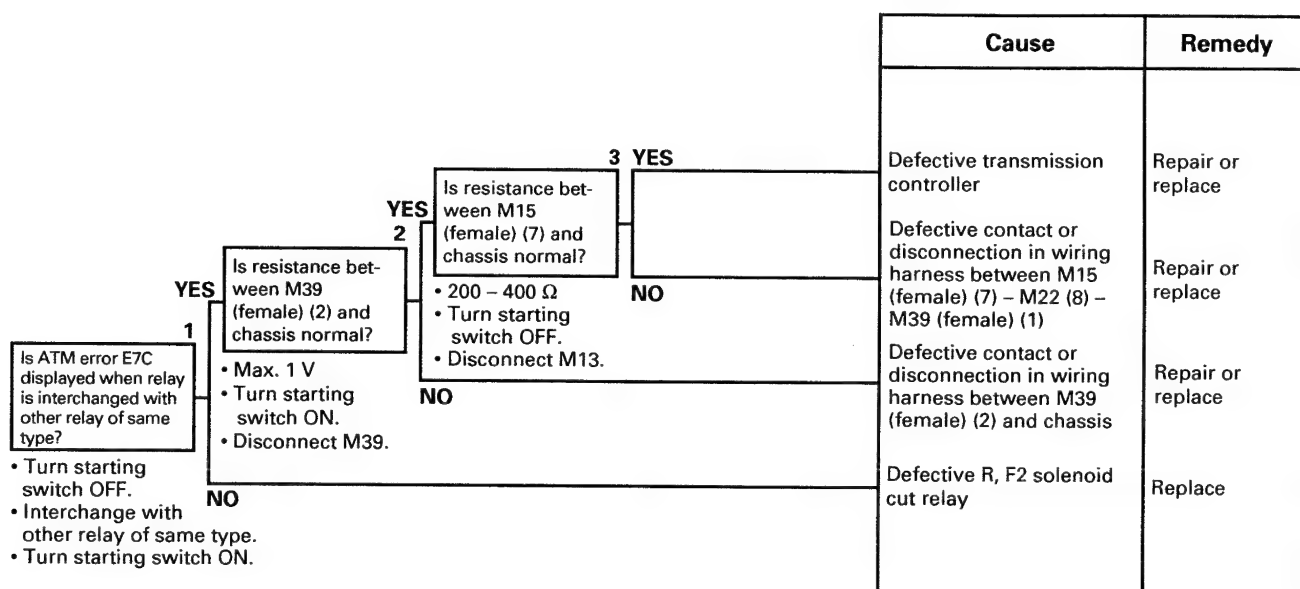


ET-30 Related electric circuit diagram

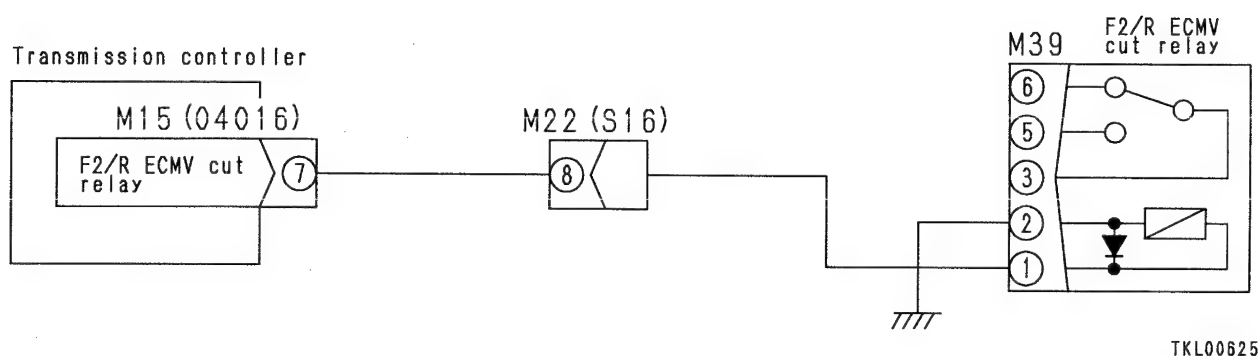


ET-31 ATM error E7C (Disconnection in F2, R solenoid [ECMV] cut relay system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



ET-31 Related electric circuit diagram



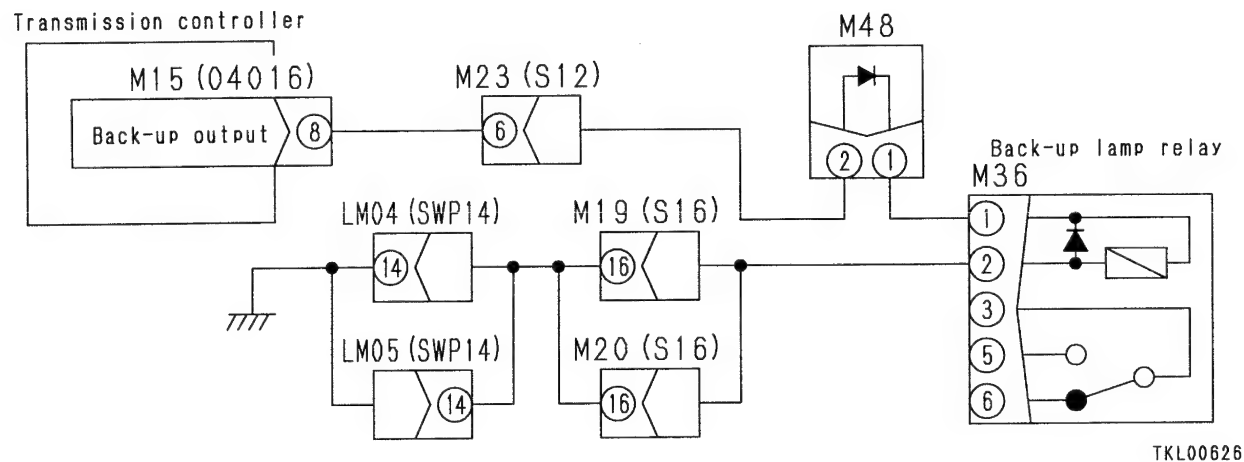
ET-32 ATM error E7D (Disconnection in back-up lamp relay) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

			Cause	Remedy	
<div><div>1</div><div>Is ATM error E7D displayed when relay is interchanged with other relay of same type?</div><div><div>• Turn starting switch OFF.</div><div>• Interchange with other relay of same type.</div><div>• Turn starting switch ON.</div></div></div> <div><div>YES</div><div>Is resistance between M36 (female) (2) and chassis normal?</div><div><div>• Max. 1 V</div><div>• Turn starting switch ON.</div><div>• Disconnect M36.</div></div></div> <div><div>NO</div><div>Is resistance between M15 (female) (8) and chassis normal?</div><div><div>• 200 – 400 Ω</div><div>• Turn starting switch OFF.</div><div>• Disconnect M15.</div></div></div> <div><div>YES</div><div>Is resistance between M15 (female) (8) and chassis normal?</div><div><div>• 200 – 400 Ω</div><div>• Turn starting switch OFF.</div><div>• Disconnect M15.</div></div></div>	3 YES		Defective transmission controller	Repair or replace	
		NO		Defective contact or disconnection in wiring harness between M15 (female) (8) – M23 (6) – M48 (2),(1) – M36 (female) (1)	Repair or replace
				Defective contact or disconnection in wiring harness between M36 (female) (2) – M19 (16), M20 (16) – LM04 (14), LM05 (14) – chassis	Repair or replace
				Defective R, F2 solenoid cut relay	Replace

023S02

ET-32 Related electric circuit diagram

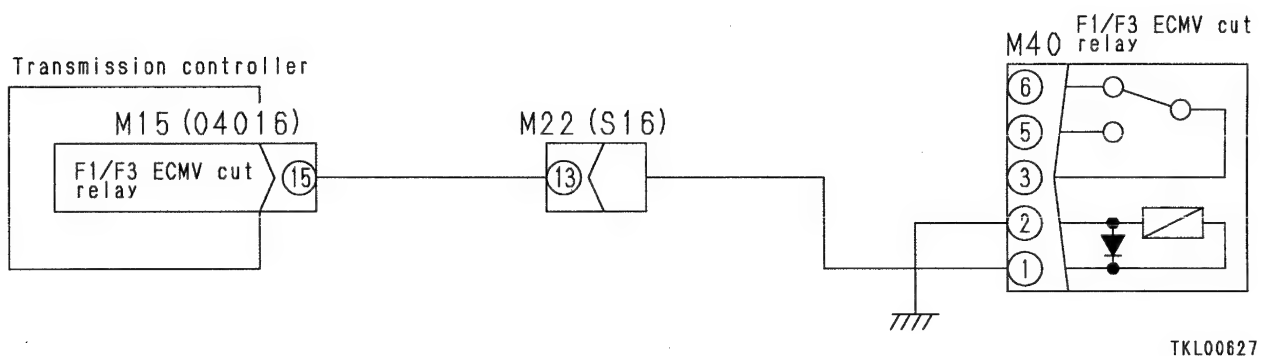


ET-33 ATM error E7E (Disconnection in F1, F3 solenoid [ECMV] cut relay system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> 1 Is ATM error E7E displayed when relay is interchanged with other relay of same type? • Turn starting switch OFF. • Interchange with other relay of same type. • Turn starting switch ON. </div> <div style="margin-bottom: 10px;"> 2 Is resistance between M40 (female) (2) and chassis normal? • Max. 1 V • Turn starting switch ON. • Disconnect M40. </div> <div> 3 Is resistance between M15 (female) (8) and chassis normal? • 200 – 400 Ω • Turn starting switch OFF. • Disconnect M15. </div> </div>	YES	Defective transmission controller	Repair or replace
	NO	Defective contact or disconnection in wiring harness between M15 (female) (15) – M22 (13) – M40 (female) (1)	Repair or replace
	NO	Defective contact or disconnection in wiring harness between M40 (female) (2) and chassis	Repair or replace
	NO	Defective F1, F3 solenoid cut relay	Replace

ET-33 Related electric circuit diagram



ET-34 ATM error E7F (Disconnection in special steering relay system) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

1

Is ATM error E7F displayed when relay is interchanged with other relay of same type?

• Turn starting switch OFF.

• Interchange with other relay of same type.

• Turn starting switch ON.

YES

2

Is resistance between M33 (female) (2) and chassis normal?

• Max. 1 V

• Turn starting switch ON.

• Disconnect M33.

NO

YES

3

Is resistance between M15 (female) (16) and chassis normal?

• 200 – 400 Ω

• Turn starting switch OFF.

• Disconnect M15.

NO

Defective transmission controller

Repair or replace

Defective contact or disconnection in wiring harness between M15 (female) (16) – M19 (13) – M33 (female) (2)

Repair or replace

Defective contact or disconnection in wiring harness between M33 (female) (2) and chassis

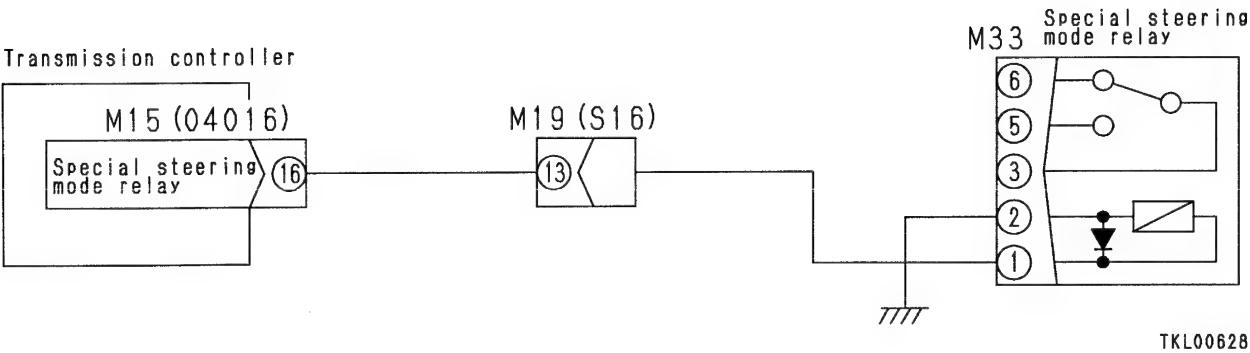
Repair or replace

Defective special steering relay

Replace

023S02

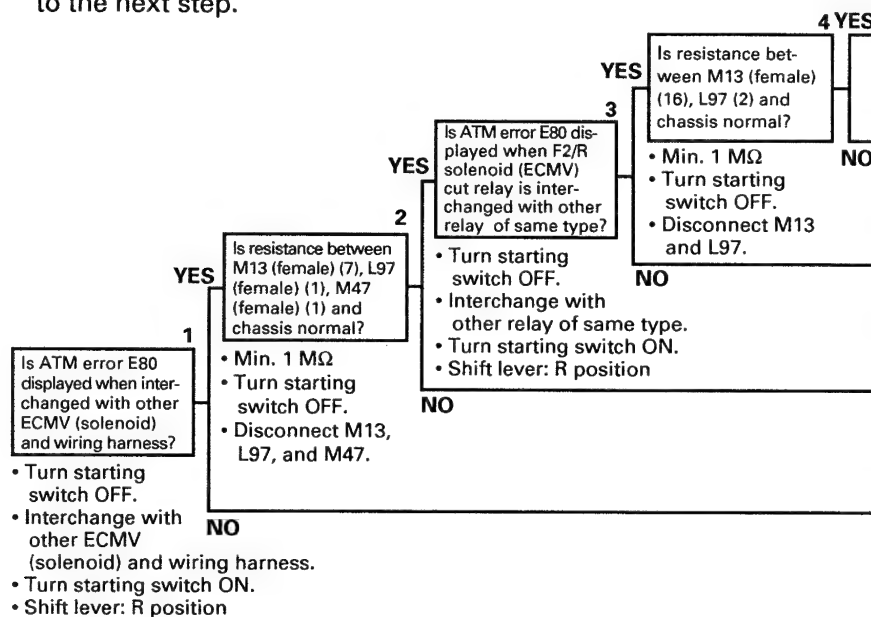
ET-34 Related electric circuit diagram



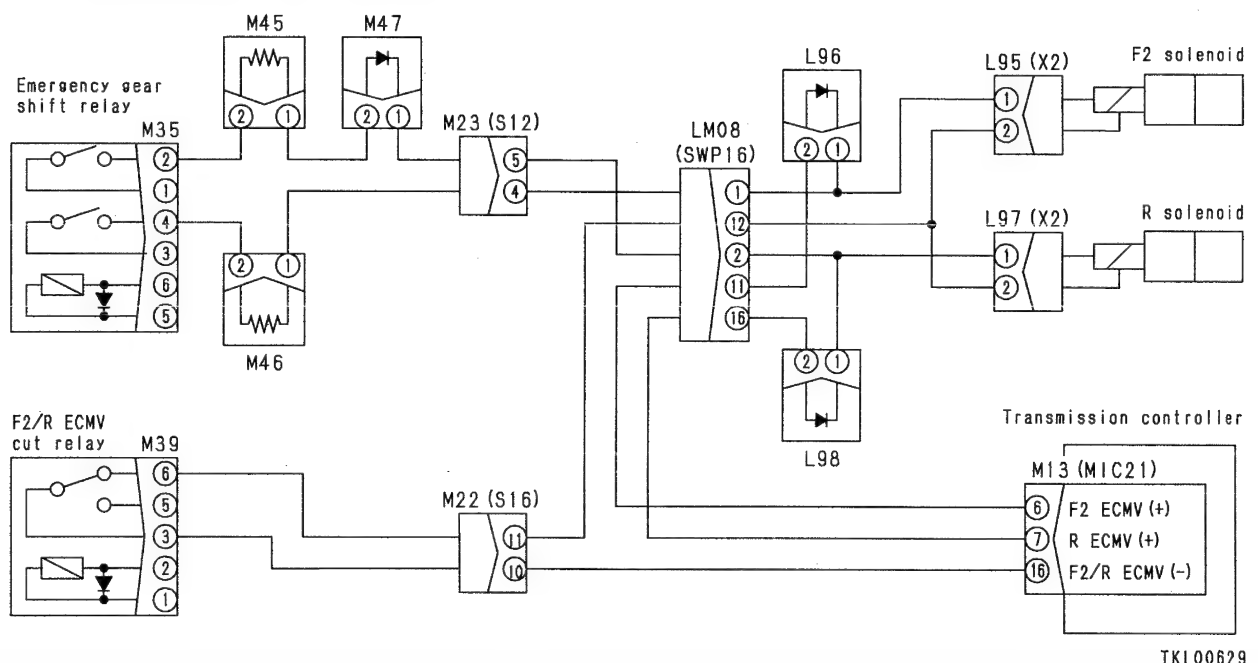
ET-35 ATM error E80 (R solenoid (ECMV) system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adaptor is inserted, or when the T-adaptor is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

Cause	Remedy
4 YES Defective transmission controller Wiring harness between M13 (female) (16) – M22 (10) – M39 (female) (3), or between M13 (female) (16) – M22 (11) – LM08 (12) – L97 (female) (2) short circuiting with chassis ground	Repair or replace Repair or replace
NO Defective R, F2 solenoid (ECMV) cut relay Wiring harness between M13 (female) (7) – LM08 (16) – L98 (2), (1) – L97 (female) (1), (including wiring harness between connecting point of L97 (female) (1) and L98 (female) (1) – LM08 (2) – M23 (5) – M47 (female) (1)) short circuiting with chassis ground Defective F2 solenoid (ECMV)	Replace Repair or replace Replace

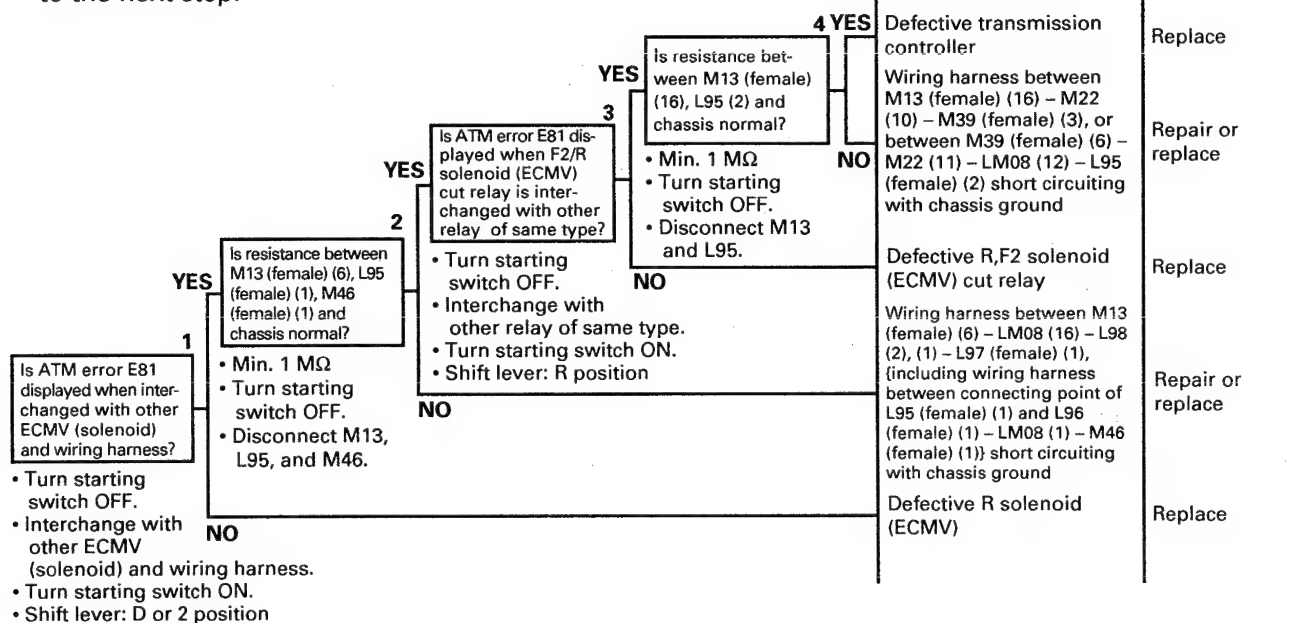


ET-35 Related electric circuit diagram

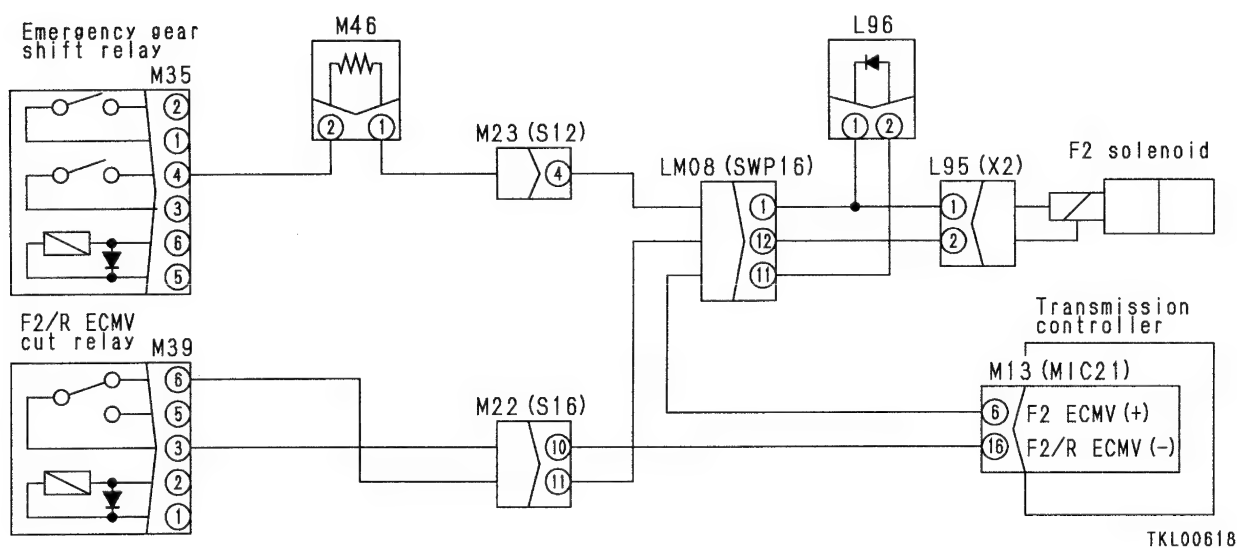


ET-36 ATM error E81 (F2 solenoid [ECMV] system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
| | |

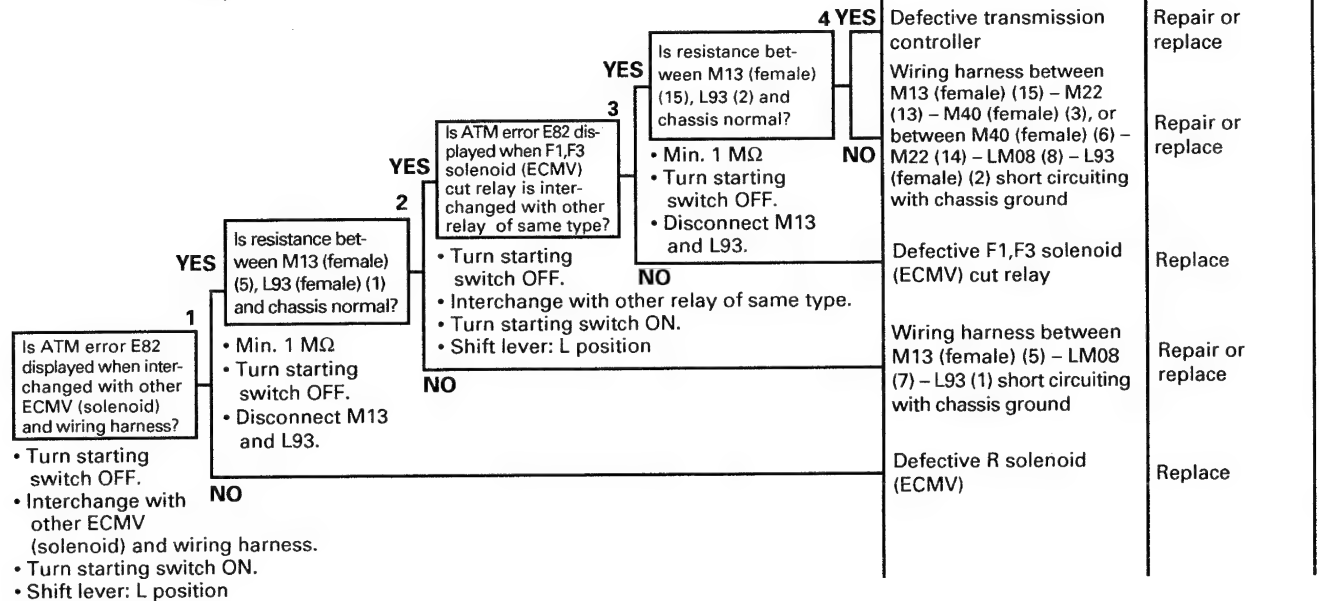


ET-36 Related electric circuit diagram

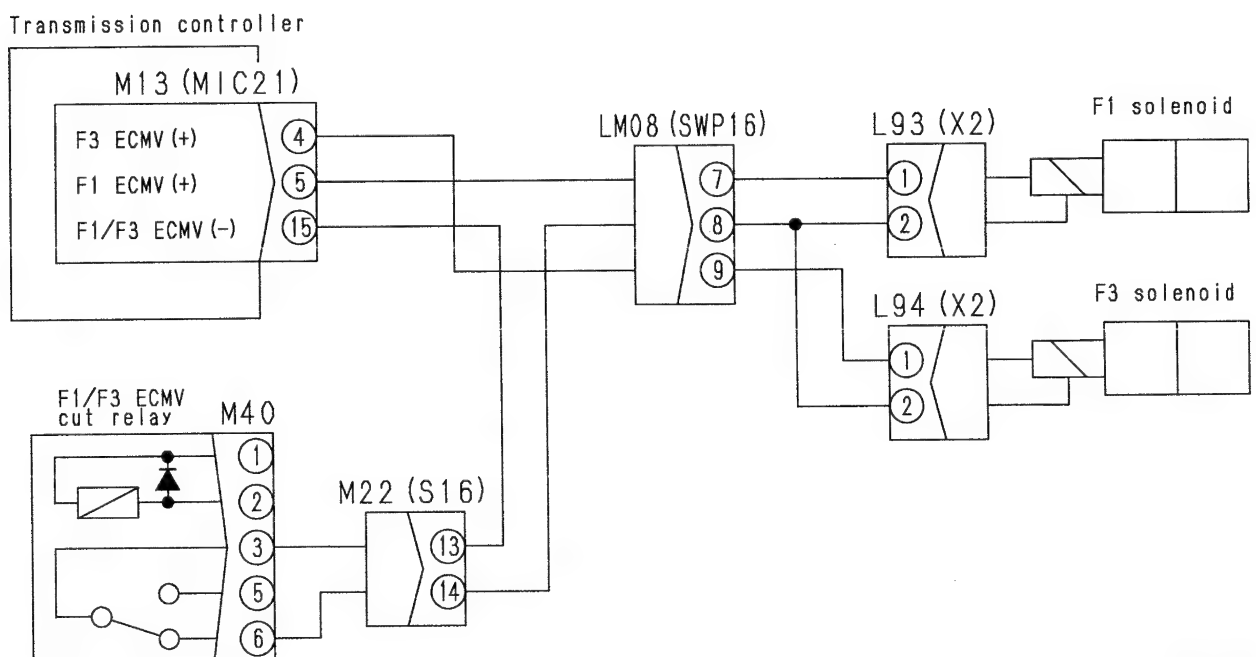


ET-37 ATM error E82 (F1 solenoid [ECMV] system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



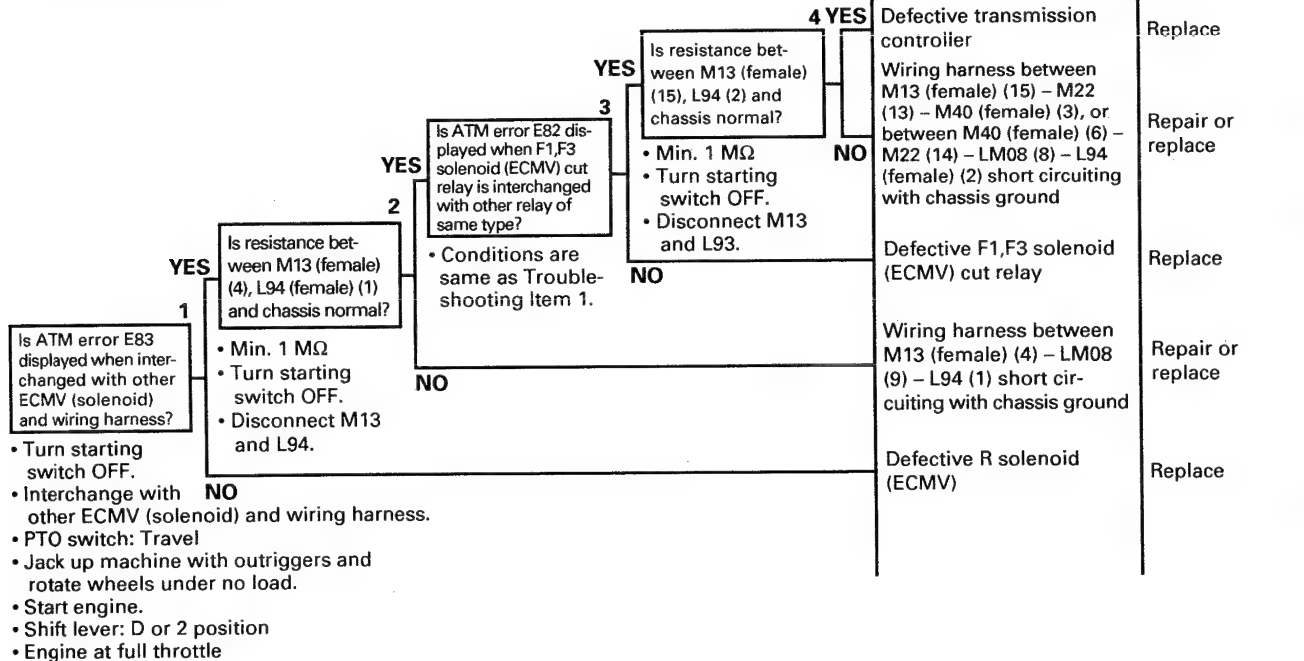
ET-37 Related electric circuit diagram



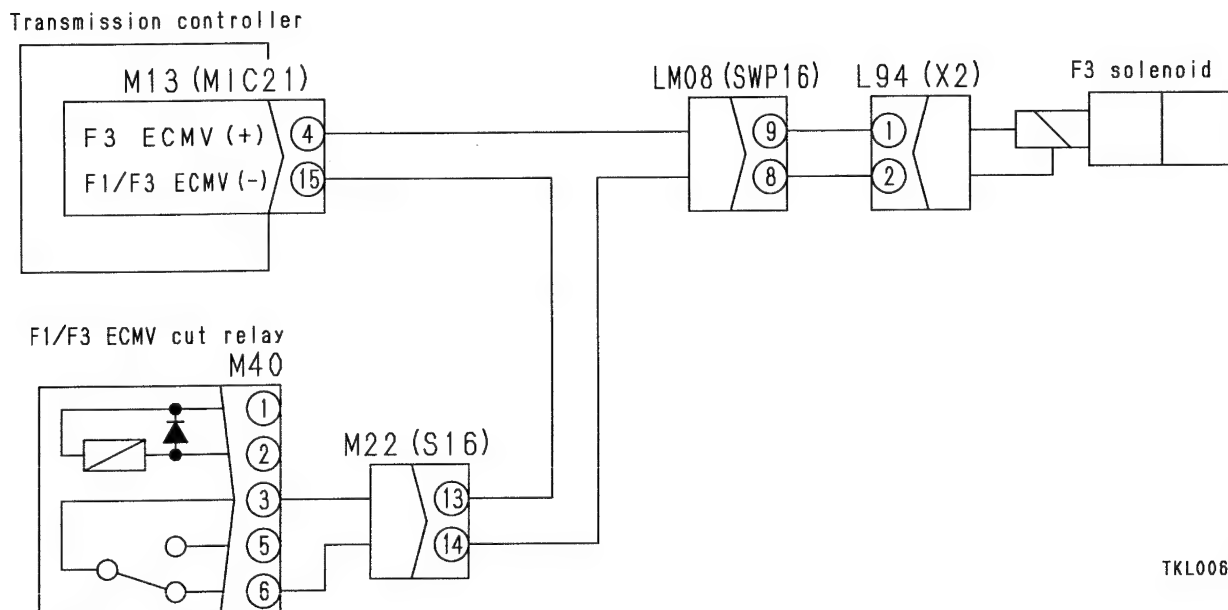
TKL00630

ET-38 ATM error E83 (F3 solenoid [ECMV] system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
| | |



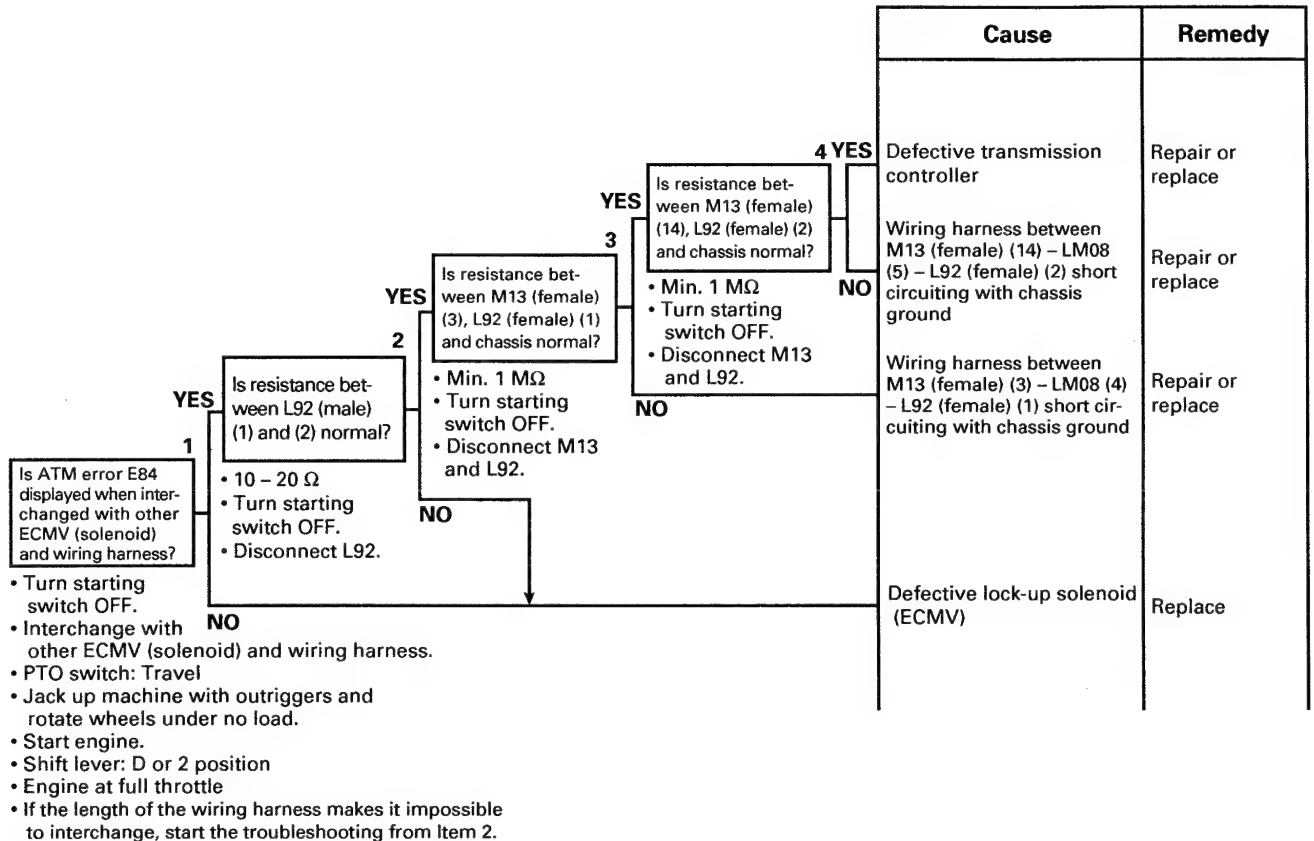
ET-38 Related electric circuit diagram



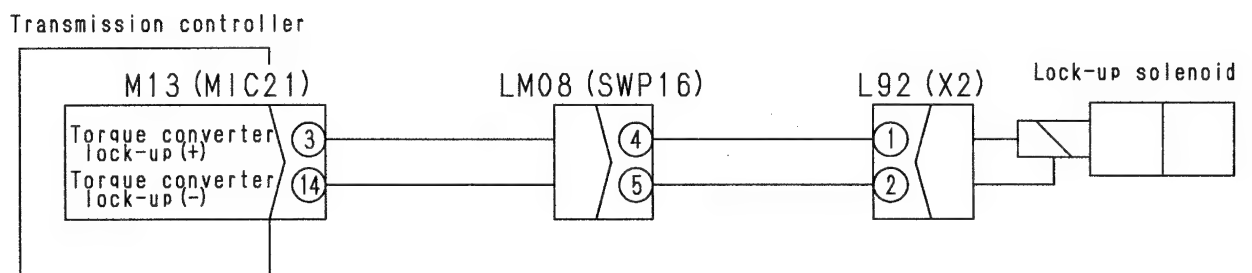
TKL00620

ET-39 ATM error E84 (Lock-up solenoid [ECMV] system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



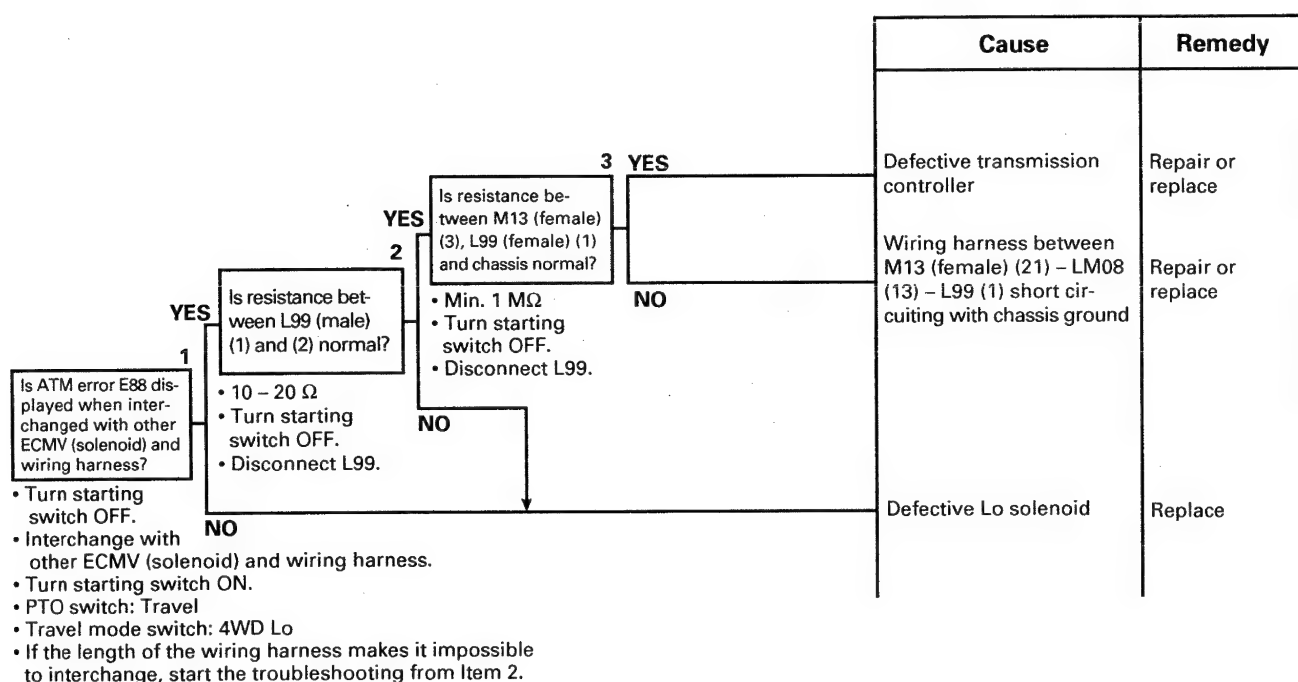
ET-39 Related electric circuit diagram



TKL00621

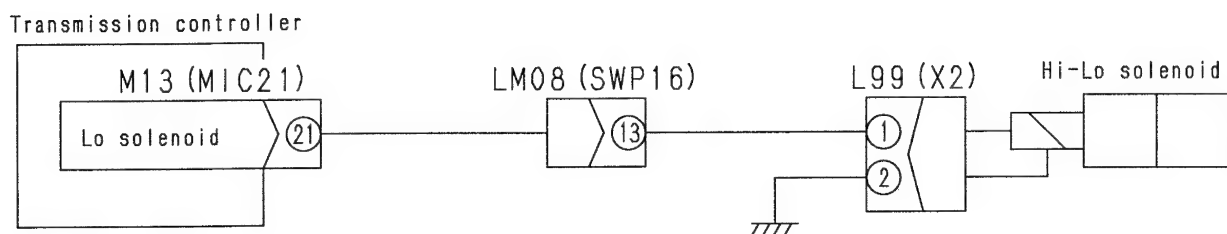
ET-40 ATM error E88 (Lo solenoid system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

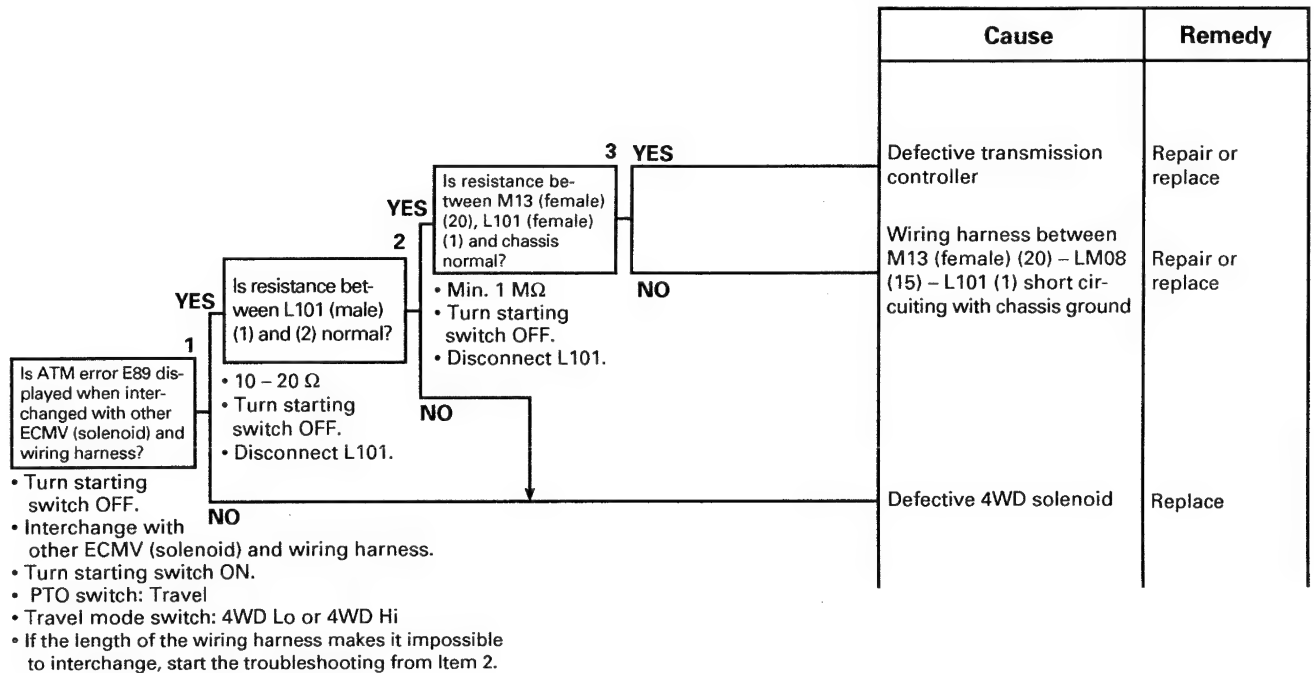
ET-40 Related electric circuit diagram



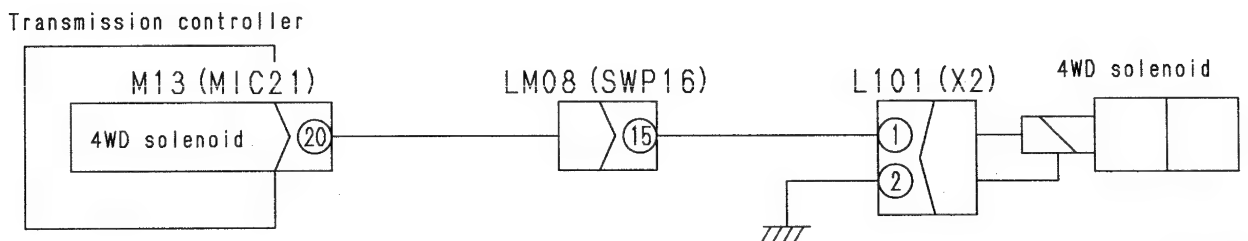
TKL00622

ET-41 ATM error E89 (4WD solenoid system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

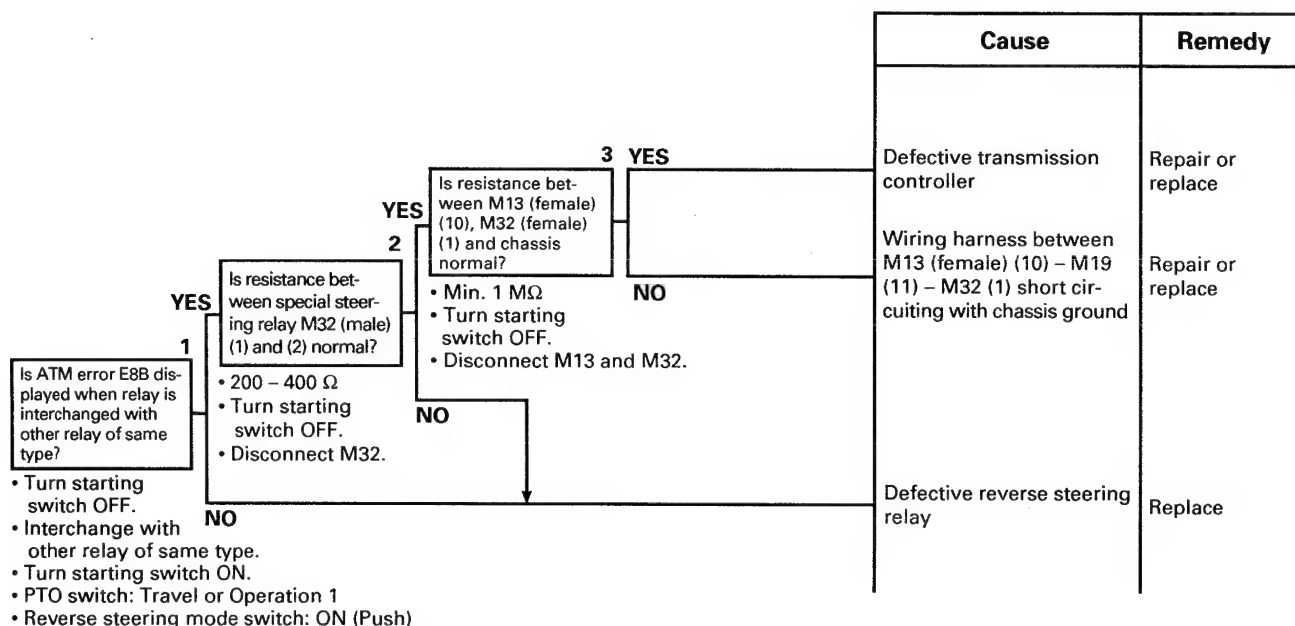


ET-41 Related electric circuit diagram



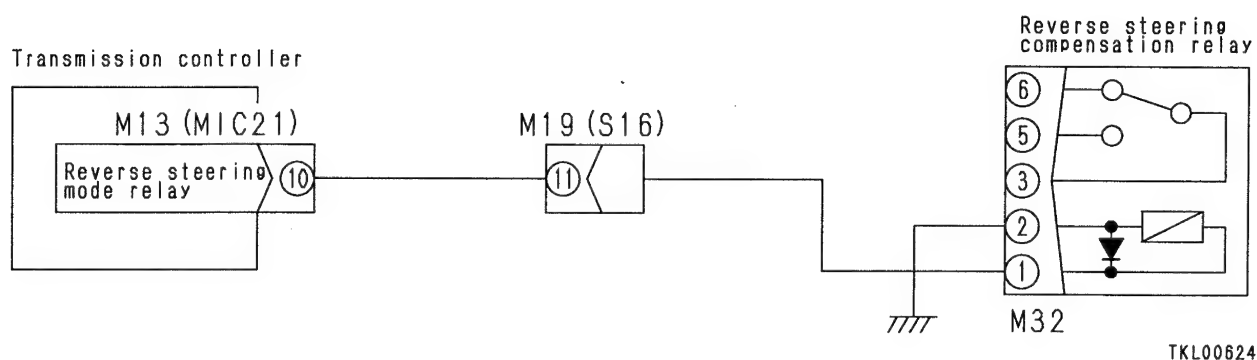
ET-42 ATM error E8B (Reverse steering relay system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



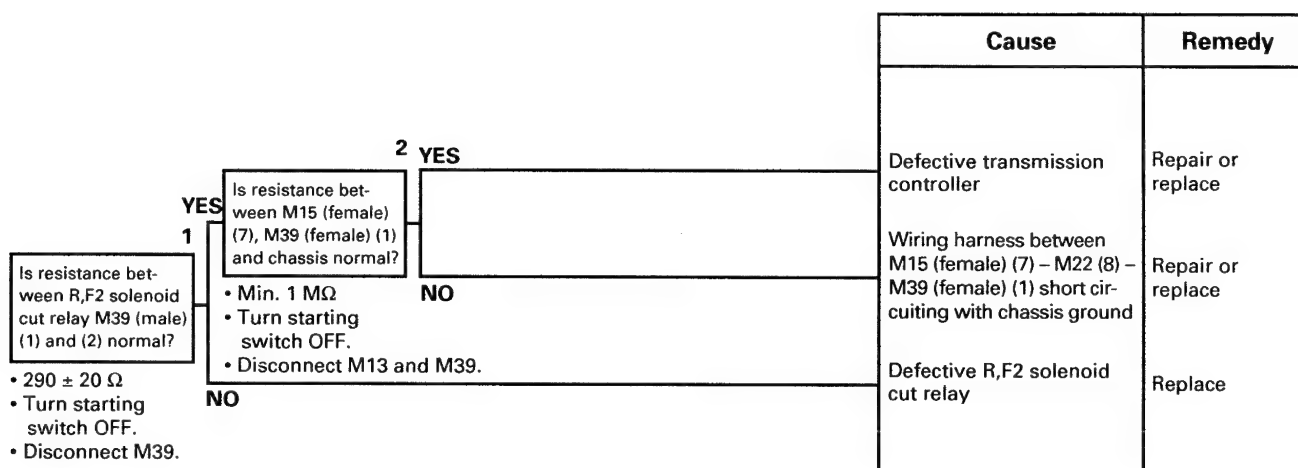
023S02

ET-42 Related electric circuit diagram

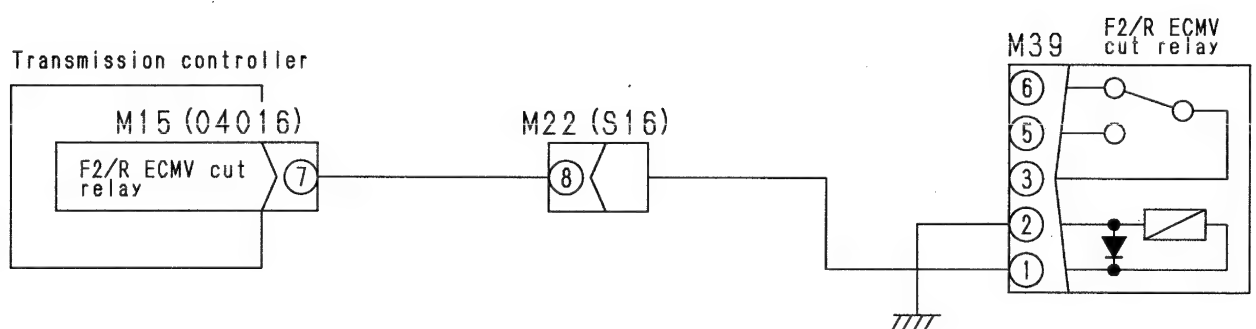


ET-43 ATM error E8C (F2, R solenoid [ECMV] cut relay system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



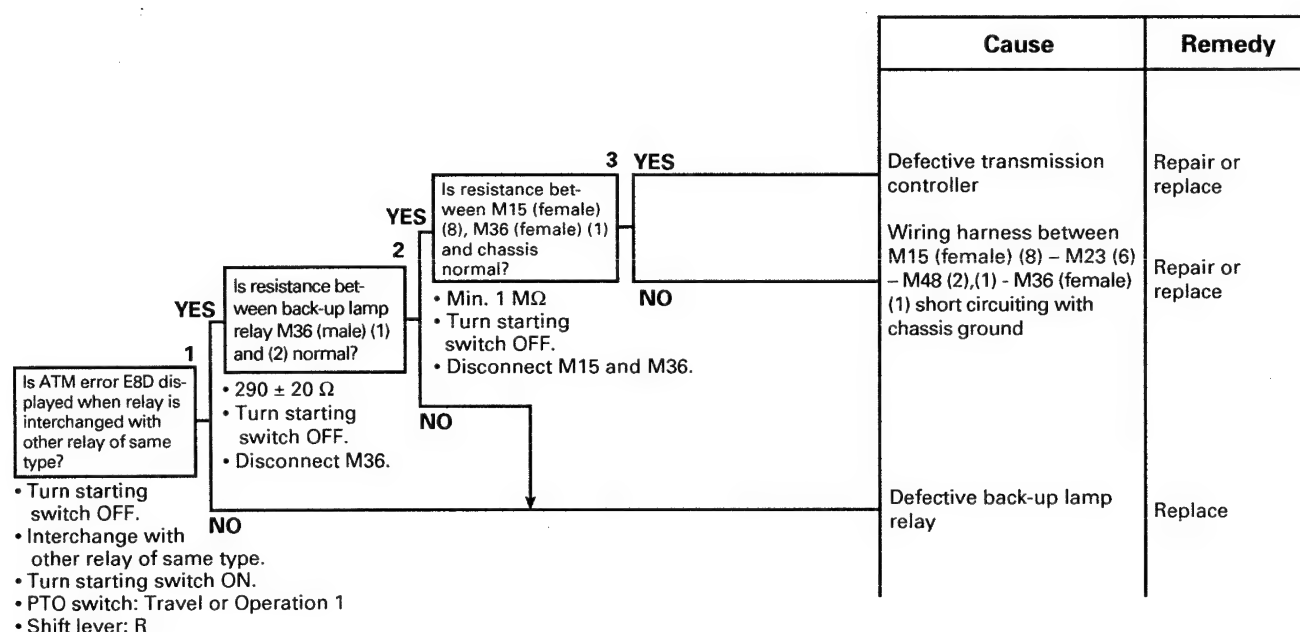
ET-43 Related electric circuit diagram



TKL00625

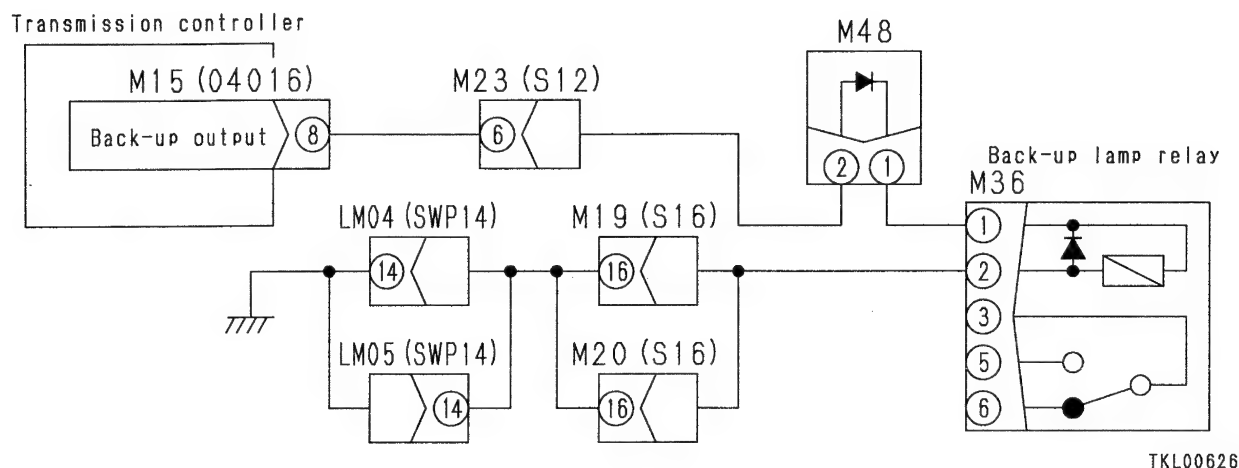
ET-44 ATM error E8D (Back-up lamp relay system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



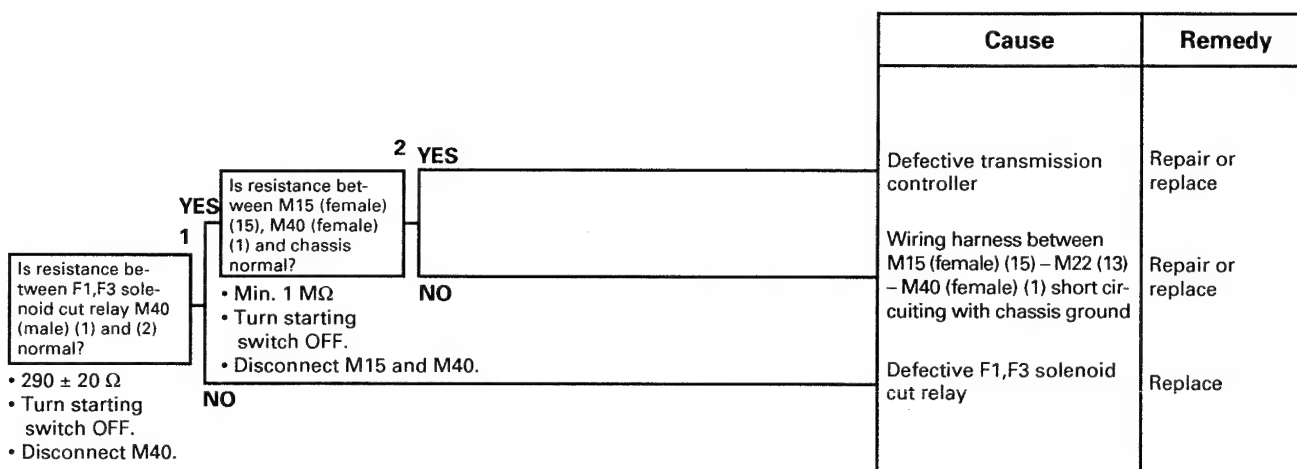
023S02

ET-44 Related electric circuit diagram

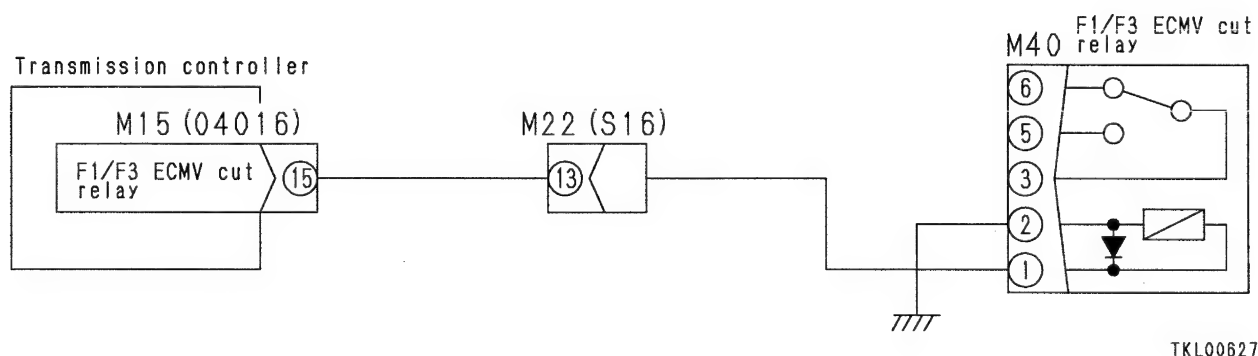


ET-45 ATM error E8E (F1, F3 solenoid [ECMV] cut relay system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

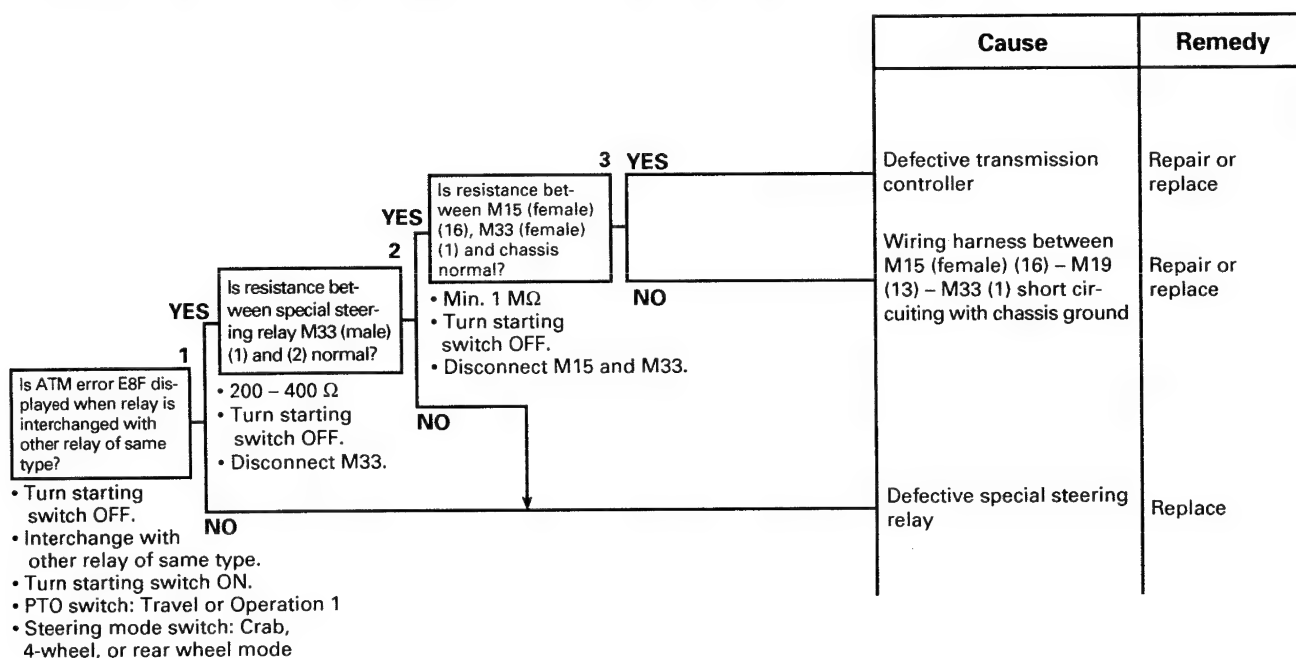


ET-45 Related electric circuit diagram



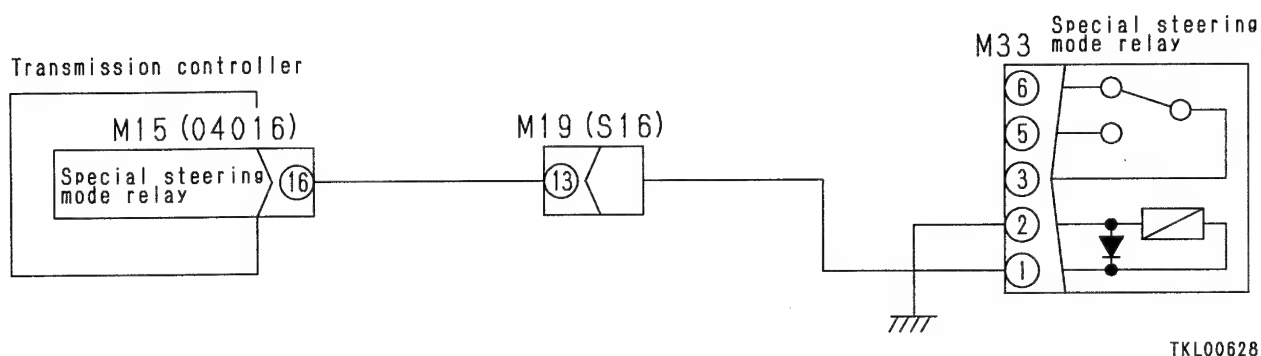
ET-46 ATM error E8F (Special steering relay system short circuited with ground) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

ET-46 Related electric circuit diagram

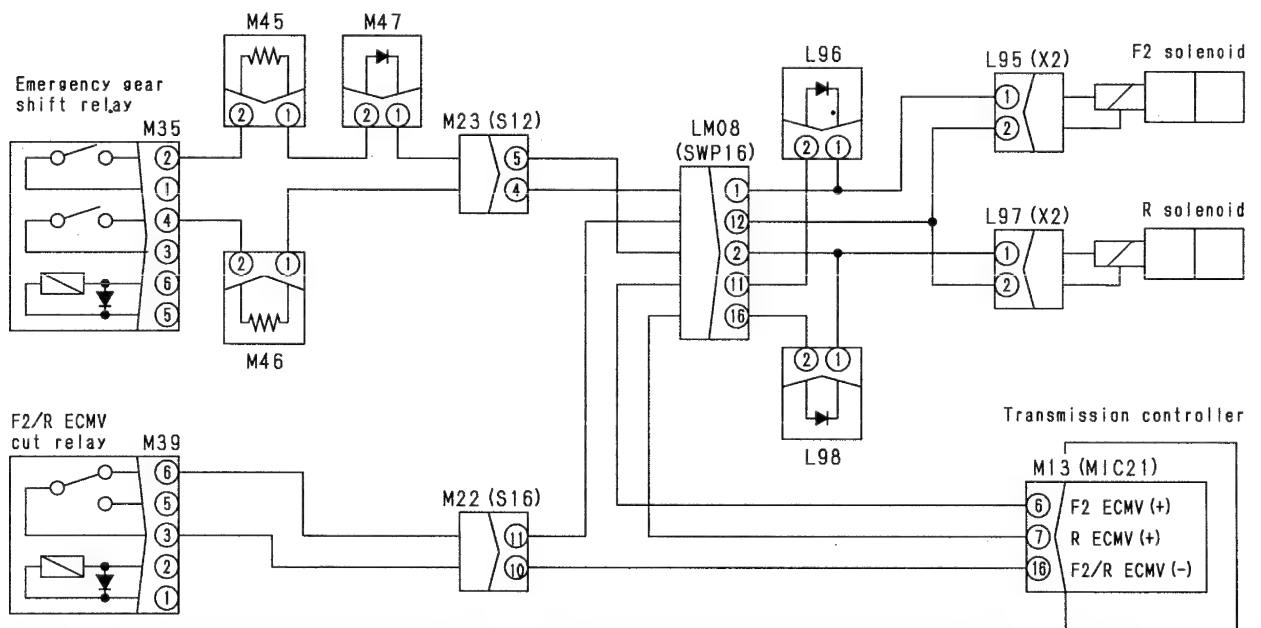


ET-47 ATM error E90,E91 (R or F2 solenoid [ECMV] short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>023S02</p> <p>1</p> <p>Is voltage between M13 (7), L97 (1), M47 (1) and chassis normal?</p> <p>• Max. 1 V</p> <p>• Disconnect M13, M39, and M47.</p> <p>• Turn starting switch ON.</p> <p>• Emergency gear shift switch: OFF</p>	YES		
	2 YES	Defective transmission controller	Repair or replace
	NO	Wiring harness between M13 (female) (6) – LM08 (11) – L96 (2), (1) – L95 (female) (1), (including wiring harness between connecting point of L95 (female) (1) and L96 (female) (1) – LM08 (1) – M23 (4) – M46 (female) (1),(2) – M35 (female) (4)) short circuiting with chassis ground	Repair or replace
	NO	Wiring harness between M13 (female) (7) – LM08 (16) – L98 (2), (1) – L97 (female) (1), (including wiring harness between connecting point of L97 (female) (1) and L98 (female) (1) – LM08 (2) – M23 (5) – M47 (1),(2) – M45 (1),(2) – M35 (female)(2)) short circuiting with chassis ground	Repair or replace

ET-47 Related electric circuit diagram



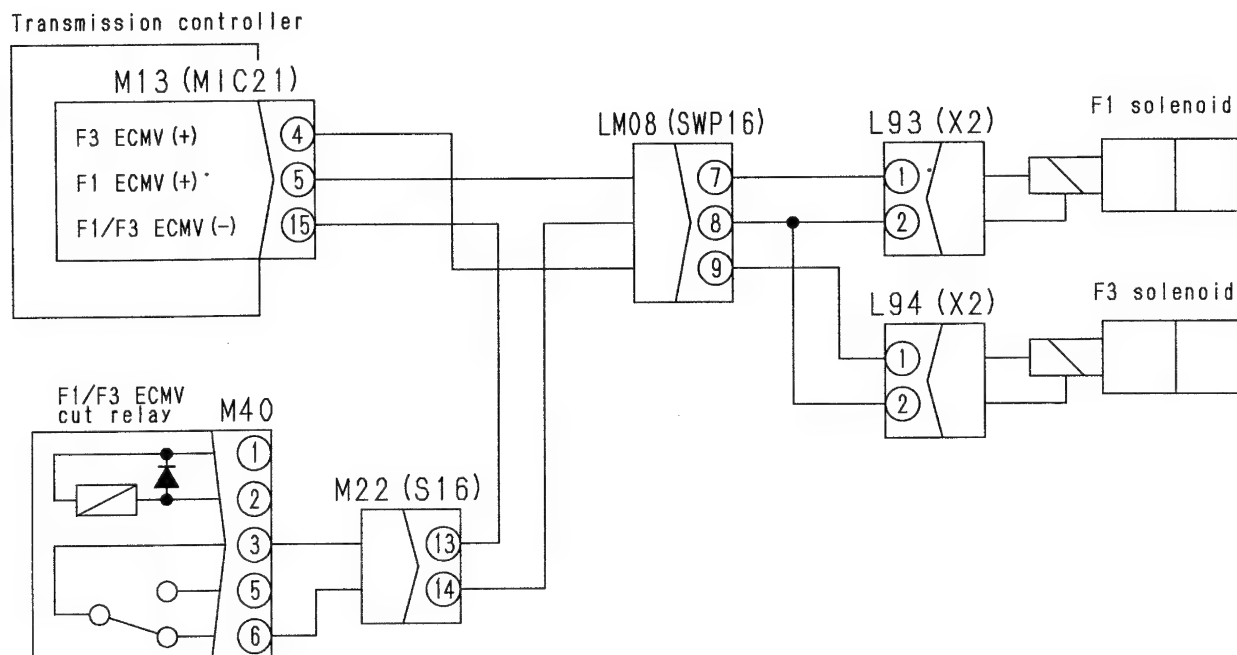
TKL00629

ET-48 ATM error E92,E93 (F3 or F1 solenoid [ECMV] short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1</p> <p>Is voltage between M13 (5), L93 (1) and chassis normal?</p> <p>• Max. 1 V</p> <p>• Disconnect M13 and L93.</p> <p>• Turn starting switch ON.</p> <p>YES</p>	<p>2</p> <p>Is voltage between M13 (4), L94 (1) and chassis normal?</p> <p>• Max. 1 V</p> <p>• Disconnect M13 and L94.</p> <p>• Turn starting switch ON.</p> <p>NO</p>	Defective transmission controller	Repair or replace
	YES	Wiring harness between M13 (female) (4) – LM08 (9) – L94 (1) short circuiting with power source	Repair or replace
	NO	Wiring harness between M13 (female) (5) – LM08 (7) – L93 (1) short circuiting with power source	Repair or replace

ET-48 Related electric circuit diagram



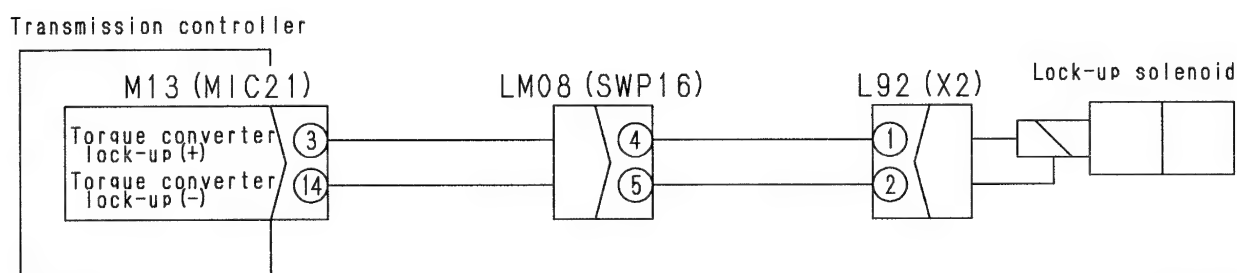
TKL00630

ET-49 ATM error E94 (Lock-up solenoid [ECMV] short circuited with power source) is displayed

- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adapter is inserted, or when the T-adapter is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
1 YES Is voltage between M13 (3), L92 (1) and chassis normal? • Max. 1 V • Disconnect M13 and L92. • Turn starting switch ON.	YES	Defective transmission controller	Repair or replace
	NO	Wiring harness between M13 (female) (3) – LM08 (4) – L92 (1) short circuiting with power source	Repair or replace

ET-49 Related electric circuit diagram



TKL00621

TROUBLESHOOTING OF HYDRAULIC AND MECHANICAL SYSTEMS (H MODE)

Table of failure modes and causes (hydraulic and mechanical systems)	20-1102
H-1 Boom and winch do not move (including cases where PTO clutch does not engage) ...	20-1105
H-2 Boom cannot be raised or lowered, or speed is slow	20-1106
H-3 Boom cannot be extended or retracted, or speed is slow	20-1108
H-4 Winch cannot be wound in or wound out, or speed is slow	20-1110
H-5 Winch moves intermittently (there is hunting)	20-1112
H-6 Jib cannot be raised, lowered, extended, or stowed (power tilt machine)	20-1114
H-7 Upper structure cannot be swung or swing speed is slow	20-1118
H-8 Outriggers cannot be extended or stowed	20-1120
H-9 Excessive hydraulic drift	20-1121
H-101 Machine does not move off	20-1122
H-102 Machine does not accelerate or does not decelerate	20-1123
H-103 Travel speed is slow or lacks power	20-1124
H-104 Torque converter lock-up does not engage or cannot be disengaged (engine stalls when machine is stopped or moves off)	20-1126
H-105 Excessive time lag when moving off (shifting gear), or shift up is slow	20-1127
H-106 Torque converter oil temperature becomes high	20-1128
H-107 Brake cannot be applied (braking effect is poor), pulls to one side, or cannot be released (drags)	20-1130
H-108 Exhaust brake cannot be applied or cannot be released	20-1132
H-109 Air pressure does not rise or is too low	20-1133
H-110 Cannot switch between 2-wheel drive and 4-wheel drive, or between Hi and Lo	20-1134
H-111 Steering mode cannot be switched	20-1134
H-112 Wheels do not move when steering wheel is turned (steering does not turn or is difficult to turn)	20-1136
H-113 Rear steering is not locked or is not released	20-1138
H-114 Suspension cannot be locked or cannot be set free	20-1139
H-115 Suspension lift cannot be used	20-1140

023S02

TABLE OF FAILURE MODES AND CAUSES (HYDRAULIC AND MECHANICAL SYSTEMS)

Failure mode		Hydraulic system																			
		Location of failure																			
		Winch pump	Boom pump	PPC pump	Transmission pump	Steering, outrigger pump	Swing pump	Clogged strainer	Clogged filter	Air sucked in	Main unload valve	PPC unload valve	Spool	Main relief valve	Main flow control	Individual flow control	Main relief valve	Priority valve	Spool	Solenoid valve (ECMV)	Torque converter regulator valve
Work equipment system	1																				
	2																				
	3																				
	4																				
	5																				
	6																				
	7																				
	8																				
	9																				
Travel system	11																				
	12																				
	13																				
	14																				
	15																				
	16																				
	17																				
	18																				
	19																				
	20																				
	21																				
	22																				
	23																				
	24																				
	25																				

023S02

023S02

Hydraulic system										Air system					Mechanical system										Troubleshooting																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Winch FREE/WORK selector valve	Winch brake selector valve	Winch clutch cylinder	Winch clutch valve	Winch brake cylinder	Jib hoist cylinder (including counterbalance valve)	Jib rotation, lock pin cylinder	Priority valve	ACC charge valve	Steering valve, steering cylinder	Outrigger, steering circuit main relief valve	Outrigger individual valve, individual cylinder	Outrigger EXTEND/STOW selector valve	Swing control valve spool	Swing motor	Crossover relief valve inside swing motor	Swing brake valve	Suspension lock cylinder	Air regulator	Air compressor, unload valve	Air governor	Air master cylinder	Brake valve	Exhaust brake cylinder	Rear steering lock cylinder			PTO	PTO clutch	Torque converter	Transmission	Drop in engine performance	Exhaust brake butterfly	Excessive resistance from travel mechanism of machine	Axle	Defective travel brake system	Winch brake	Reduction gear	Solenoid valve	Torque converter oil temperature sensor	Swivel joint	Swing machinery	Engine																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

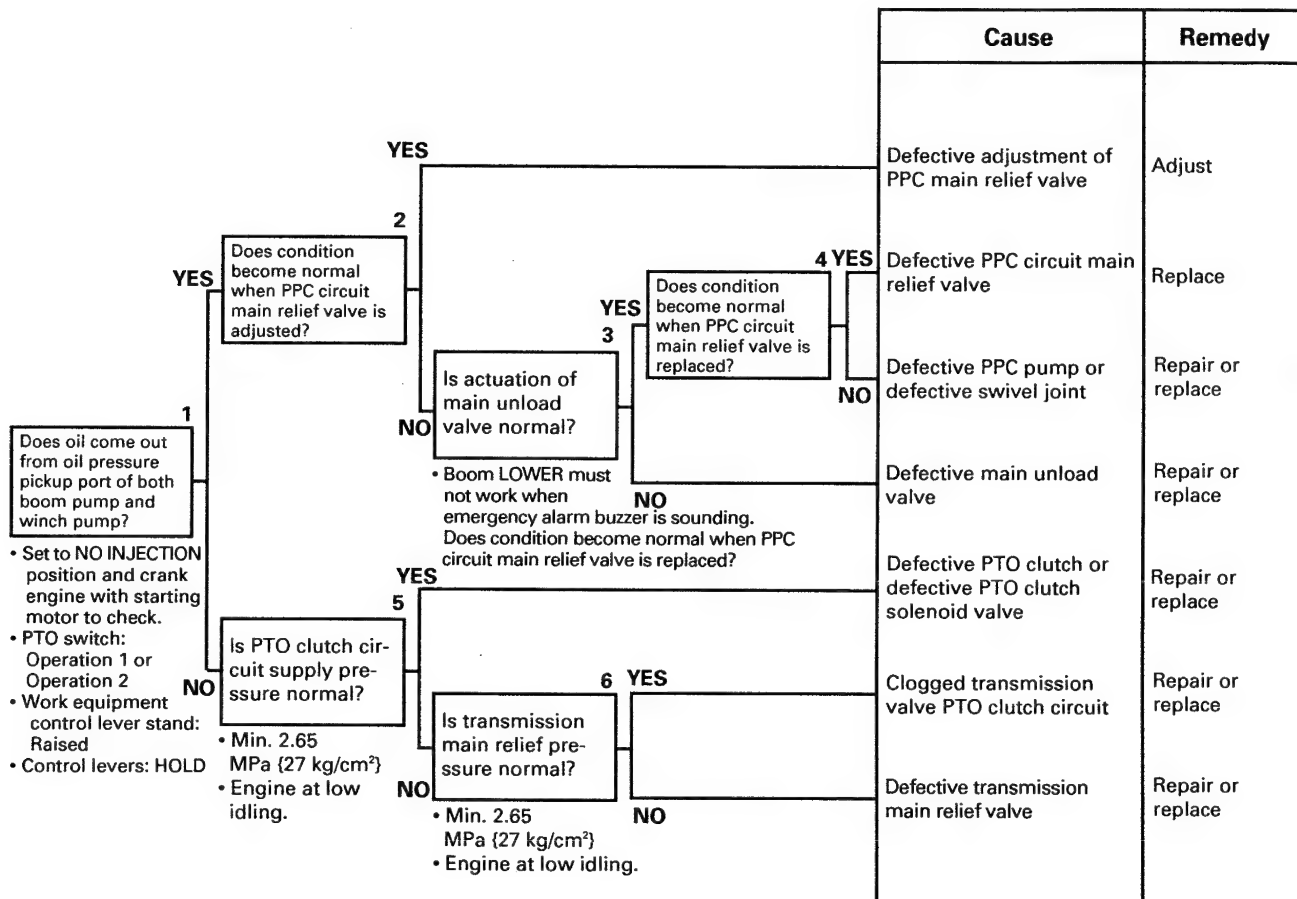
H-1 Boom and winch do not move (including cases where PTO clutch does not engage)

⚠ Check that there is no one in the surrounding area before starting troubleshooting.

★ When the electric system is normal.

★ Check that the oil level in the hydraulic tank is normal.

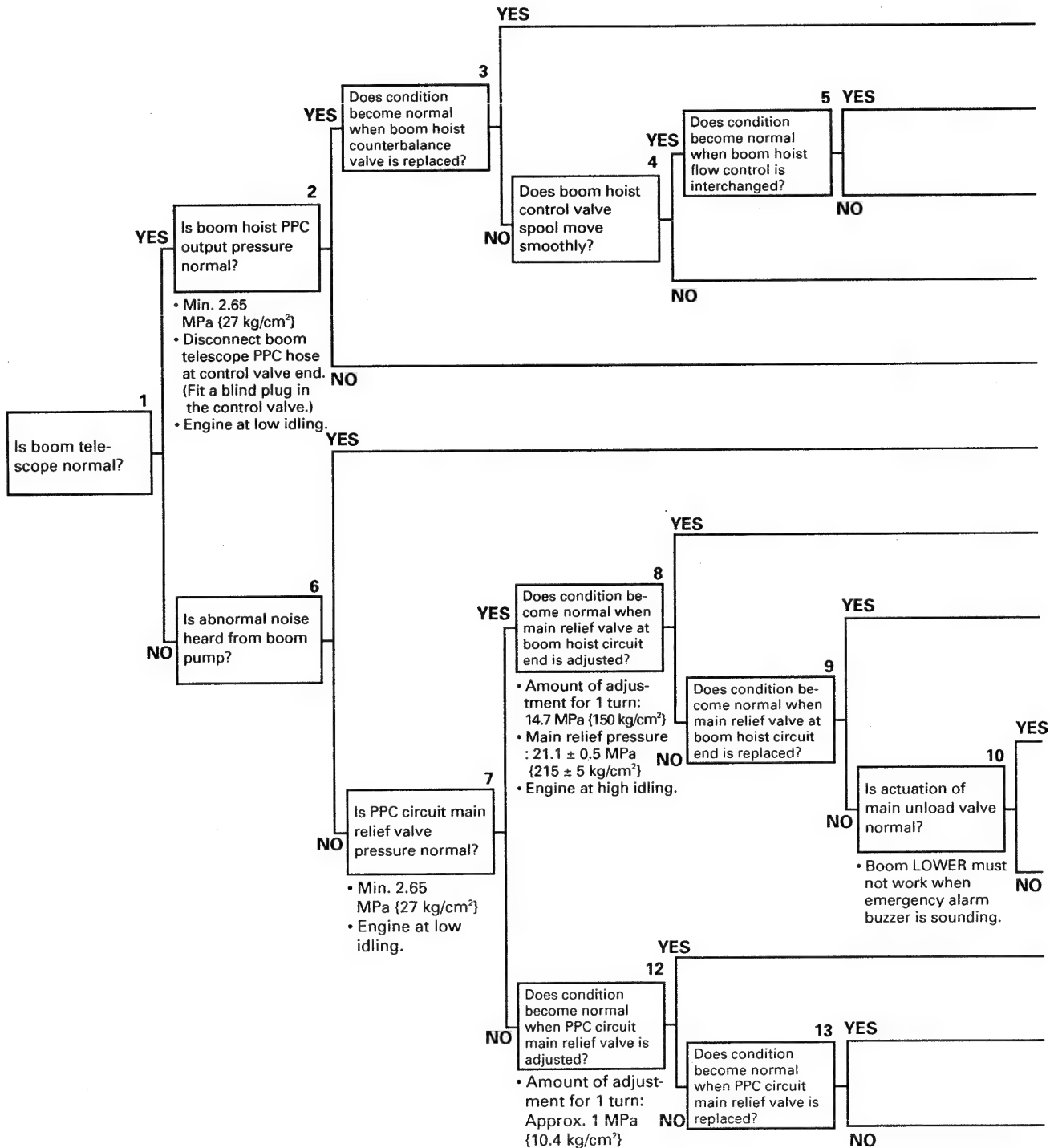
023S02



H-2 Boom cannot be raised or lowered, or speed is slow

! Check that there is no one in the surrounding area before starting troubleshooting.

- ★ When the electric system is normal.
- ★ When the operation of the PTO clutch is normal.
- ★ Carry out the operation with the PTO switch at Operation 1 or Operation 2 and the work equipment lever stand raised.



023S02

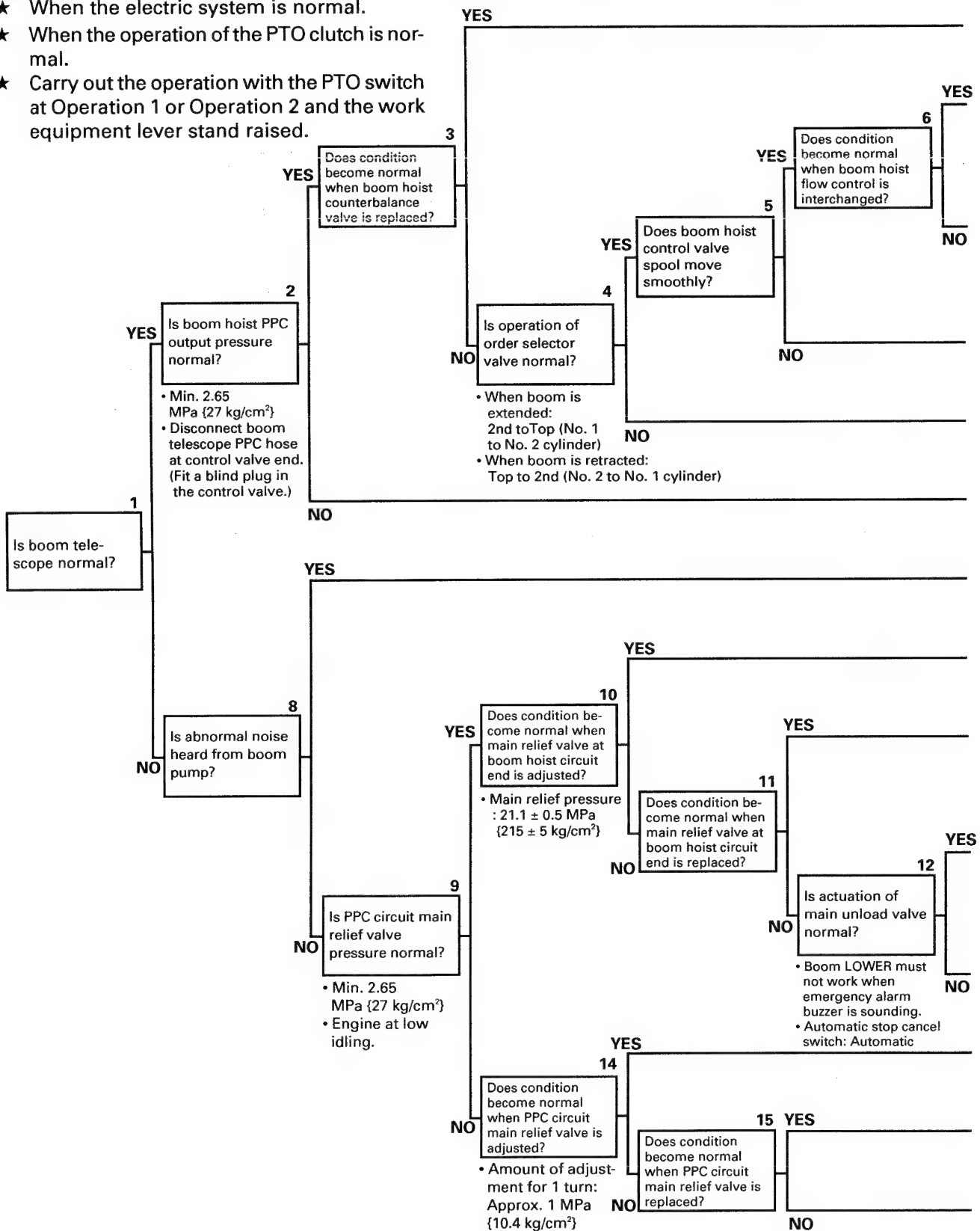
023S02

		Cause	Remedy
		Defective boom hoist counterbalance valve	Repair or replace
		Defective boom hoist flow control	Repair or replace
		Defective boom hoist cylinder	Repair or replace
		Defective actuation of boom hoist control valve spool	Repair or replace
		Defective boom hoist PPC valve	Repair or replace
		Air sucked into suction circuit	Repair
		Defective adjustment of main relief valve at boom circuit end	Adjust
		Defective main relief valve at boom circuit end	Replace
		Defective control valve flow control at boom circuit end	Repair or replace
		Drop in boom pump performance or defective swivel joint	Repair or replace
<div> <div>11 YES</div> <div>Does condition become normal when boom control valve flow control is replaced?</div> <div>NO</div> </div>		Defective main unload valve	Repair or replace
		Defective adjustment of PPC circuit main relief valve	Repair or replace
		Defective PPC circuit main relief valve	Replace
		Drop in PPC pump performance	Repair or replace

H-3 Boom cannot be extended or retracted, or speed is slow

⚠ Check that there is no one in the surrounding area before starting troubleshooting.

- ★ When the electric system is normal.
- ★ When the operation of the PTO clutch is normal.
- ★ Carry out the operation with the PTO switch at Operation 1 or Operation 2 and the work equipment lever stand raised.



023S02

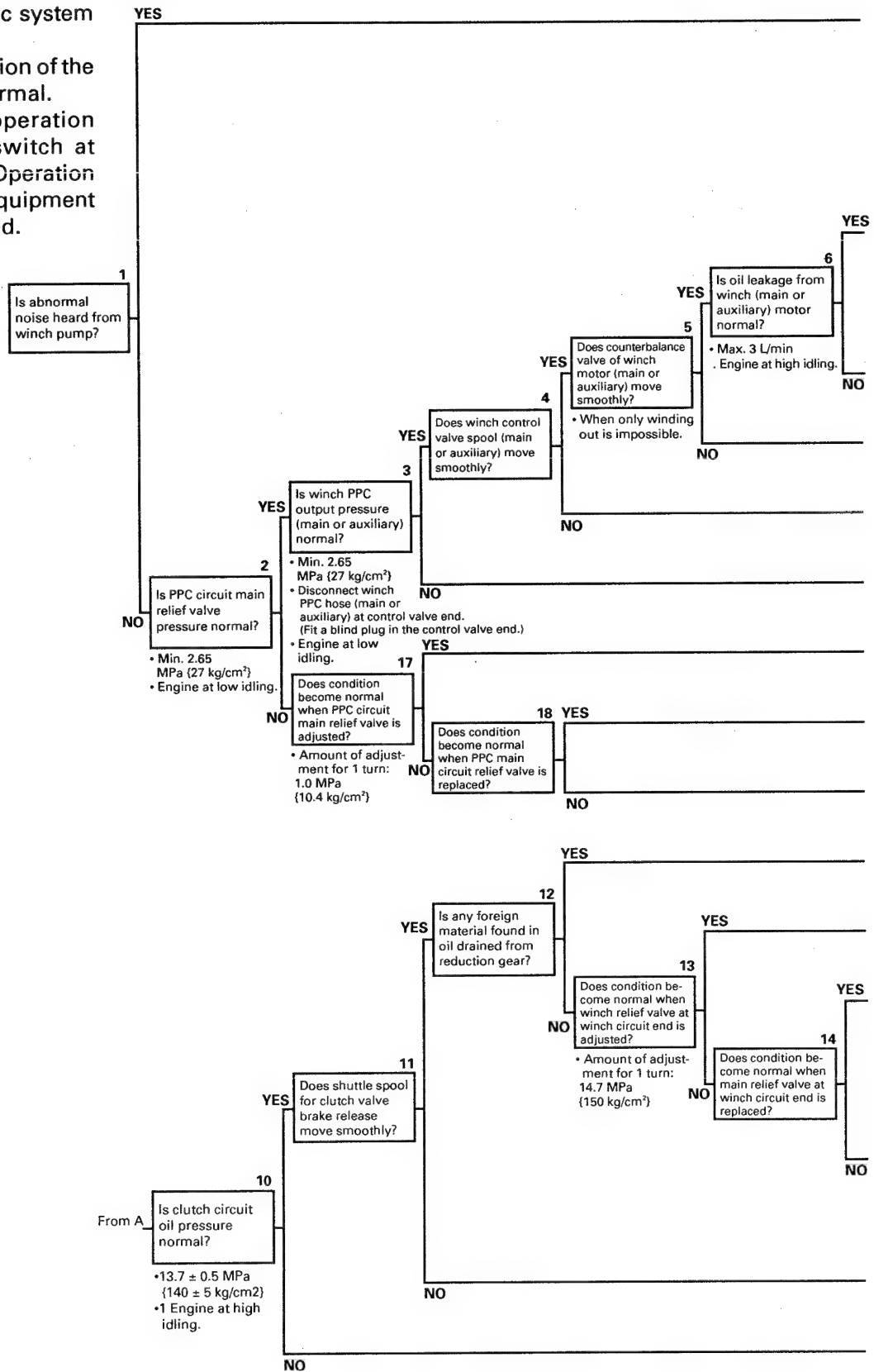
		Cause	Remedy
		Defective boom telescope counterbalance valve	Repair or replace
		Defective boom telescope flow control	Repair or replace
7 YES		Defective wire inside boom	Repair or replace
Is oil leakage from boom telescope cylinder normal?		Defective boom telescope cylinder	Repair or replace
	NO	Defective actuation of boom telescope control valve spool	Repair or replace
<ul style="list-style-type: none"> • Max. 2 cc/min • Engine at high idling • Boom telescope relief 		Defective order selector valve	Repair or replace
		Defective boom telescope PPC valve	Repair or replace
		Air sucked into suction circuit	Repair
		Defective adjustment of main relief valve at boom circuit end	Adjust
		Defective main relief valve at boom circuit end	Replace
13 YES		Defective boom control valve flow control	Repair or replace
Does condition become normal when boom control valve flow control is replaced?		Drop in boom pump performance or defective swivel joint	Repair or replace
	NO	Defective main unload valve	Repair or replace
		Defective adjustment of PPC circuit main relief valve	Repair or replace
		Defective PPC circuit main relief valve	Replace
		Drop in PPC pump performance	Repair or replace

023S02

H-4 Winch cannot be wound in or wound out, or speed is slow

⚠ Check that there is no one in the surrounding area before starting troubleshooting.

- ★ When the electric system is normal.
- ★ When the operation of the PTO clutch is normal.
- ★ Carry out the operation with the PTO switch at Operation 1 or Operation 2 and the work equipment lever stand raised.



023S02

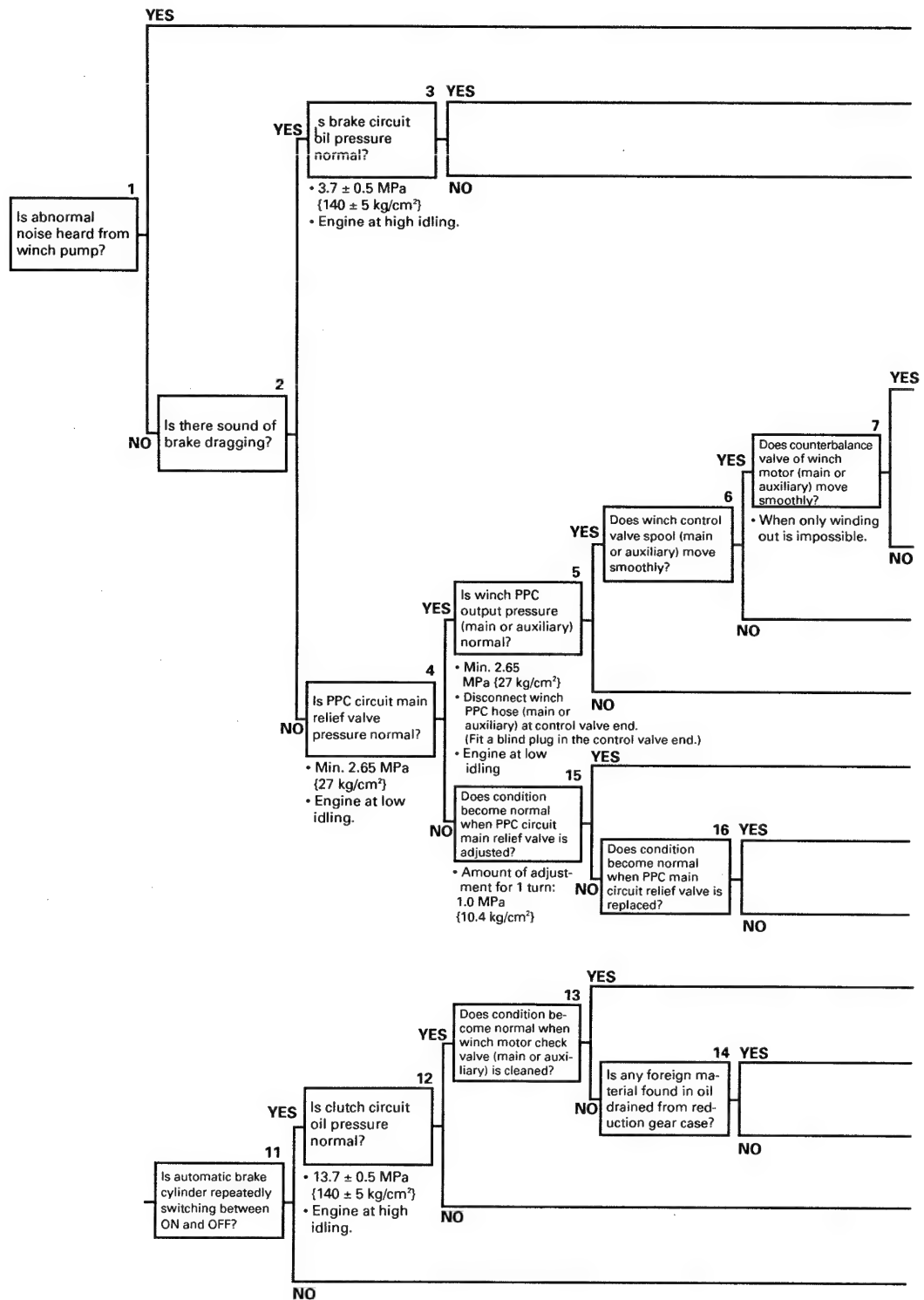
	Cause	Remedy
	Air sucked into suction circuit	Repair
	Go to A	
9 YES Is ACC charge valve output pressure normal? • 13.7 ± 0.5 MPa (140 ± 5 kg/cm ²) • Engine at high idling.	Defective actuation of ACC charge valve	Repair or replace
YES 8 Is actuation of steering priority valve normal? • Is hydraulic pressure formed at port EF (winch line) when steering is not operated?	Defective priority valve	Repair or replace
7 Does condition become normal when winch flow control (main or auxiliary) is interchanged?	Defective winch flow control (main or auxiliary)	Repair or replace
NO	Defective winch motor (main or auxiliary)	Repair or replace
	Defective actuation of winch motor counterbalance valve (main or auxiliary)	Repair or replace
	Defective actuation of winch control valve spool (main or auxiliary)	Repair or replace
	Defective winch PPC valve (main or auxiliary)	Repair or replace
	Defective adjustment of PPC circuit main relief valve	Repair or replace
	Defective adjustment of PPC circuit main relief valve	Replace
	Drop in PPC pump performance	Repair or replace
	Defective reduction gear	Repair or replace
	Defective adjustment of main relief valve at winch circuit end	Adjust
	Defective adjustment of main relief valve at winch circuit end	Replace
16 YES Does condition become normal when winch control valve flow control is replaced?	Defective winch control valve flow control	Repair or replace
YES 15 Is actuation of main unload valve normal? • Winch WIND IN must not work when emergency alarm buzzer is sounding.	Defective actuation of clutch cylinder or clutch slipping or drop in winch pump performance	Repair or replace
NO	Defective main unload valve	Repair or replace
	Defective actuation of brake oil pressure circuit selector valve	Repair or replace
	Defective winch FREE/WORK selector valve	Repair or replace

023S02

H-5 Winch moves intermittently (there is hunting)

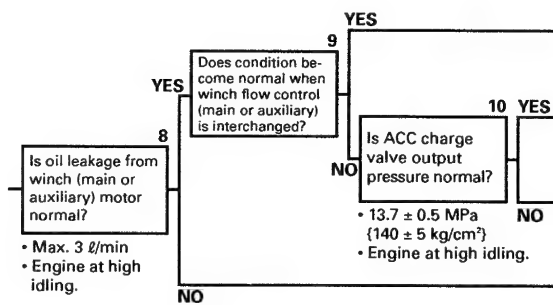
⚠ Check that there is no one in the surrounding area before starting troubleshooting.

- ★ When the electric system is normal.
- ★ Check that the oil level in the hydraulic tank is normal.
- ★ Carry out the operation with the PTO switch at Operation 1 or Operation 2 and the work equipment lever stand raised.



023S02

	Cause	Remedy
	Air sucked into suction circuit	Repair
	Defective brake contact or defective actuation of brake oil pressure cylinder	Repair or replace
	Defective actuation of shuttle spool for clutch valve brake release	Repair or replace
	Go to A	
	Defective winch flow control (main or auxiliary)	Repair or replace
	Defective ACC charge valve	Repair or replace
	Defective actuation of winch motor counterbalance valve (main or auxiliary)	Repair or replace
	Defective winch motor (main or auxiliary)	Repair or replace
	Defective winch control valve spool (main or auxiliary)	Repair or replace
	Defective winch PPC valve (main or auxiliary)	Repair or replace
	Defective adjustment of PPC circuit main relief valve	Repair or replace
	Defective PPC circuit main relief valve	Replace
	Drop in PPC pump performance	Repair or replace
	Defective actuation of winch motor check valve	Repair or replace
	Defective reduction gear	Repair or replace
	Defective winch motor	Replace
	Defective actuation of winch FREE/WORK selector valve of clutch valve	Repair or replace
	Defective brake selector valve	Repair or replace

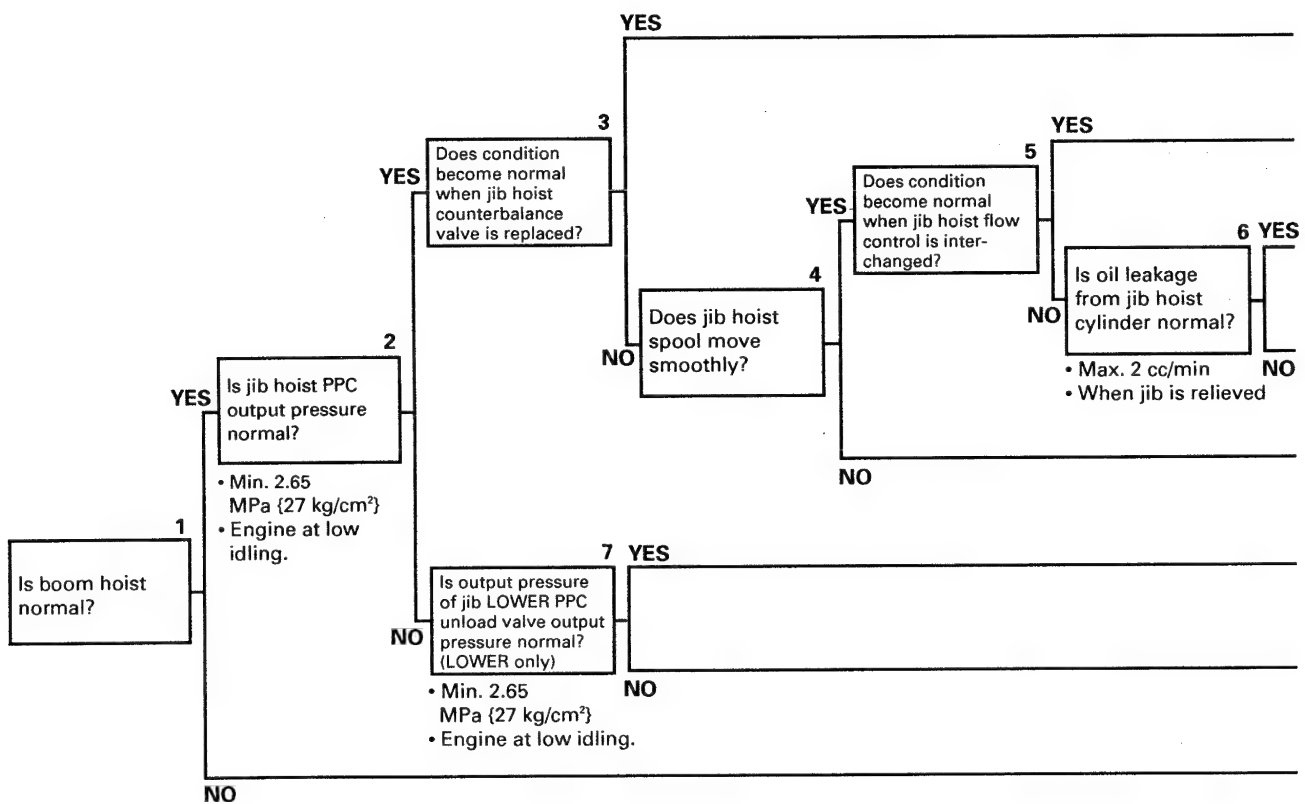


023S02

H-6 Jib cannot be raised, lowered, extended, or stowed (power tilt machine)

- ⚠ Check that there is no one in the surrounding area before starting troubleshooting.
 ★ When the electric system is normal.

a) Jib cannot be raised or lowered

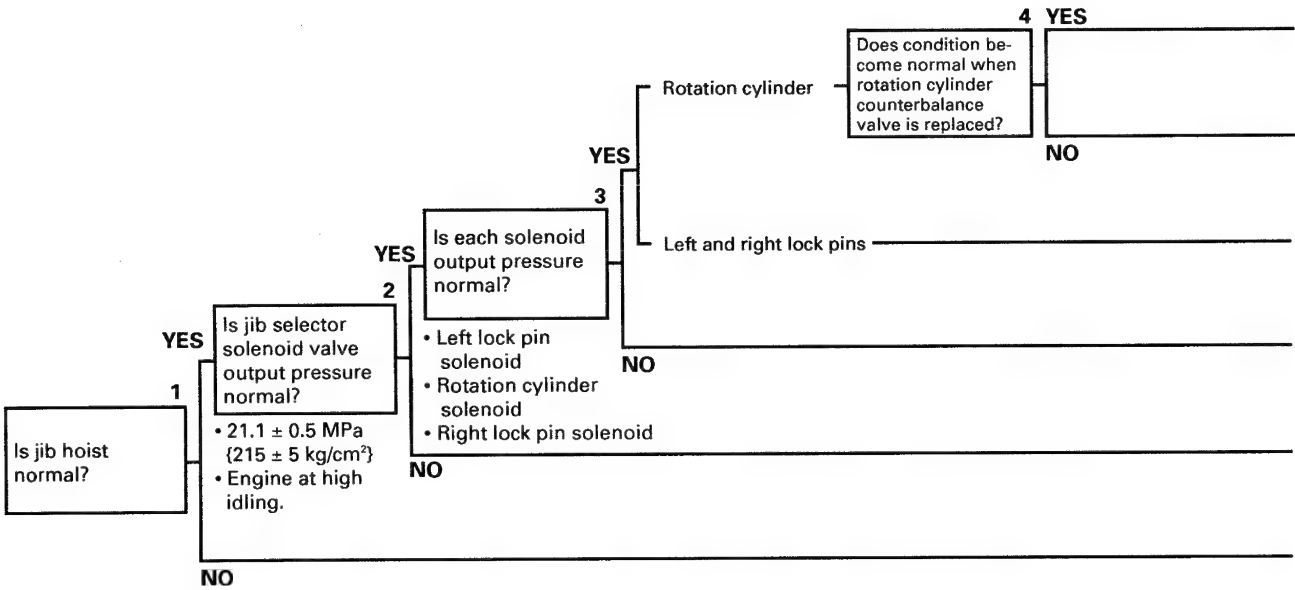


023S02

023S02

		Cause	Remedy
		Defective jib hoist counterbalance valve	Repair or replace
		Defective jib hoist flow control	Repair or replace
		Defective jib selector solenoid valve	Repair or replace
		Defective jib hoist cylinder	Repair or replace
		Defective actuation of jib hoist spool	Repair or replace
		Defective jib hoist PPC valve	Repair or replace
		Defective jib LOWER PPC unload valve	Repair or replace
		Go to Troubleshooting H-2, Item 7.	

b) Jib cannot be automatically extended or stowed



023S02

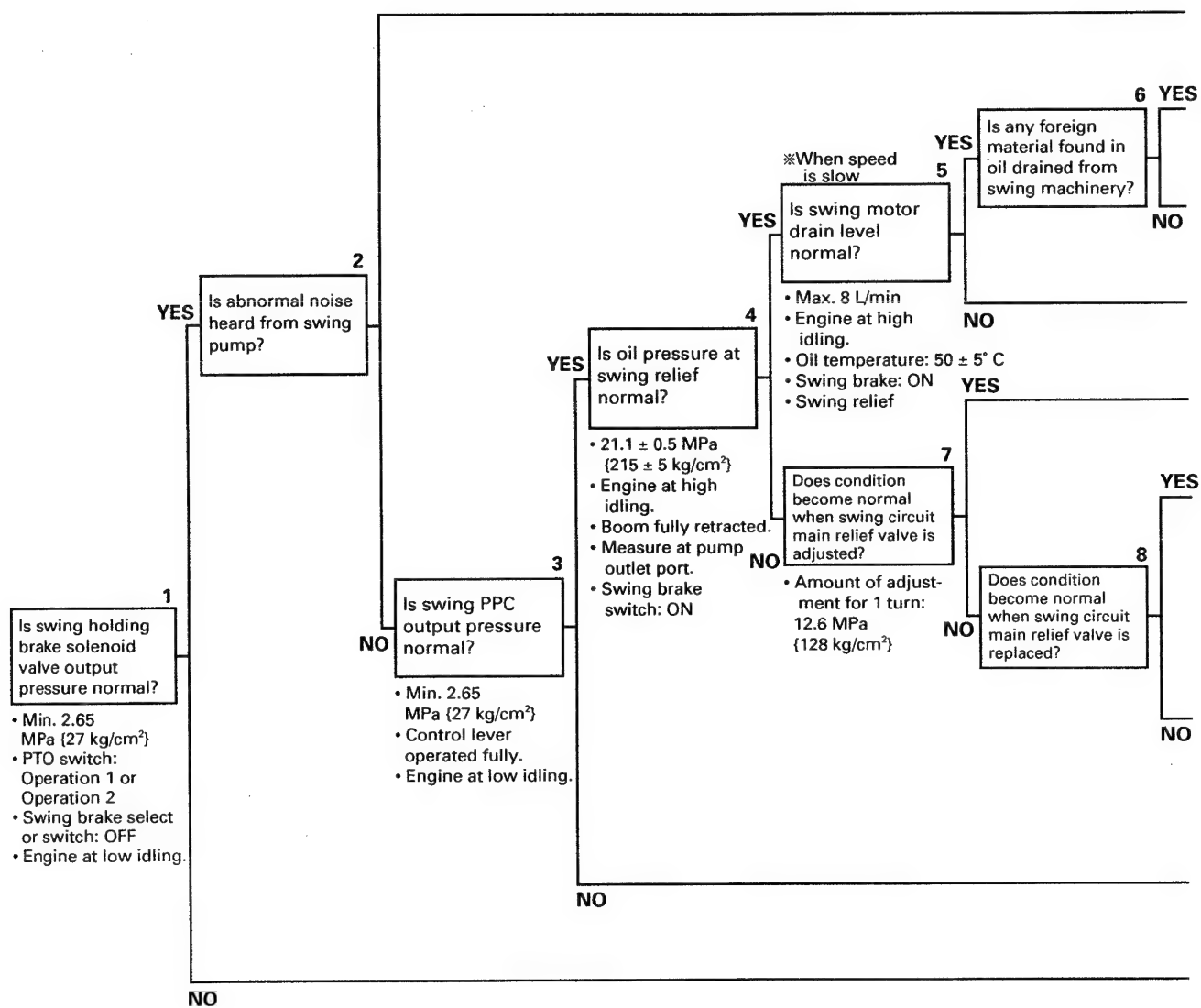
023S02

	Cause	Remedy
	Defective rotation cylinder counterbalance valve	Repair or replace
	Defective rotation cylinder	Repair or replace
	Defective lock pin cylinder	Repair or replace
	One of solenoids is defective	Repair or replace
	Defective jib selector solenoid	Repair or replace
	Go to troubleshooting Item 2, a)	

H-7 Upper structure cannot be swung or swing speed is slow

⚠ Check that there is no one in the surrounding area before starting troubleshooting.

- ★ When the PPC pilot pressure is normal.
- ★ When the electric system is normal.



023S02

	Cause	Remedy
	Air sucked into suction circuit or defective pump	Repair or replace
	Defective swing holding brake or defective swing machinery	Repair or replace
	Defective actuation of swing control valve spool	Repair or replace
	Excessive leakage inside swing motor	Replace
	Defective adjustment of swing circuit main relief valve	Adjust
	Defective swing circuit main relief valve	Replace
	Defective actuation of crossover relief valve inside swing motor (dirt stuck or drop in set pressure)	Repair or replace
	Drop in swing pump performance	Replace
	Defective actuation of swing motor suction poppet	Repair or replace
	Defective swing PPC valve	Replace
	Defective actuation of swing holding brake solenoid valve	Repair or replace

15 Is actuation of main unload valve normal?

• Winch WIND IN must not work when emergency alarm buzzer is sounding.

YES → **16** Does condition become normal when winch control valve flow control is replaced?

NO → []

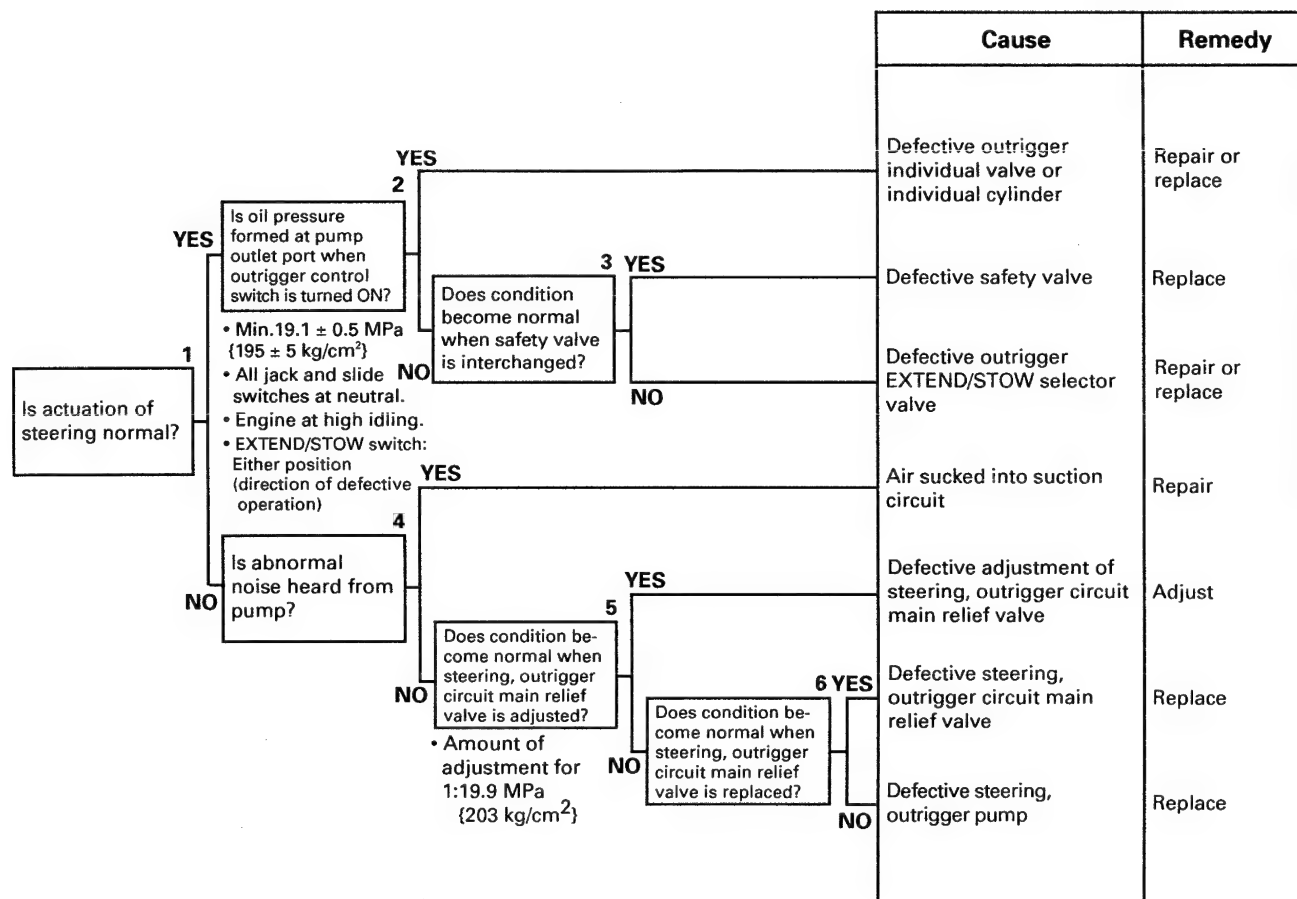
16 YES → []

NO → []

H-8 Outriggers cannot be extended or stowed

⚠ Check that there is no one in the surrounding area before starting troubleshooting.

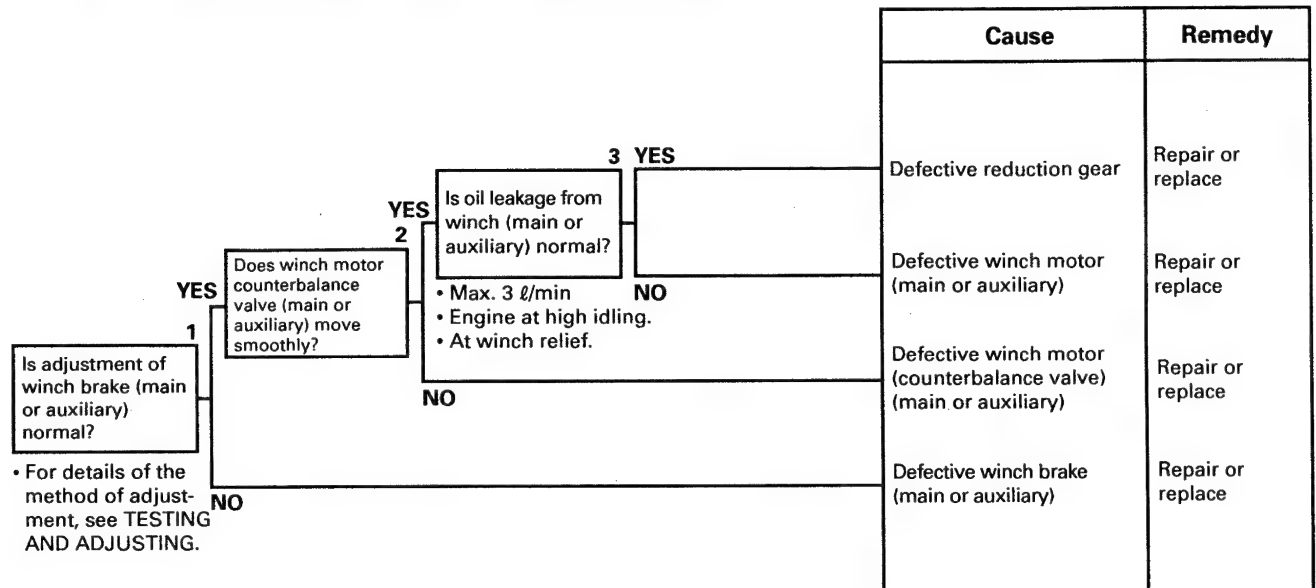
- ★ When the operation of the PTO clutch is normal.
- ★ When the electric system is normal.
- ★ Carry out the operation with the PTO switch at Operation 1.



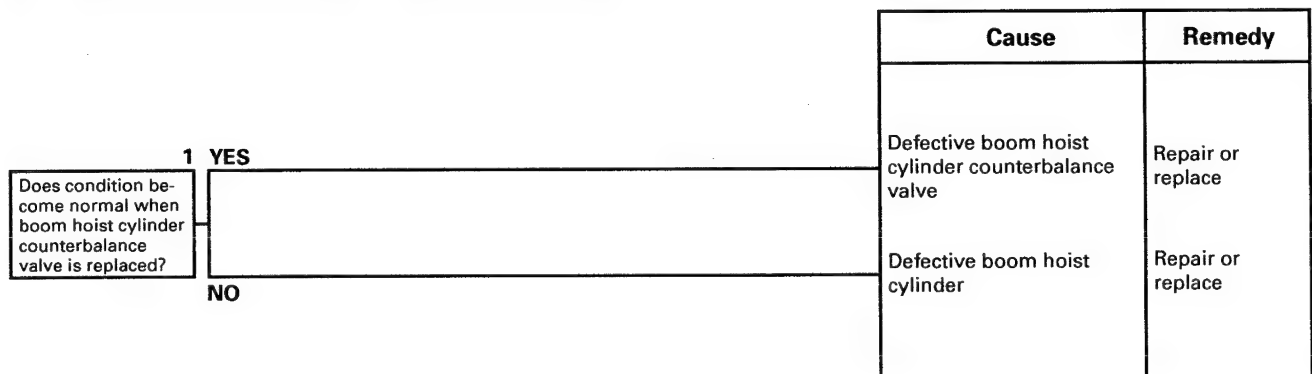
023S02

H-9 Excessive hydraulic drift

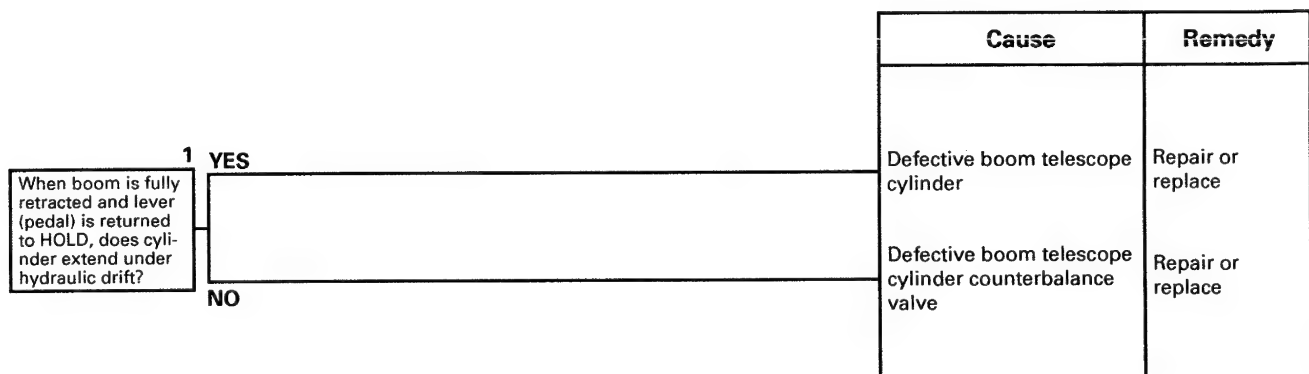
1) Excessive hydraulic drift in winch (main or auxiliary)



2) Excessive hydraulic drift in boom hoist circuit

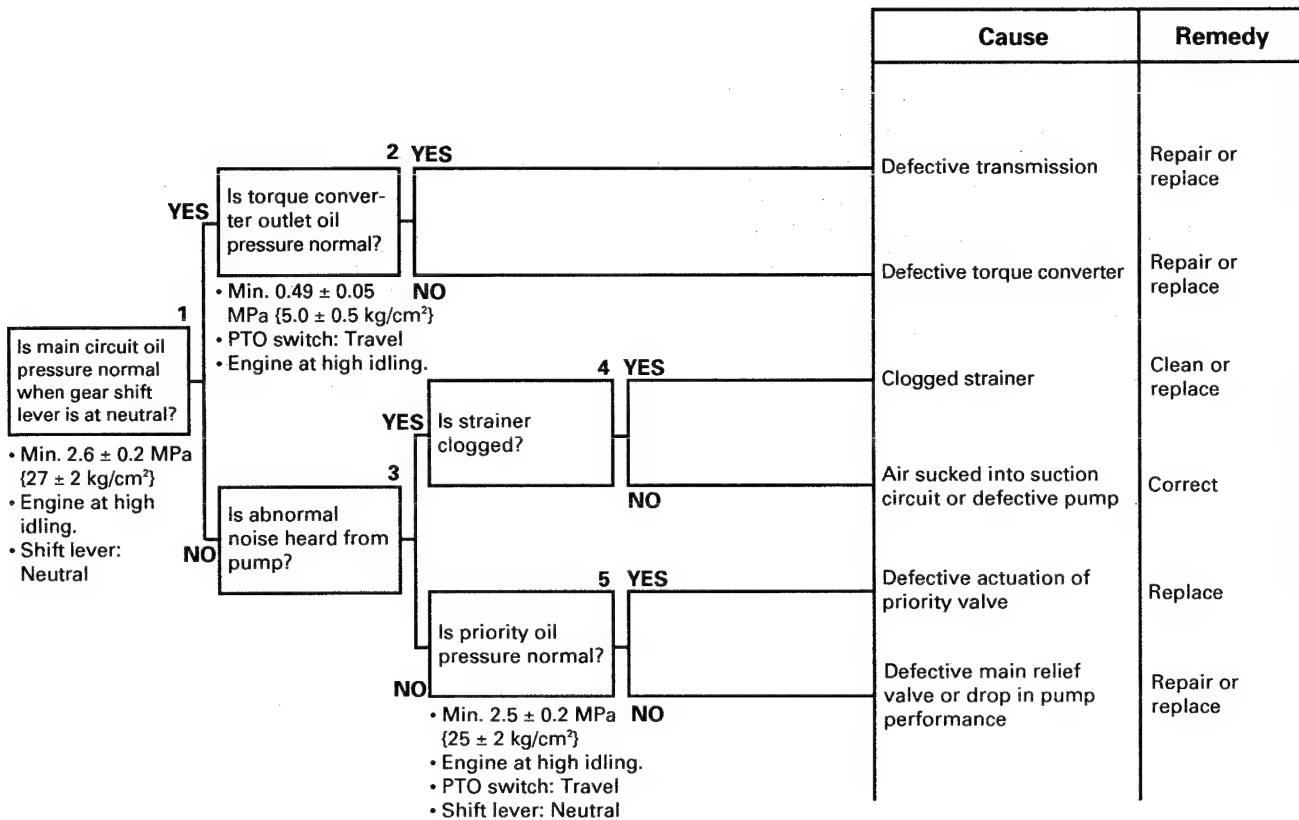


3) Excessive hydraulic drift in boom telescope circuit



H-101 Machine does not move off

★ When the electric system is normal.



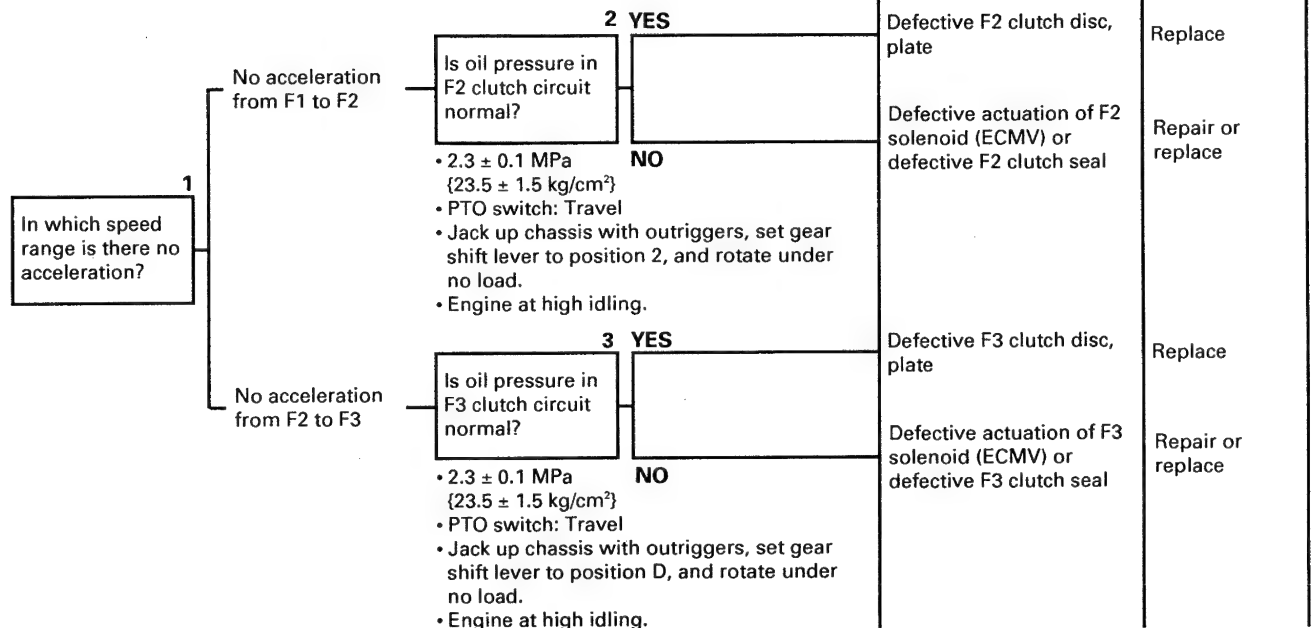
023S02

H-102 Machine does not accelerate or does not decelerate

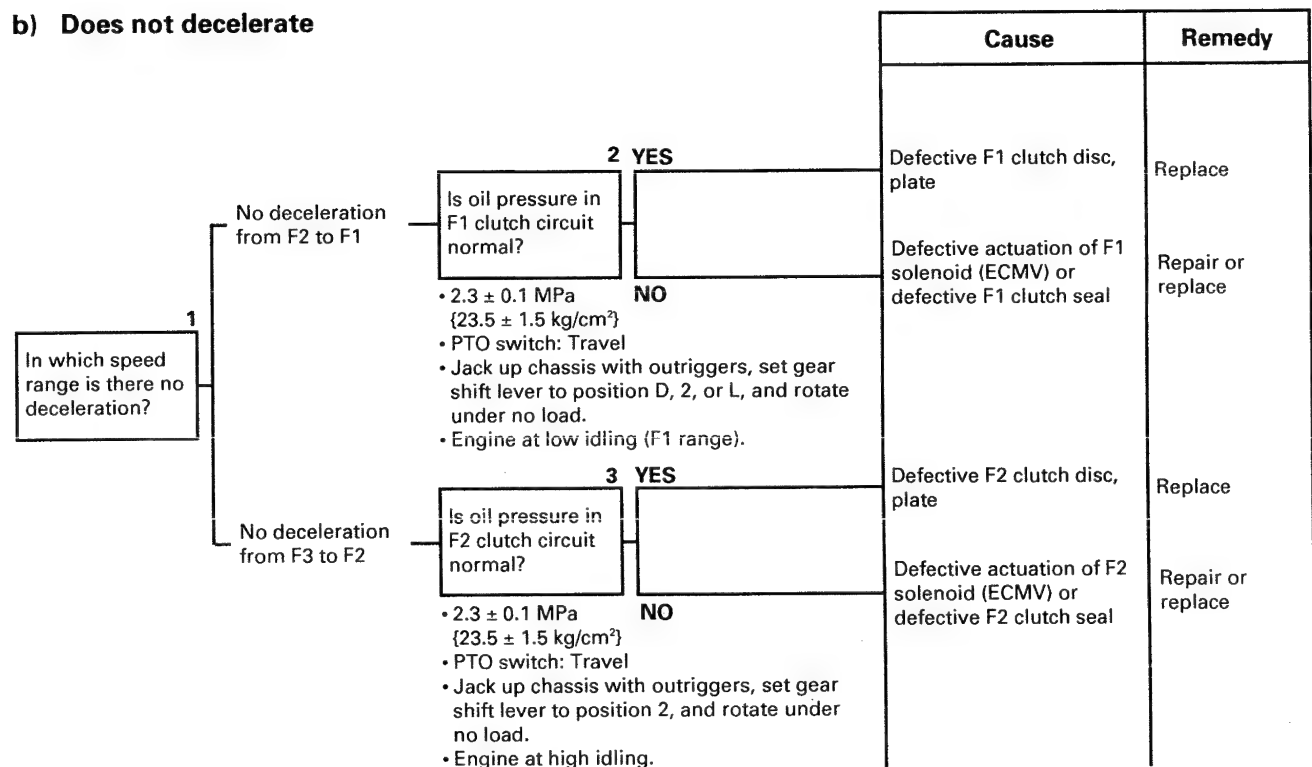
⚠ Check that there is no one in the surrounding area before starting troubleshooting.

★ When the electric system is normal.

a) Does not accelerate



b) Does not decelerate

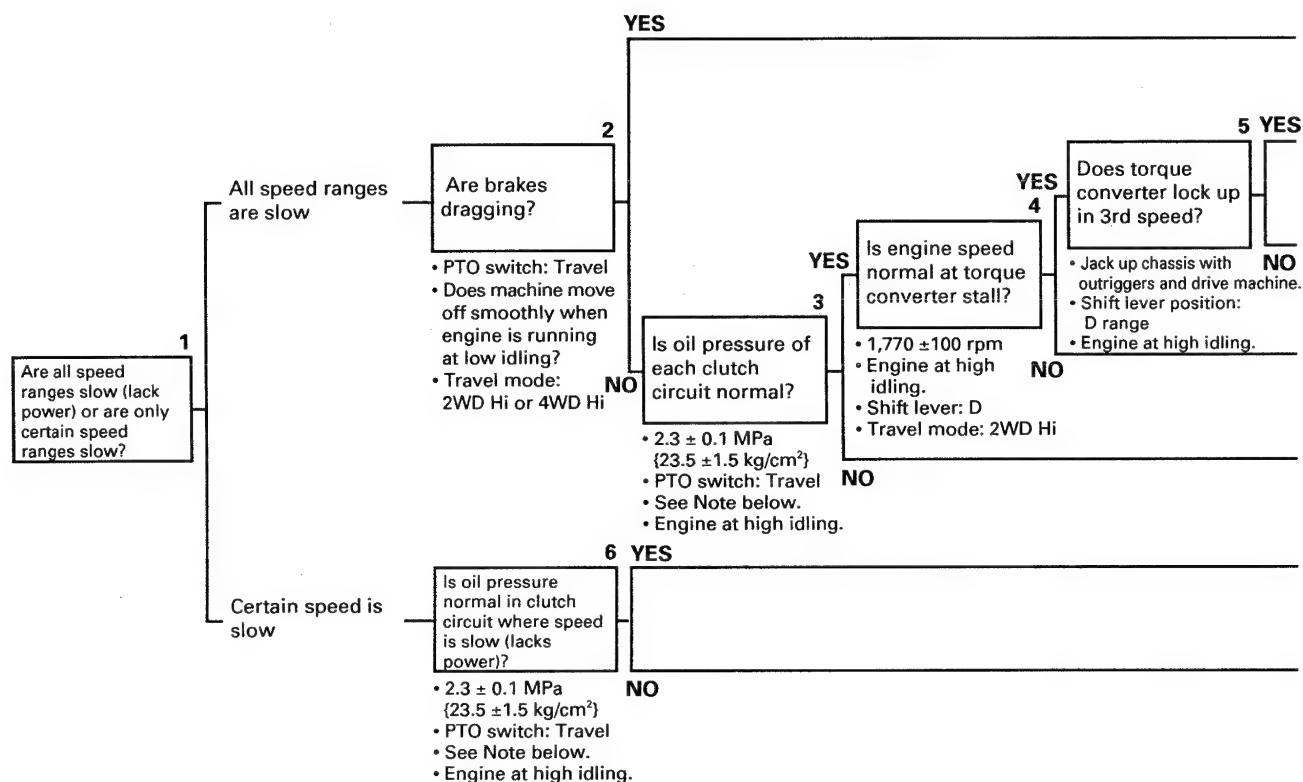


⚠ Before jacking up the machine, retract the boom, set the outriggers to the maximum width, and be extremely careful about safety. Check carefully that there is no one in the surrounding area before rotating the wheels under no load.

H-103 Travel speed is slow or lacks power

⚠ Check that there is no one in the surrounding area before starting troubleshooting.

★ When the electric system is normal.



023S02

Note: Procedure for measuring oil pressure in each clutch circuit.

F1 clutch : Jack up machine with outriggers, set gear shift lever to position D, 2, or L, and rotate wheels under no load with engine running at low idling.

F2 clutch : Jack up machine with outriggers, set gear shift lever to position 2, and rotate wheels under no load with engine running at high idling.

F3 clutch : Jack up machine with outriggers, set gear shift lever to position D, and rotate wheels under no load with engine running at high idling.

R clutch : Jack up machine with outriggers, set gear shift lever to position R, and rotate wheels under no load with engine running at high idling.

023S02

	Cause	Remedy
	Defective brake system (see H-108)	Repair
	Excessive resistance from travel mechanism of machine.	
	Defective torque converter lock-up (see H-105)	
	Drop in engine performance (See S MODE, TROUBLESHOOTING OF ENGINE SYSTEM.)	
	Go to H-101 "Machine does not move off".	Repair
	Distortion of clutch disc (plate)	
	Defective actuation of applicable clutch solenoid (ECMV)	Repair or replace

H-104 Torque converter lock-up does not engage or cannot be disengaged (engine stalls when machine is stopped or moves off)

★ When the electric system is normal.

a) Does not engage

1

YES

Is torque converter lock-up oil pressure normal?

• 2.0 ± 0.1 MPa {20.5 ± 1.5 kg/cm²}

• Jack up chassis with outriggers, and accelerate to 3rd.

• Engine at high idling.

• Gear shift lever: D

NO

Defective torque converter lock-up clutch (defective disc or piston seal)

Defective lock-up ECMV or defective actuation of lock-up valve

Repair or replace

Repair or replace

b) Does not disengage

1

YES

Is torque converter lock-up oil pressure normal?

• 0 MPa {0 kg/cm²}

• Shift lever: Neutral

• Start engine.

NO

Defective torque converter lock-up clutch

Defective lock-up solenoid (ECMV) or defective actuation of lock-up valve

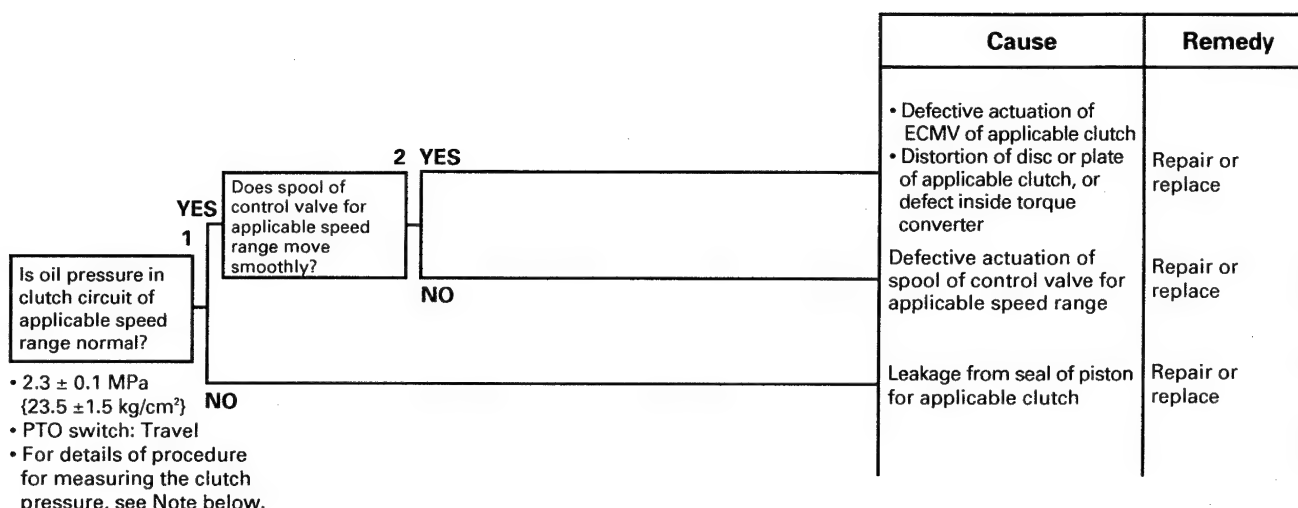
Repair

Repair or replace

023S02

H-105 Excessive time lag when moving off (shifting gear), or shift up is slow

★ When the electric system is normal.



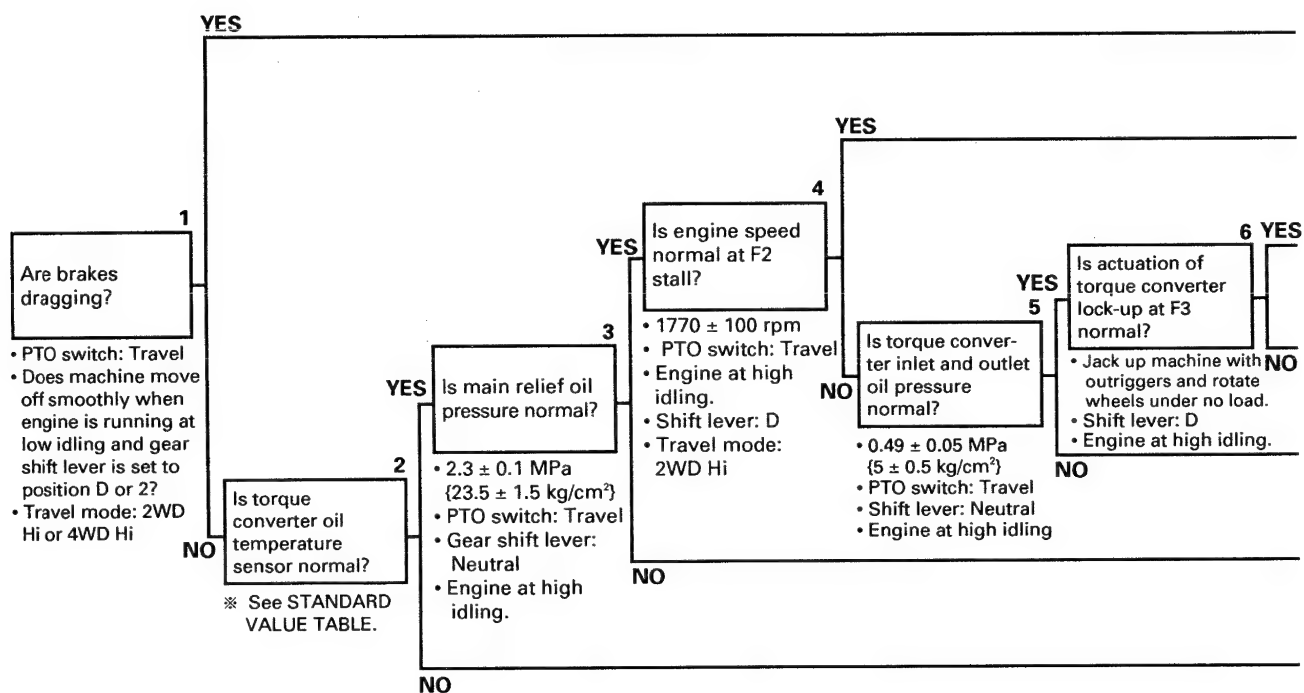
Note: Procedure for measuring oil pressure in each clutch circuit.

- F1 clutch : Jack up machine with outriggers, set gear shift lever to position D, 2, or L, and rotate wheels under no load with engine running at low idling.
- F2 clutch : Jack up machine with outriggers, set gear shift lever to position 2, and rotate wheels under no load with engine running at high idling.
- F3 clutch : Jack up machine with outriggers, set gear shift lever to position D, and rotate wheels under no load with engine running at high idling.
- R clutch : Jack up machine with outriggers, set gear shift lever to position R, and rotate wheels under no load with engine running at high idling.

H-106 Torque converter oil temperature becomes high

⚠ Check that there is no one in the surrounding area before starting troubleshooting.

★ When the electric system is normal.



023S02

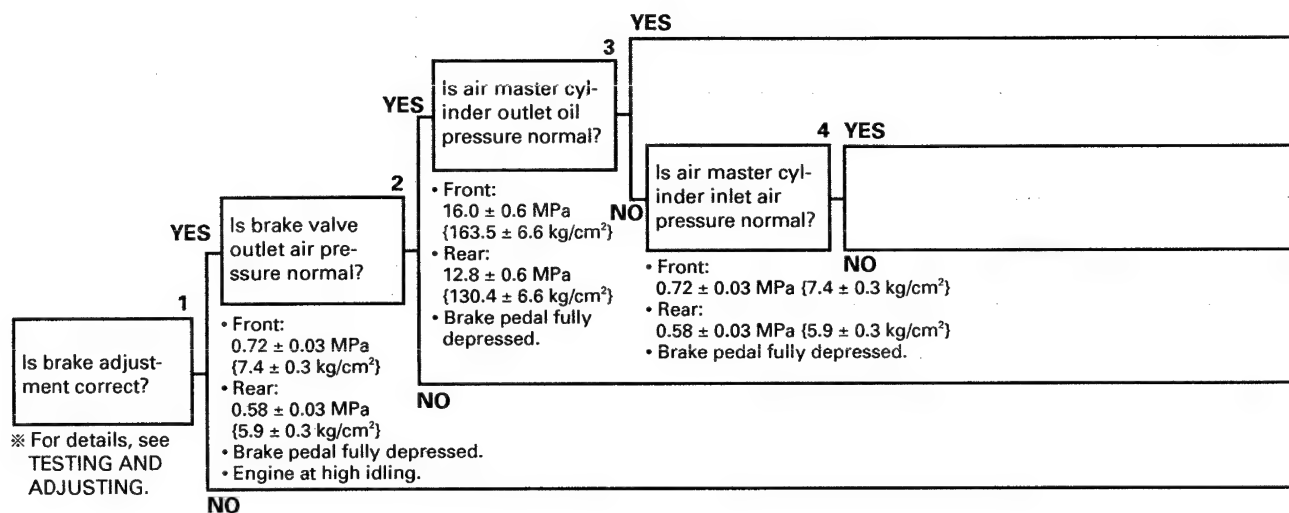
Cause	Remedy
Defective brake system	Repair
Defective coolant system (See S MODE, TROUBLE-SHOOTING OF ENGINE SYSTEM.)	
Defect inside transmission or excessive resistance from travel mechanism of machine.	
Defective actuation of torque converter lock-up (see H-105)	
Defective actuation of torque converter regulator valve or defect inside torque converter	Repair or replace
Go to H-101 "Machine does not move off".	Replace
Defective torque converter oil temperature sensor	

023S02

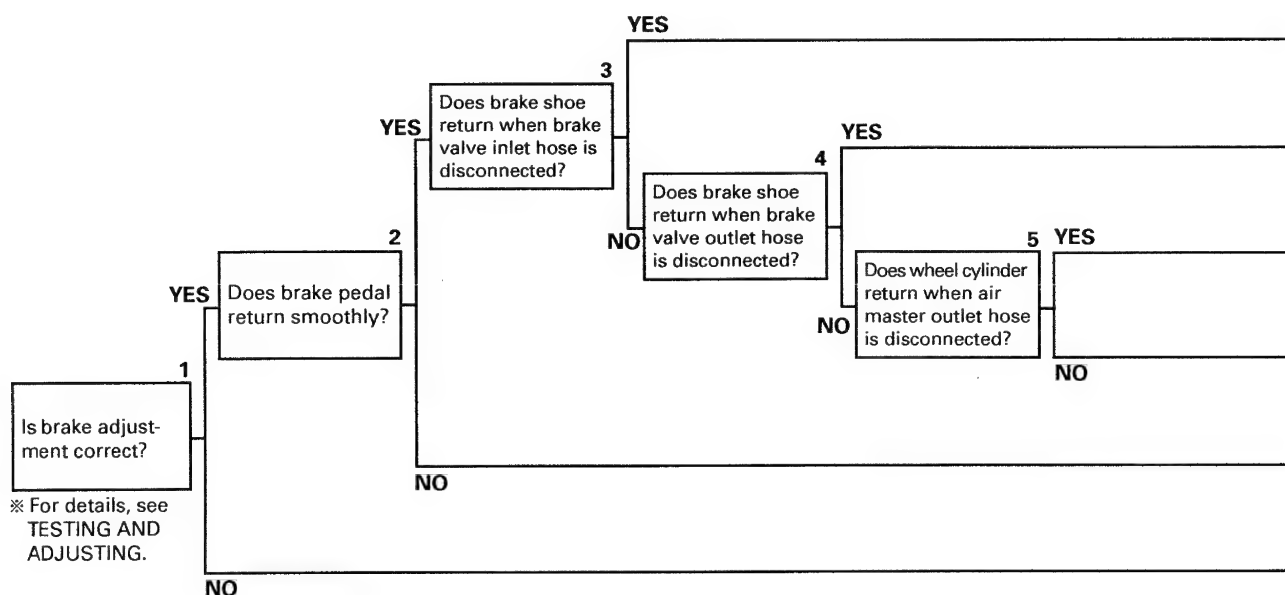
H-107 Brake cannot be applied (braking effect is poor), pulls to one side, or cannot be released (drags)

- ★ Check that the air pressure and brake fluid level are normal before starting troubleshooting.
- ★ Check that there is no air in the brake oil (fluid).
- ★ Check that there is no external leakage of oil or leakage of air.

a) Brake cannot be applied (braking effect is poor) or pulls to one side



b) Brake cannot be released (drags)



023S02

023S02

	Cause	Remedy
	<ul style="list-style-type: none"> Defective actuation, wear of brake disc Defective actuation of wheel cylinder 	Repair or replace
	Defective air master cylinder	Repair or replace
	Defective air regulator	Repair or replace
	Defective actuation of brake valve	Repair or replace
	Defective adjustment of brake	Adjust

	Cause	Remedy
	Defective return of air master cylinder (booster)	Repair or replace
	Defective return of brake valve	Repair or replace
	Defective return of air master cylinder	Repair or replace
	Defective return of wheel cylinder	Repair or replace
	Defective return of brake pedal	Repair
	Defective adjustment of brake	Adjust

H-108 Exhaust brake cannot be applied or cannot be released

- ★ When the operation of the transmission is normal.
- ★ When the electric system is normal.

a) Exhaust brake cannot be applied

		Cause	Remedy
<div> <div>1</div> <div>Is cylinder actuated normally when rod end of exhaust brake cylinder is disconnected?</div> <div> <div>YES</div> <div>NO</div> </div> <div> <div>• Turn starting switch ON.</div> <div>• Accelerator pedal: OFF (do not depress)</div> <div>• Exhaust brake switch: ON</div> </div> </div>	YES	Defective actuation of exhaust brake butterfly	Repair
	2 YES	Defective actuation of exhaust brake cylinder	Replace
	NO	Defective actuation of exhaust brake magnetic (solenoid) valve	Repair or replace
<div> <div>2</div> <div>Is cylinder actuated normally when rod end of exhaust brake cylinder is disconnected?</div> <div> <div>YES</div> <div>NO</div> </div> <div> <div>• Turn starting switch ON.</div> <div>• Accelerator pedal: OFF (do not depress)</div> <div>• Exhaust brake switch: ON</div> </div> </div>			

b) Exhaust brake cannot be released

		Cause	Remedy
<div> <div>1</div> <div>Is cylinder actuated normally when rod end of exhaust brake cylinder is disconnected?</div> <div> <div>YES</div> <div>NO</div> </div> <div> <div>• Turn starting switch ON.</div> <div>• Accelerator pedal: OFF (do not depress)</div> <div>• Exhaust brake switch: ON</div> </div> </div>	YES	Defective actuation of exhaust brake butterfly	Repair
	2 YES	Defective actuation of exhaust brake cylinder	Replace
	NO	Defective actuation of exhaust brake magnetic (solenoid) valve	Repair or replace
<div> <div>2</div> <div>Does air stop when exhaust brake magnetic valve outlet hose is disconnected?</div> <div> <div>YES</div> <div>NO</div> </div> <div> <div>• Turn starting switch ON.</div> <div>• Accelerator pedal: OFF (do not depress)</div> <div>• Exhaust brake switch: OFF</div> </div> </div>			

023S02

H-109 Air pressure does not rise or is too low

a) Air pressure does not rise

		Cause	Remedy
<div> <div>Does air come out when compressor outlet hose is removed?</div> <div>1</div> <div>YES</div> <div>Does air pressure rise when air supply (inlet) hose of air governor is removed?</div> <div>2</div> <div>YES</div> <div>Defective air governor</div> <div>Adjust or replace</div> </div> <div> <div>• Fit a blind plug in the hose.</div> <div>NO</div> <div>Defective air regulator (safety valve) or air leakage from circuit</div> <div>Repair or replace</div> </div> <div> <div>Does air pressure rise when air compressor unload valve is cleaned?</div> <div>3</div> <div>YES</div> <div>Air compressor unload valve stays open</div> <div>Correct</div> </div> <div> <div>• 0.84 ± 0.03 MPa {8.6 ± 0.3 kg/cm²}</div> <div>• Engine at high idling.</div> <div>NO</div> <div>Defective air compressor</div> <div>Repair or replace</div> </div>			

b) Air pressure is too low

		Cause	Remedy
<div> <div>Does condition become normal when air governor is adjusted?</div> <div>1</div> <div>YES</div> <div>Drop in air governor set pressure</div> <div>Adjust</div> </div> <div> <div>• 0.84 ± 0.03 MPa {8.6 ± 0.3 kg/cm²}</div> <div>• Engine at high idling.</div> <div>NO</div> <div>Does condition become normal when unload valve is cleaned?</div> <div>2</div> <div>YES</div> <div>Defective actuation of air compressor unload valve</div> <div>Repair</div> </div> <div> <div>NO</div> <div>Drop in set pressure of air regulator (safety valve) or leakage of air from circuit</div> <div>Repair or replace</div> </div>			

023S02

H-110 Cannot switch between 2-wheel drive and 4-wheel drive, or between Hi and Lo

- ★ Check that the PTO switch is at Travel or Operation 1.
- ★ When the electric system is normal.
- ★ When the travel system is normal.
- ★ When there is no oil leakage.

a) Cannot switch between 2-wheel drive and 4-wheel drive

		Cause	Remedy
1 YES Is 2-wheel/4-wheel selector circuit supply pressure (power train main relief pressure) normal? • 2.7 ± 0.2 MPa { 28.0 ± 2.0 kg/cm ² } • Engine at high idling.	YES	Defective actuation of 2-wheel/4-wheel selector solenoid valve or defective actuation of 2-wheel/4-wheel selector cylinder	Repair or replace
	NO	Go to H-101 "Machine does not move off" and start from Item 5.	Replace

b) Cannot switch between Hi and Lo

		Cause	Remedy
1 YES Is Hi/Lo selector circuit supply pressure (power train main relief pressure) normal? • 2.7 ± 0.2 MPa { 28.0 ± 2.0 kg/cm ² } • Engine at high idling.	YES	Defective actuation of Hi/Lo selector solenoid valve or defective actuation of Hi/Lo selector cylinder	Repair or replace
	NO	Go to H-102 "Machine does not move off" and start from Item 5.	Replace

023S02

H-111 Steering mode cannot be switched

		Cause	Remedy
1 YES Is output pressure of steering mode solenoid valve normal? • 19.1 ± 0.5 MPa { 195 ± 5 kg/cm ² } • Engine at high idling.	YES	Defective steering mode solenoid valve	Repair or replace
	NO	Go to H-113, Item 7.	

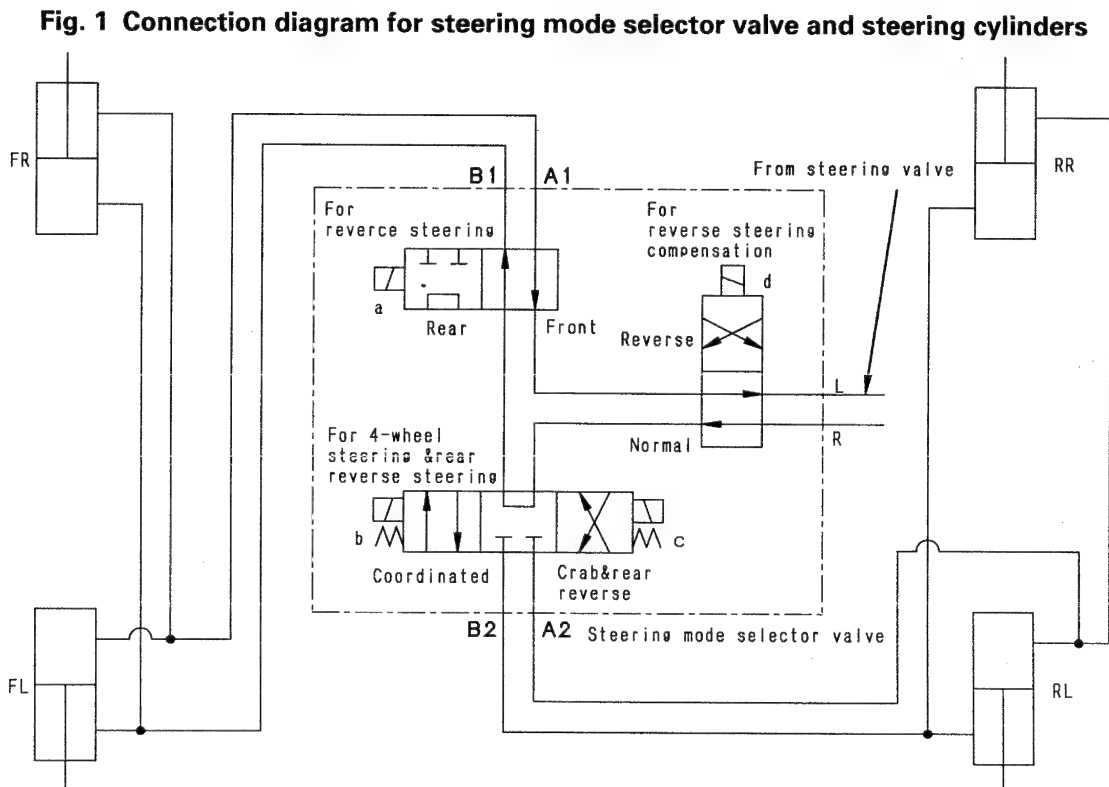
REFERENCE FOR H-111

- ★ **Measure the output pressure of the steering mode solenoid valve when there is electricity passing through the steering mode solenoid.**
 - 1) The rear steering is automatically locked in front 2-wheel travel, and is automatically released in any mode other than front 2-wheel travel.
 - 2) For front 2-wheel travel, the steering mode solenoids are all turned OFF. If the system will not switch to front 2-wheel travel, one of the modes other than front 2-wheel travel is not released, so carry out troubleshooting of the item for the mode which is not released.

		Rear lock solenoid		Indicator		Steering mode solenoid			
		Lock	Cance	Lock	Cance	a	b	c	d
Steering mode	Front 2-wheel	○		○					
	Rear 2-wheel		○		○	○	○		
	4-wheel coordinated		○		○		○		
	4-wheel crab		○		○			○	
	Reverse front 2-wheel	○		○					○
	Reverse rear 2-wheel		○		○	○	○		○
	Reverse 4-wheel coordinated		○		○		○		○

Table 1
Actuation condition of steering mode and solenoid, and actuation condition of steering lock solenoid

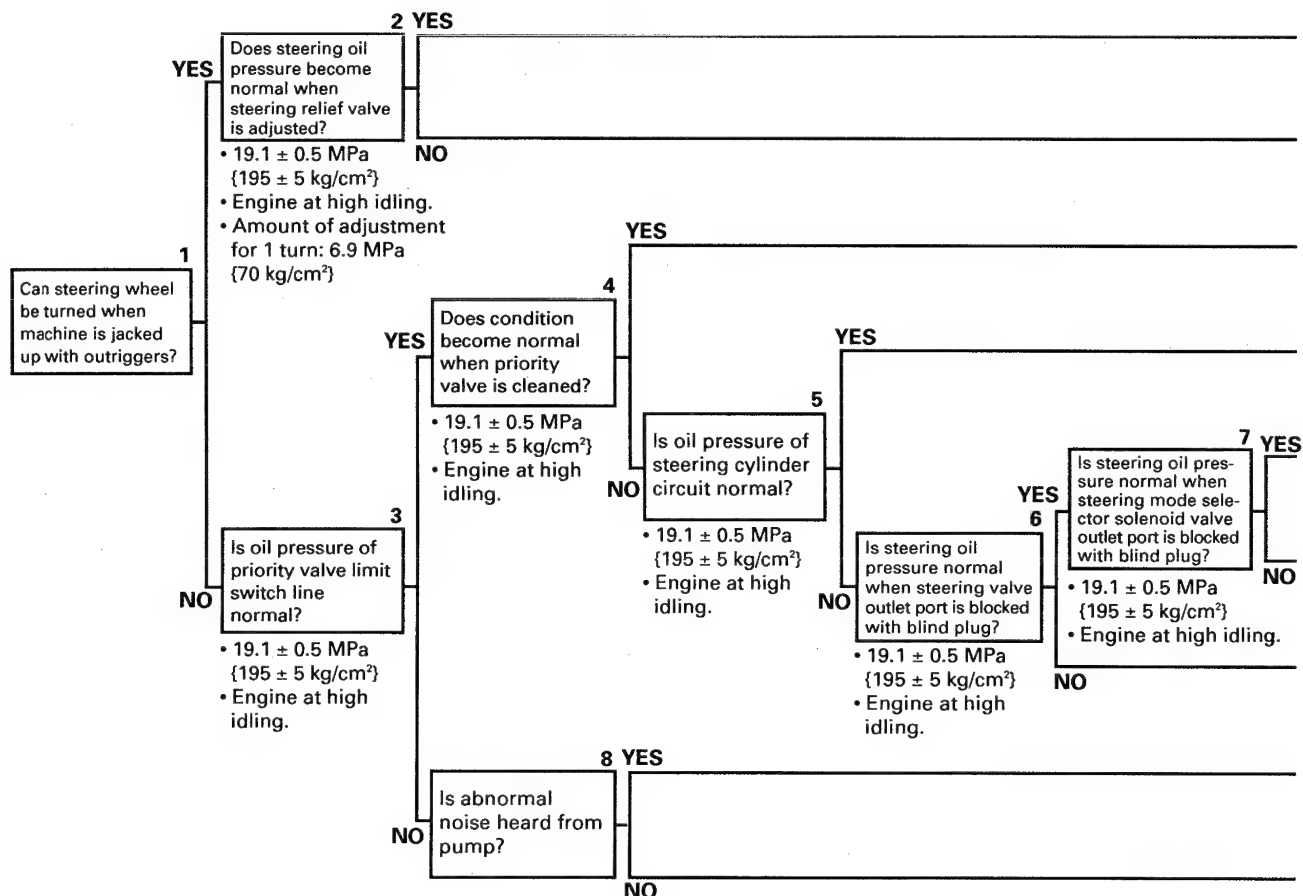
○: Electricity is passing through solenoid



TKL00631

H-112 Wheels do not move when steering wheel is turned (steering does not turn or is difficult to turn)

★ When the electric system is normal.



023S02

023S02

	Cause	Remedy
	Defective adjustment of steering relief valve	Repair
	Defective steering relief valve	Replace
	Defective actuation of priority valve	Repair or replace
	Damaged axle	Repair
	Defective steering cylinder	Repair or replace
	Defective steering mode selector solenoid valve	Repair or replace
	Defective steering valve	Repair or replace
	Air sucked into suction circuit	Repair
	Drop in steering, outrigger pump performance	Replace

H-113 Rear steering is not locked or is not released

- ★ When the electric system is normal.
- ★ When the air pressure is normal.

a) Rear steering is not locked

		Cause	Remedy
<div> <div>1 YES</div> <div>Does air come out when rear steering LOCK/FREE solenoid valve outlet hose is disconnected?</div> </div>		Defective actuation of rear steering lock cylinder	Repair or replace
		Defective rear steering LOCK/FREE solenoid valve	Repair or replace
<div> <div>NO</div> <div> <ul style="list-style-type: none"> • Start engine. • PTO switch: Travel or Operation 1 • Rear steering lock cancel switch: LOCK </div> </div>			

b) Rear steering is not released

		Cause	Remedy
<div> <div>1 YES</div> <div>Does air come out when rear steering LOCK/FREE solenoid valve outlet hose is disconnected?</div> </div>		Defective actuation of rear steering lock cylinder	Repair or replace
		Defective rear steering LOCK/FREE solenoid valve	Repair or replace
<div> <div>NO</div> <div> <ul style="list-style-type: none"> • Start engine. • PTO switch: Travel or Operation 1 • Rear steering lock cancel switch: FREE </div> </div>			

023S02

H-114 Suspension cannot be locked or cannot be set free

- ★ When the electric system is normal.
- ★ When the operation of the transmission is normal.

a) Suspension cannot be locked

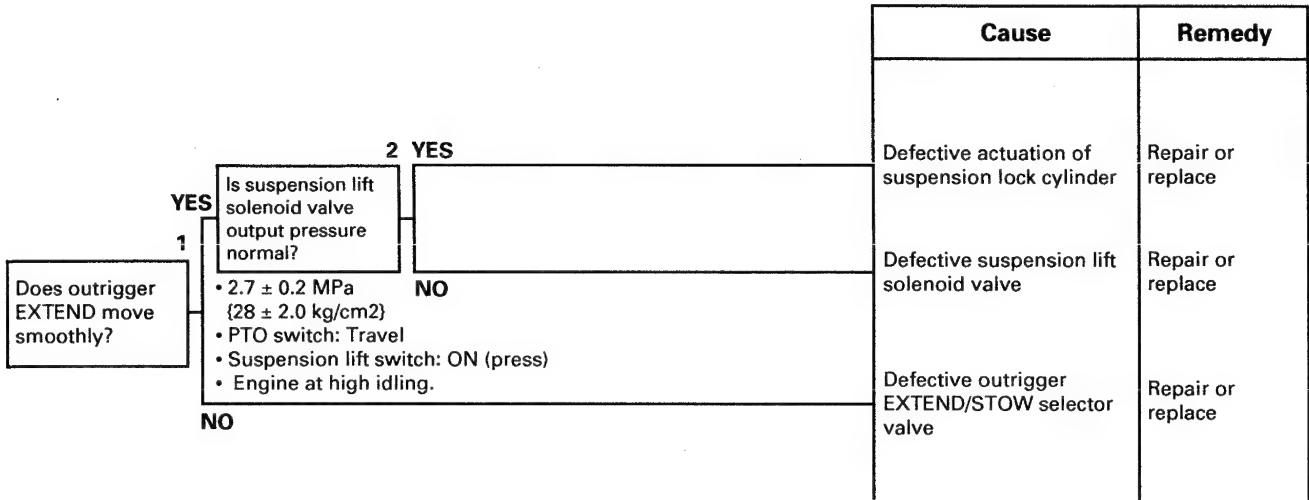
		Cause	Remedy
<div> <div>1</div> <div>YES</div> <div>Is suspension locked when suspension lock cylinder pilot hose is disconnected?</div> <div> <div>• When suspension is lowered.</div> <div>NO</div> </div> </div>		Defective suspension LOCK/FREE solenoid valve	Repair or replace
		Defective suspension lock cylinder	Repair or replace

b) Suspension cannot be set free

		Cause	Remedy
<div> <div>1</div> <div>YES</div> <div>Is suspension LOCK/FREE solenoid outlet pressure normal?</div> <div> <div> <div>• 2.7 ± 0.2 MPa {28 ± 2.0 kg/cm²}</div> <div>• PTO switch: Travel</div> <div>• Suspension lock switch: FREE</div> <div>• Engine at high idling.</div> </div> <div>NO</div> </div> </div>		Defective suspension lock cylinder	Repair or replace
		Defective suspension LOCK/FREE solenoid valve	Repair or replace

023S02

H-115 Suspension lift cannot be used



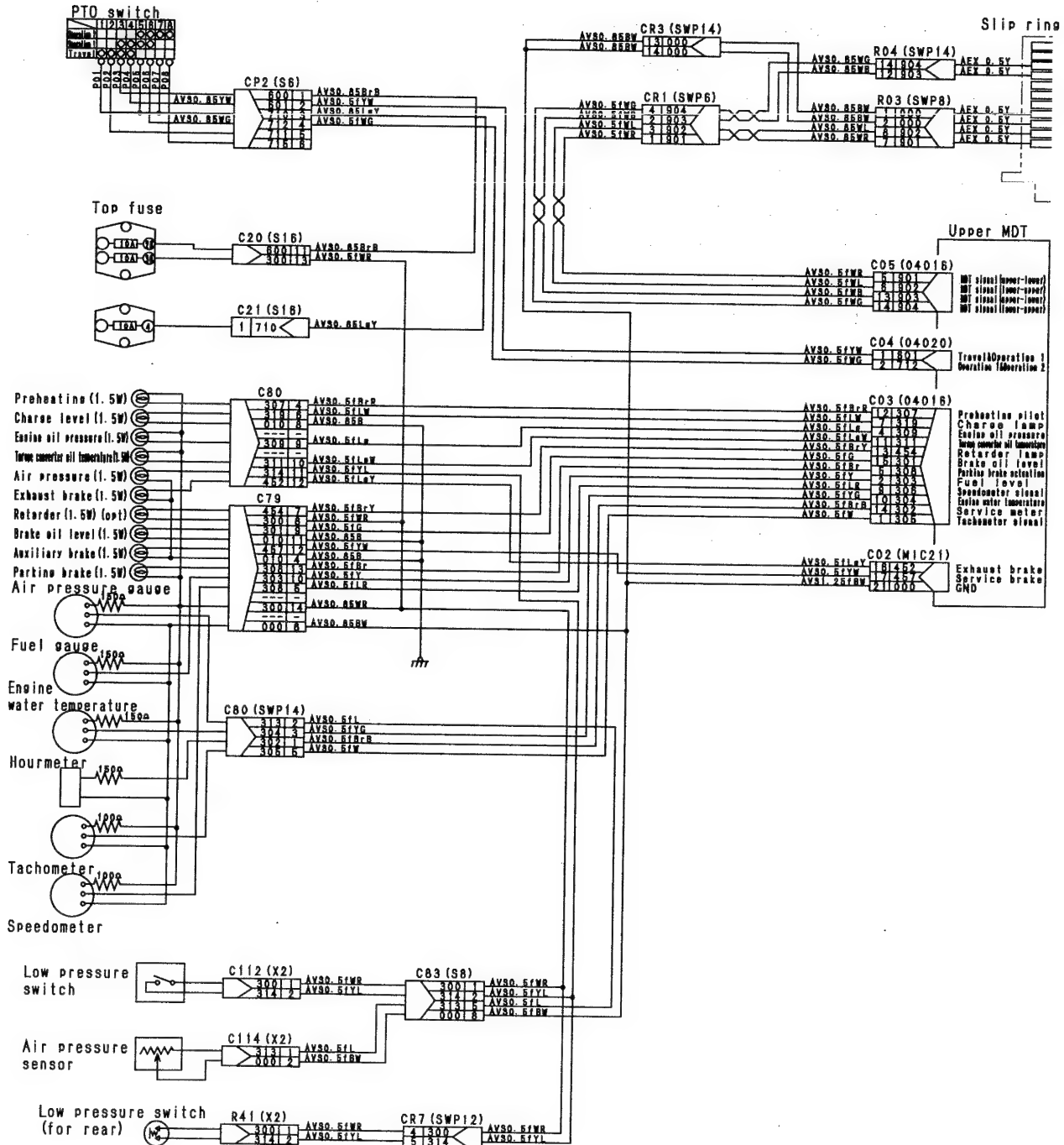
023S02

TROUBLESHOOTING OF MONITOR PANEL SYSTEM (M MODE)

Electrical circuit diagram of monitor panel system	20-1202
M- 1 Abnormality in air pressure gauge	20-1204
M- 2 Air pressure goes down but monitor lamp does not light up	20-1207
M- 3 Exhaust brake lamp does not light up	20-1208
M- 4 Preheating monitor lamp does not light up	20-1209
M- 5 Charge lamp does not go out	20-1210
M- 6 Engine oil pressure lamp does not go out	20-1211
M- 7 Auxiliary (service) brake lamp does not light up	20-1212
M- 8 Defective lighting up of parking brake lamp	20-1214
M- 9 Abnormal display of fuel gauge	20-1216
M-10 Abnormal display of water temperature gauge	20-1218
M-11 Tachometer does not work	20-1220
M-12 Speedometer does not work	20-1222
M-13 Torque converter oil temperature caution lamp lights up	20-1224
M-14 Brake fluid level caution lamp lights up	20-1225
M-15 Hourmeter does not work	20-1226

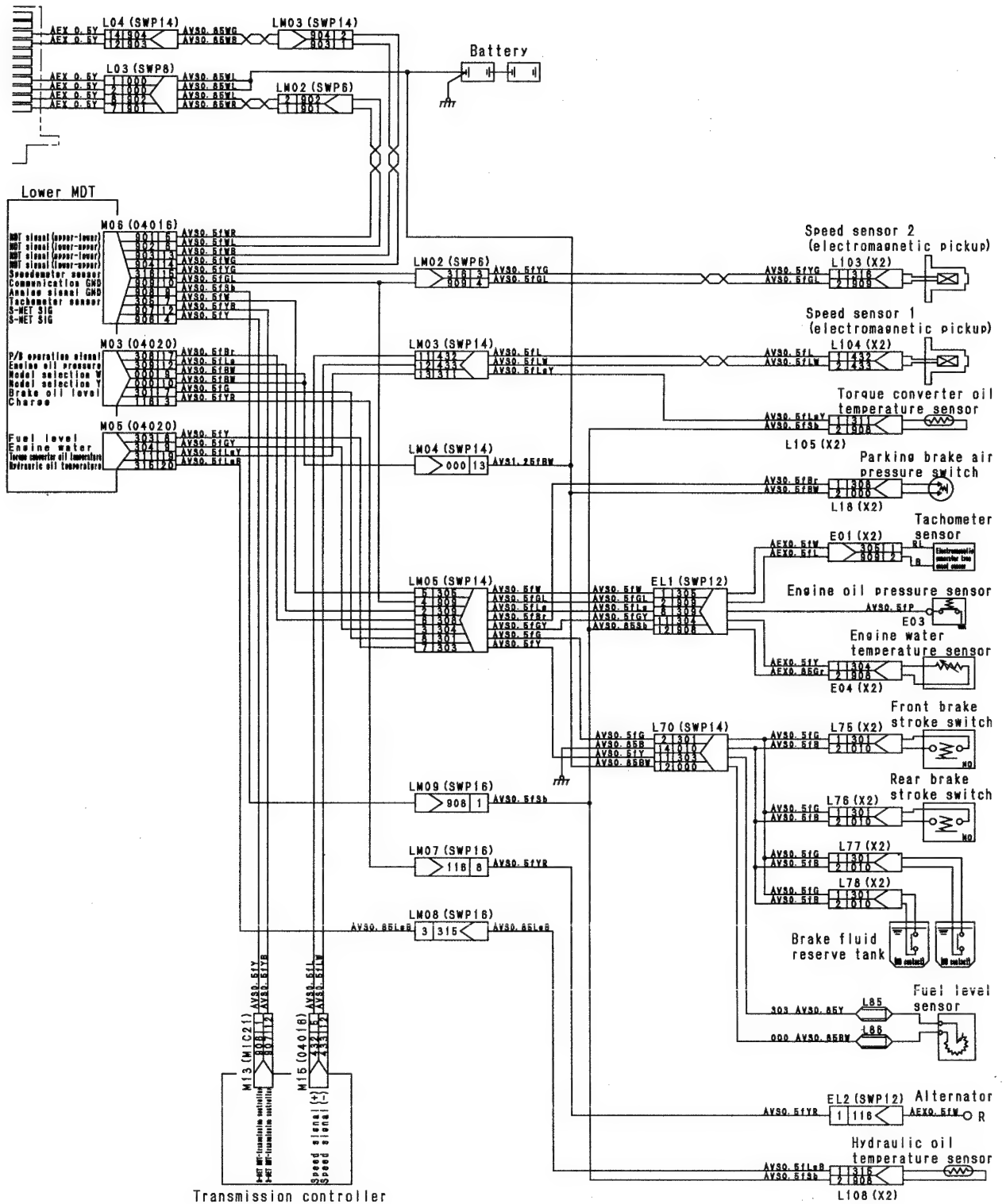
023S02

ELECTRICAL CIRCUIT DIAGRAM OF MACHINE MONITOR SYSTEM



023S02

TKL00632

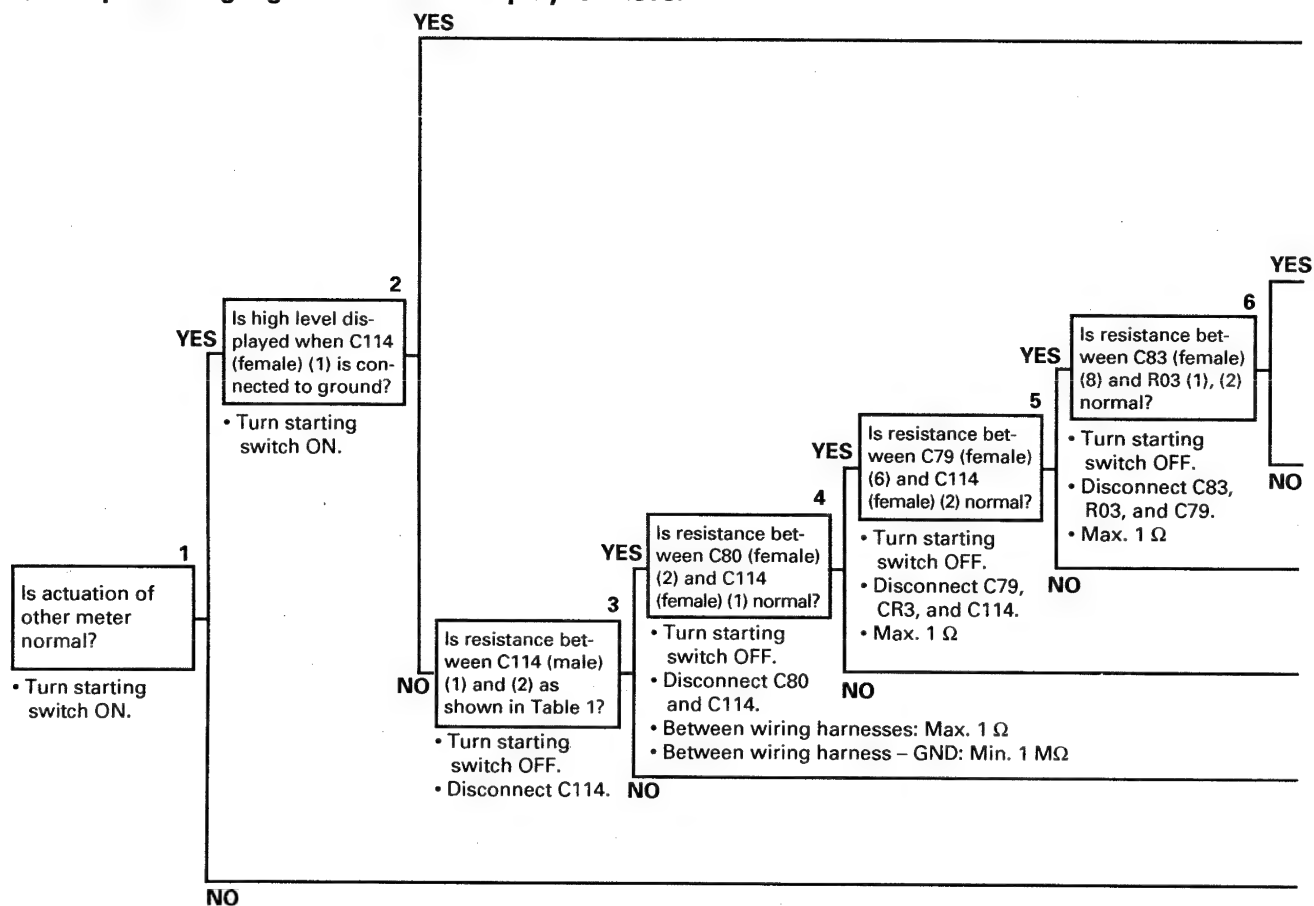


TKL00633

M-1 Abnormality in air pressure gauge

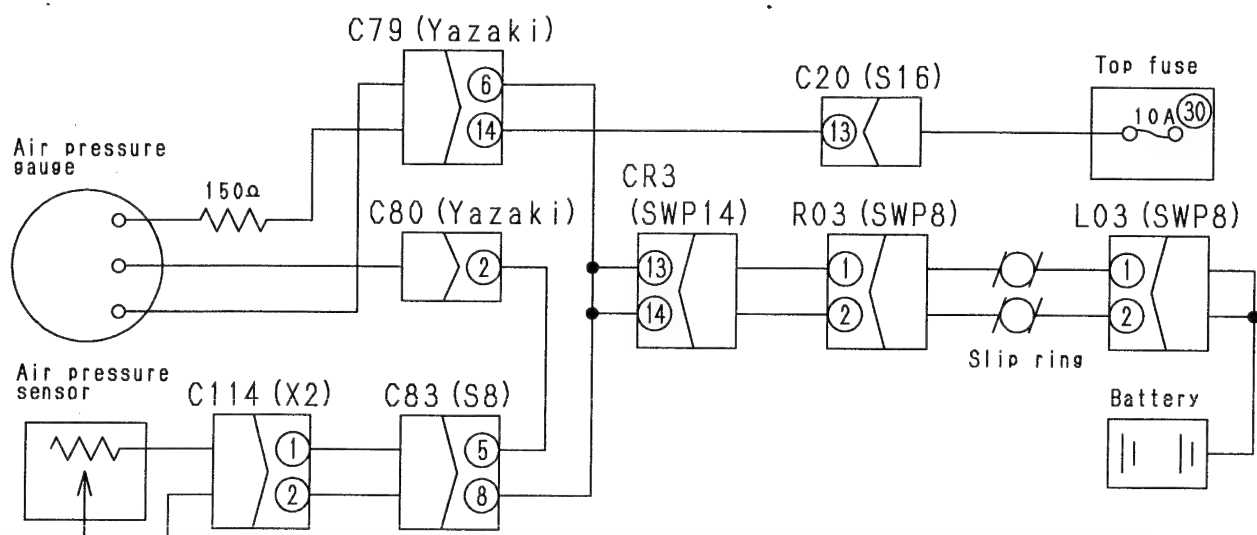
- ★ When no error code is displayed.
- ★ Check that top fuse 30 is not blown. (If it is blown, carry out troubleshooting for "Short circuit with chassis ground in wiring harness between fuse and C79 (female) (14)".)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Air pressure gauge continues to display low level



023S02

M-1 a) Related electrical circuit diagram



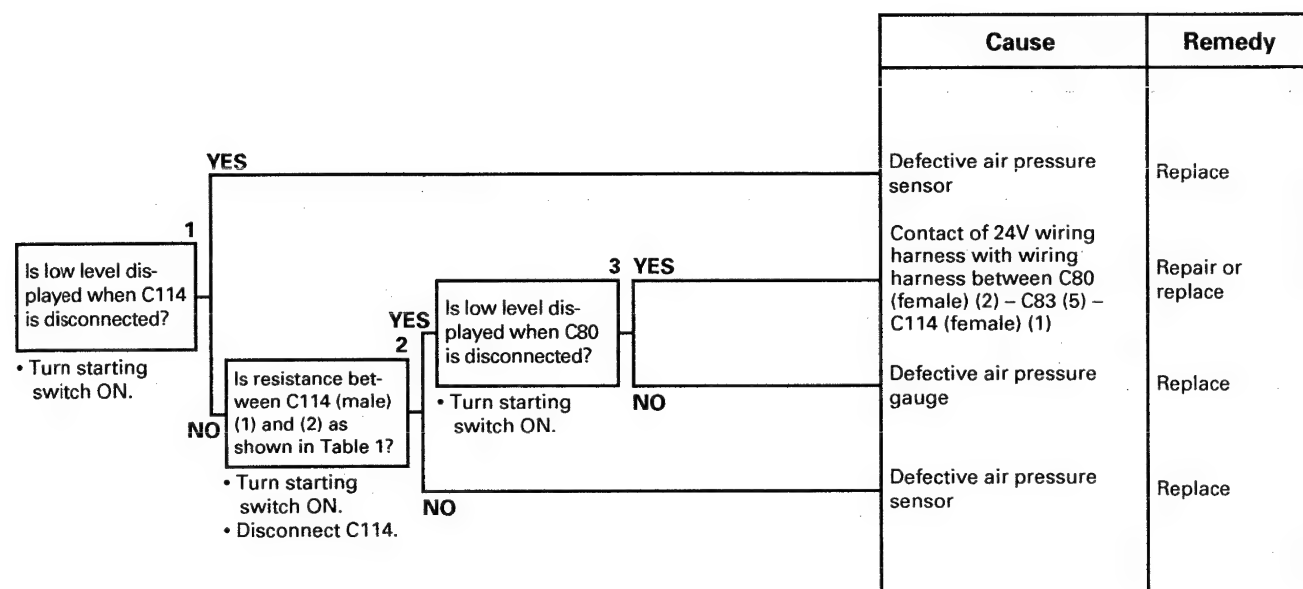
TKL00634

		Cause	Remedy
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> 1 Is resistance between L03 (male) (1), (2) and battery normal? • Turn starting switch OFF. • Disconnect L03. • Max. 1 Ω </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> YES • Turn starting switch OFF. • Disconnect C79 and C80. </div> <div style="border: 1px solid black; padding: 5px;"> 2 YES Is resistance of air pressure gauge as shown in Table 1? • Turn starting switch OFF. • Disconnect C79 and C80. </div> </div> <div style="margin-top: 10px;"> NO </div> </div>		Defective air pressure sensor	Replace
		Defective slip ring	Repair or replace
		Defective air pressure gauge	Replace
		Defective contact or disconnection in wiring harness between L03 (male) (1), (2) and battery	Repair or replace
		Defective contact or disconnection in wiring harness between C83 (female) (8) – CR3 (13), (14) – R03 (female) (1), (2)	Repair or replace
		Defective contact or disconnection in wiring harness between C79 (female) (6) – C83 (8) – C114 (female) (2)	Repair or replace
		Defective contact or disconnection in wiring harness between C80 (female) (2) – C83 (5) – C114 (female) (1), or short circuit with ground	Repair or replace
		Defective air pressure sensor	Replace
		Defective contact or disconnection in wiring harness between top fuse 30 and C20 (13), C79 (female) (4)	Repair or replace

Table 1 (Reference value)

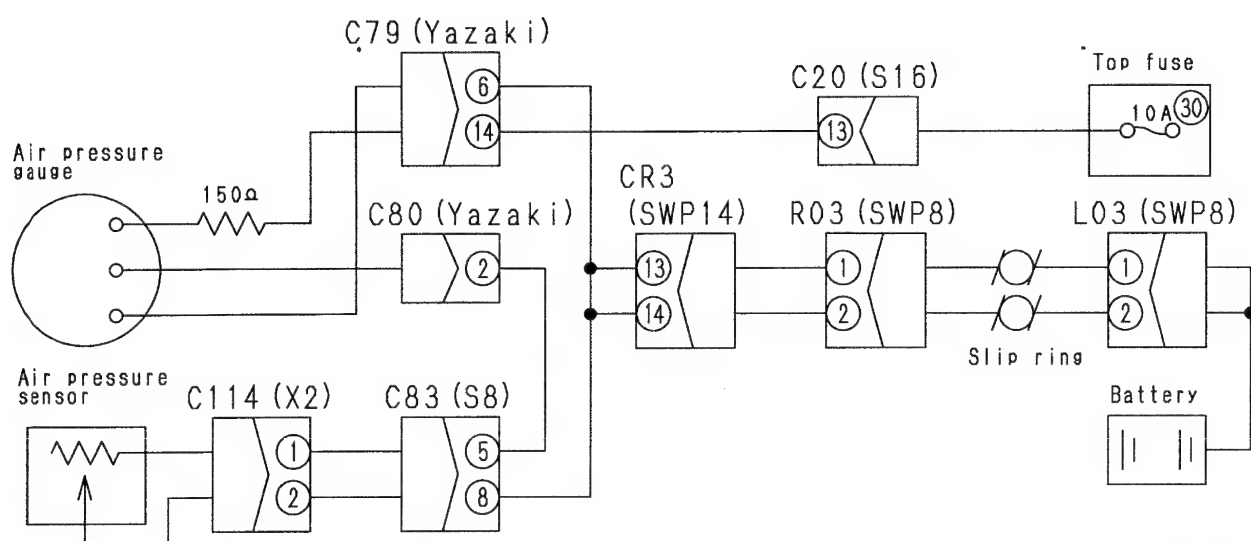
Air pressure gauge MPa {kg/cm ² }	0.1{1.0}	0.49{5.0}	0.98{10.0}
Defective slip ring (Ω)	66.1	51.9	10.2

b) Air pressure gauge continues to display high level



023S02

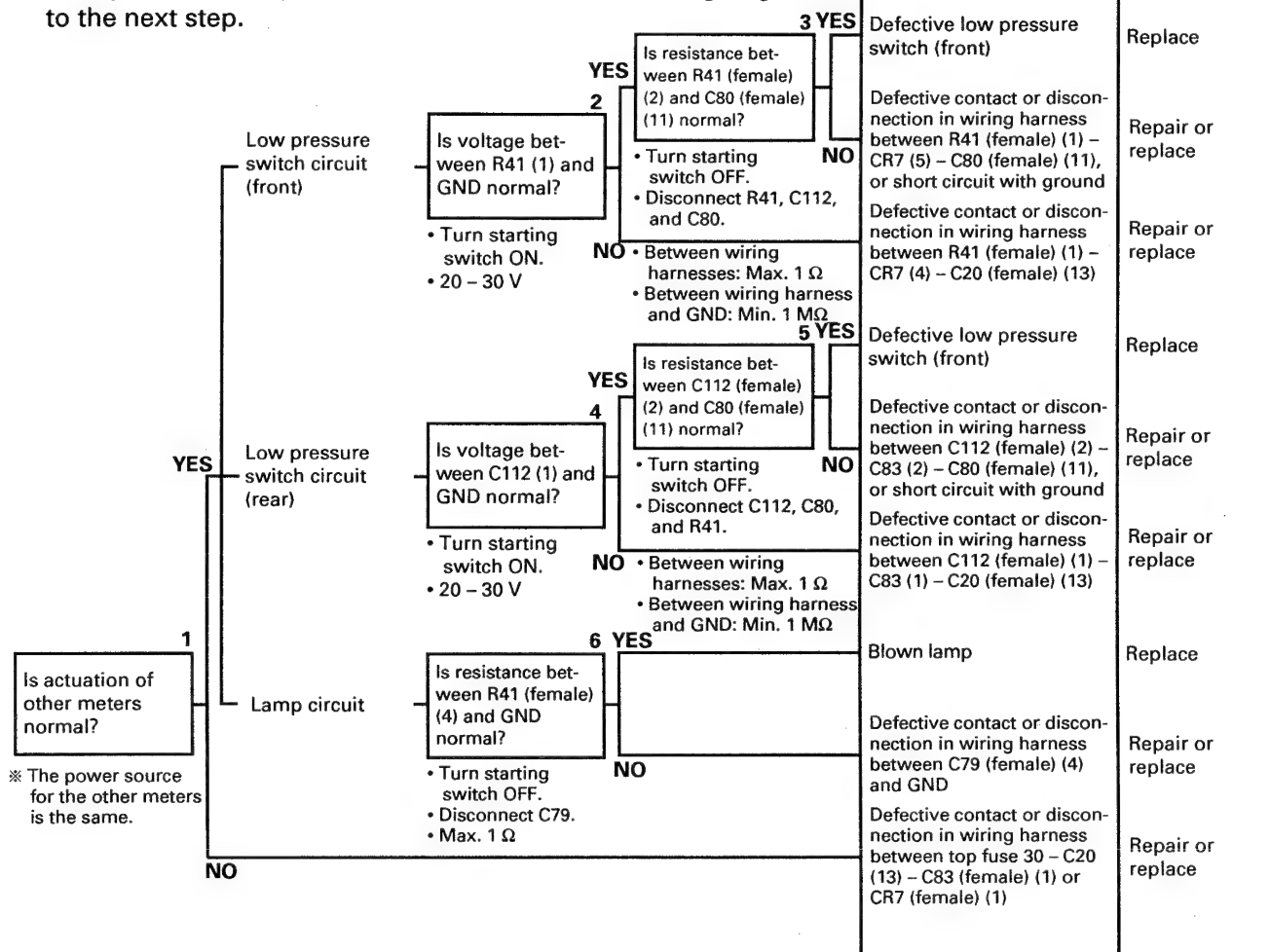
M-1 b) Related electrical circuit diagram



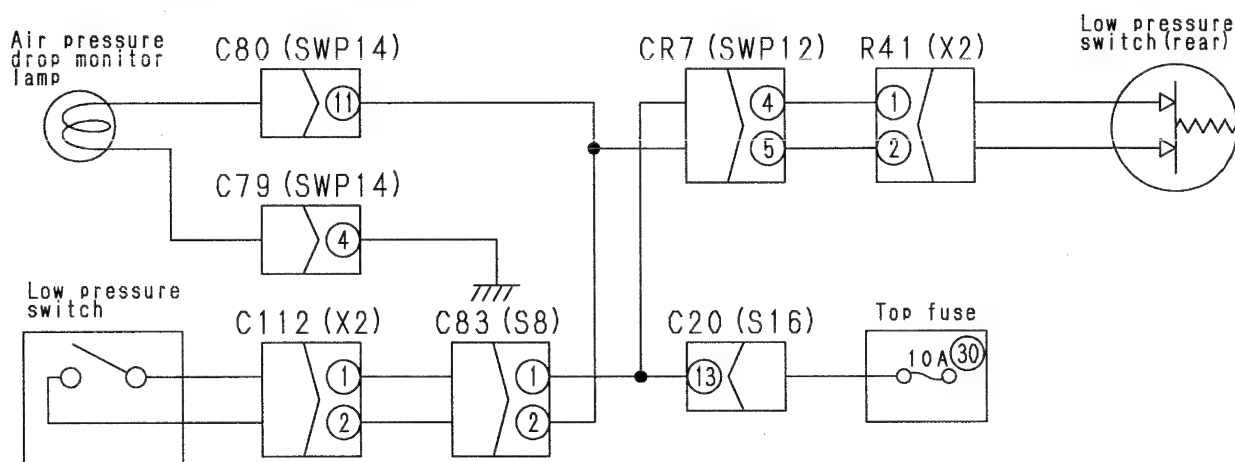
TKL00634

M-2 Air pressure goes down but monitor lamp does not light up

- ★ When no error code is displayed.
- ★ Check that top fuse 30 is not blown.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

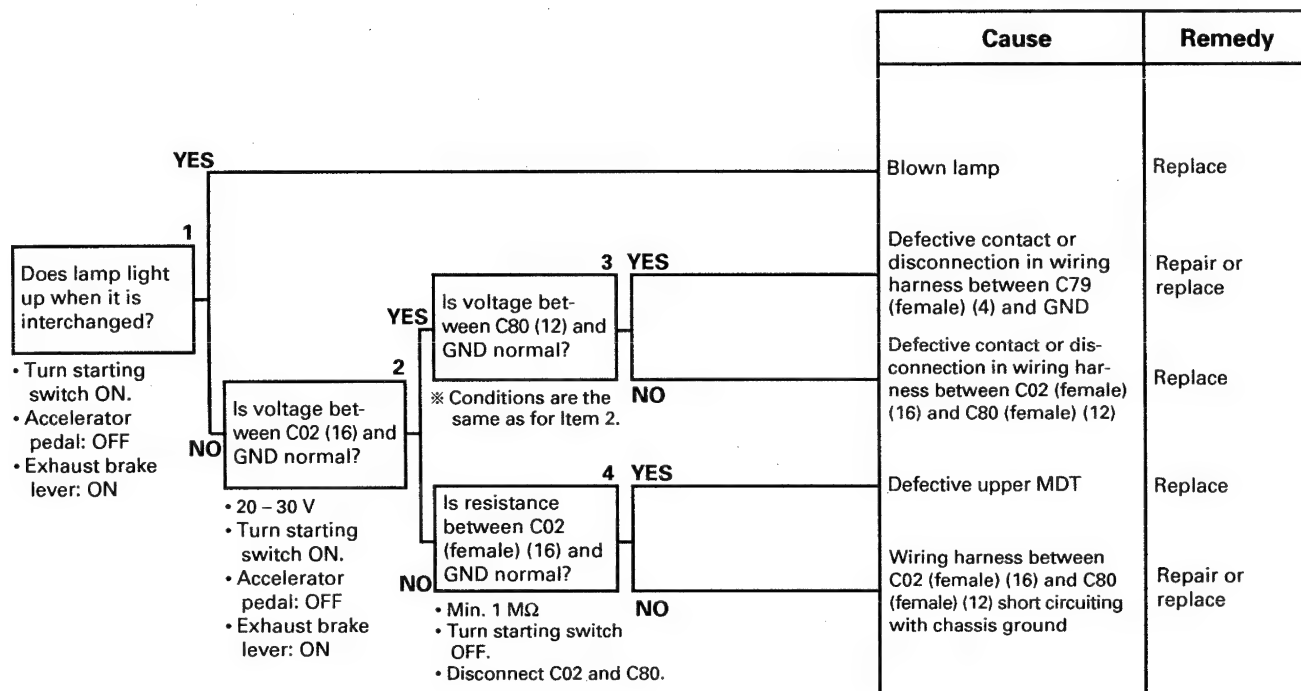


M-2 Related electric circuit diagram



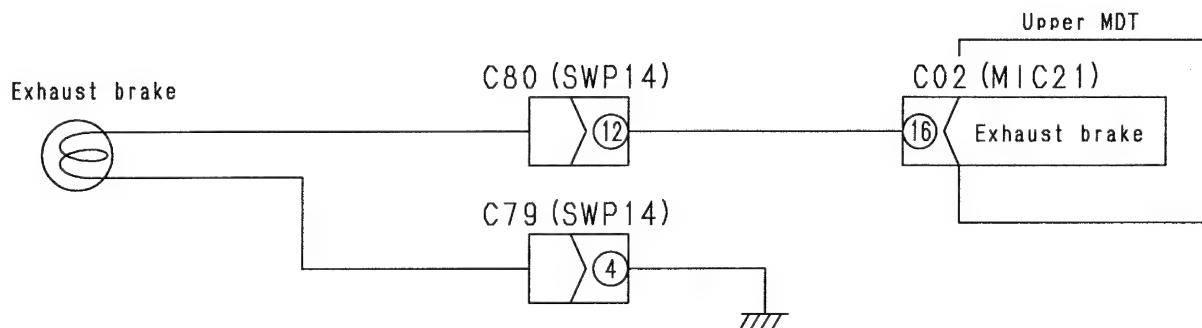
M-3 Exhaust brake lamp does not light up

- ★ When no error code is displayed.
- ★ When the actuation of the exhaust brake is normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

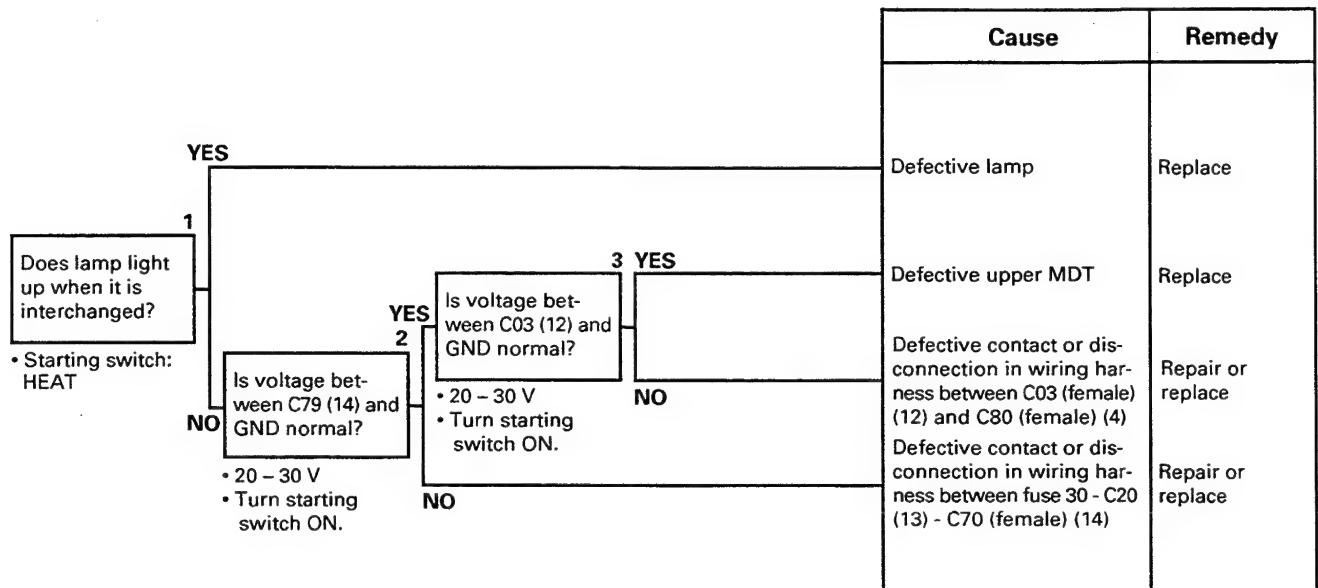
M-3 Related electric circuit diagram



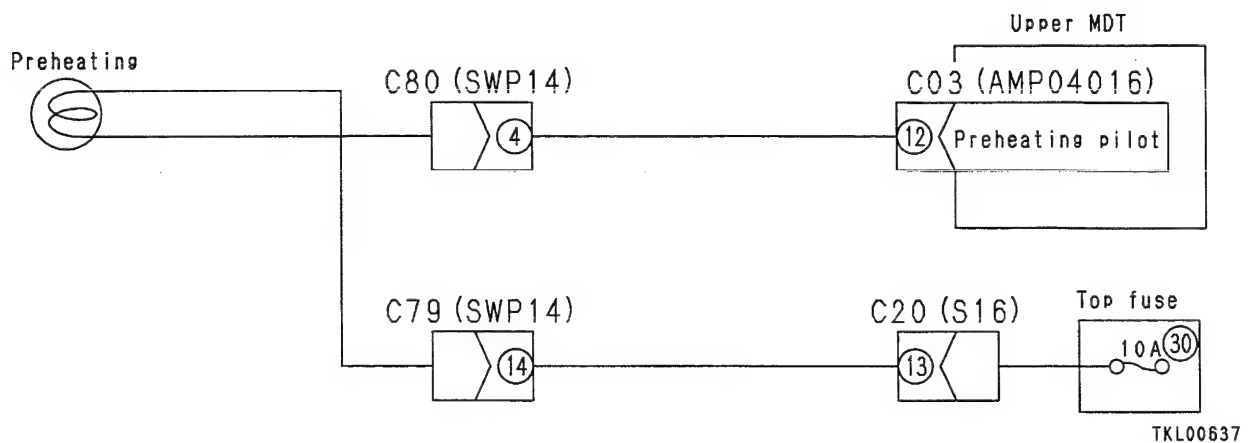
TKL00636

M-4 Preheating monitor lamp does not light up

- ★ When no error code is displayed.
- ★ When the preheating is normal.
- ★ Check that top fuse 30 is not blown.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



M-4 Related electric circuit diagram



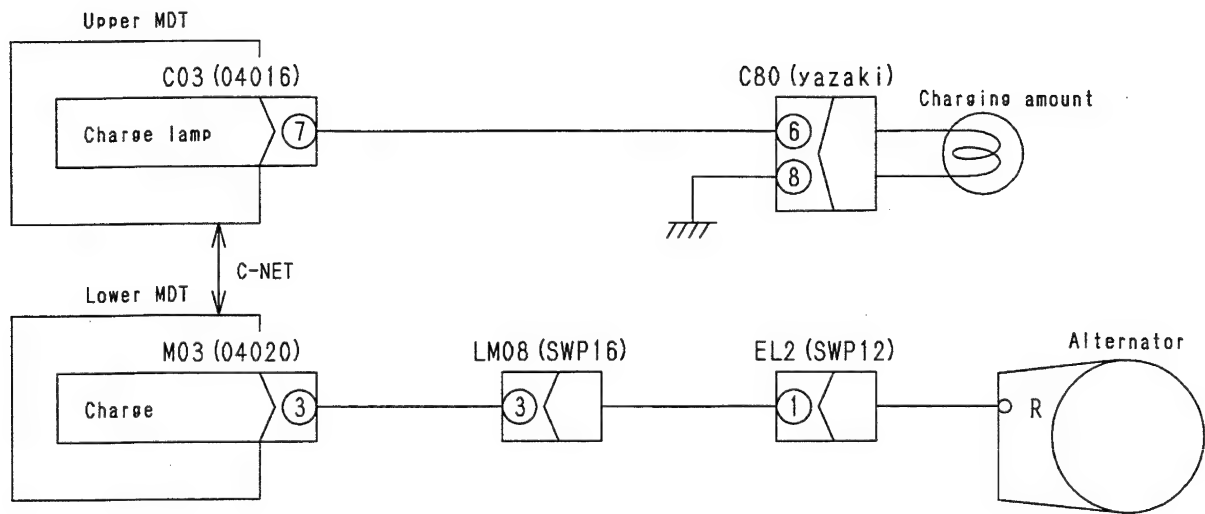
M-5 Charge lamp does not go out

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1</div> <div>Is voltage between alternator R terminal and GND normal?</div> <div> <ul style="list-style-type: none"> • 27.5 - 29.5 V • Engine at midrange speed or above. </div> </div>	YES	<div> <div>2</div> <div>Is voltage between M03 (3) and GND normal?</div> <div> <ul style="list-style-type: none"> • Max. 1 V • Turn starting switch ON. </div> </div>	<div> <div>3 YES</div> <div>Defective upper MDT</div> <div>Replace</div> </div>
	YES	<div> <div>3 NO</div> <div>Is voltage between (female) (7) and GND normal when C03 is disconnected?</div> </div>	<div> <div>Wiring harness between C03 (female) (7) and M80 (female) short circuiting with power source</div> <div>Repair or replace</div> </div>
	NO	<div> <div>Defective contact or disconnection in wiring harness between alternator R terminal - EL2 (1) - LM07 (8), M03 (female) (3)</div> <div>Repair or replace</div> </div>	<div> <div>Defective generation of electricity by alternator</div> <div>Repair or replace</div> </div>
	NO	<div> <div>Defective generation of electricity by alternator</div> <div>Repair or replace</div> </div>	<div> <div>Defective generation of electricity by alternator</div> <div>Repair or replace</div> </div>

023S02

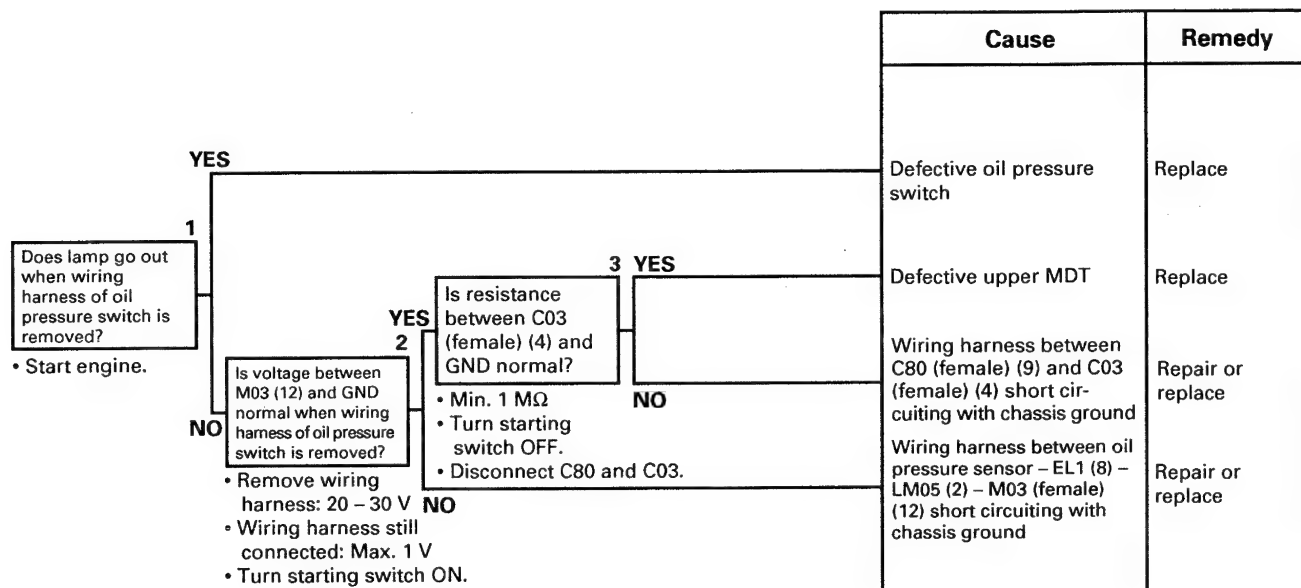
M-5 Related electric circuit diagram



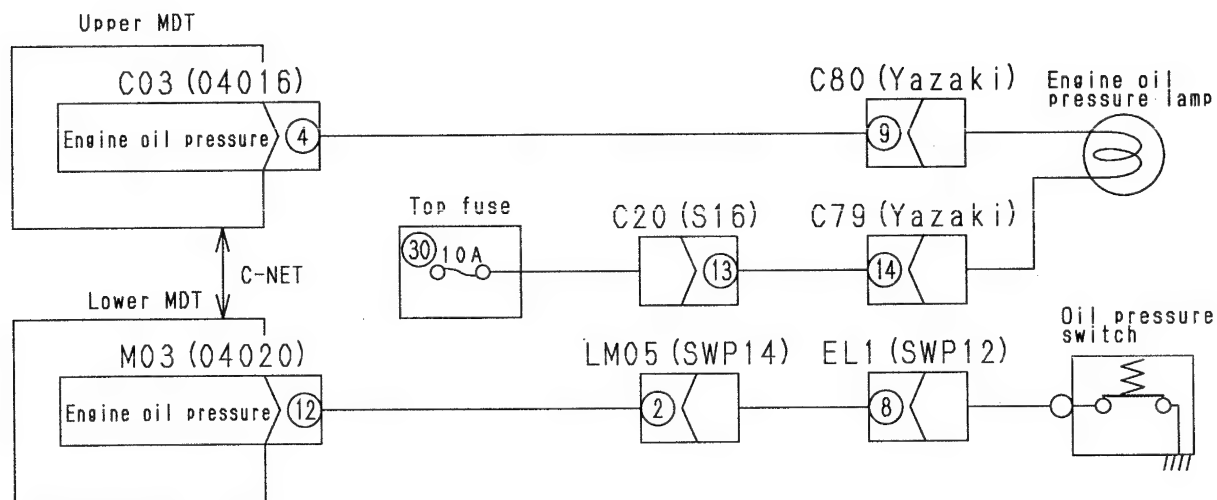
TVL00941

M-6 Engine oil pressure lamp does not go out

- ★ When no error code is displayed.
- ★ When the engine oil pressure is normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that top fuse 30 is not blown.



M-6 Related electric circuit diagram



TKL00639

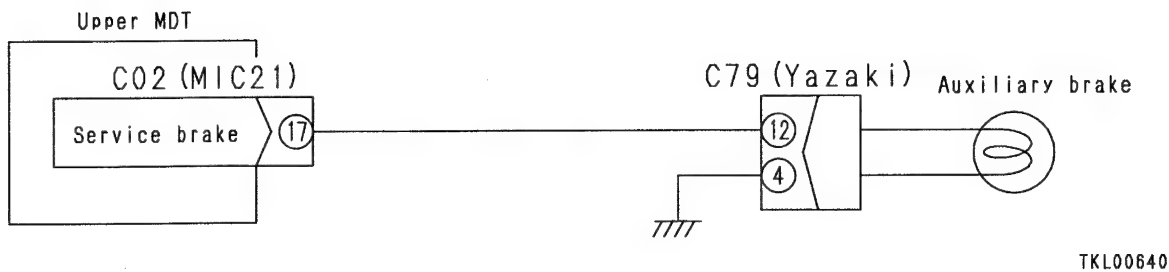
M-7 Auxiliary (service) brake lamp does not light up

- ★ When no error code is displayed.
- ★ When the actuation of the brake is normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

				Cause	Remedy
<div>1</div> <div>Does lamp light up when it is interchanged?</div> <div><ul style="list-style-type: none">• Turn starting switch ON.• Auxiliary brake switch: ON</div>				Defective lamp	Replace
YES					
<div>2</div> <div>Is voltage between C02 (16) and GND normal?</div> <div><ul style="list-style-type: none">• Turn starting switch ON.• Auxiliary brake switch: ON• 20 – 30 V</div>					
NO					
YES					
<div>3</div> <div>Is voltage between C79 (12) and GND normal?</div> <div><ul style="list-style-type: none">※ Conditions are the same as for Item 2.</div>					
YES				Defective contact or disconnection in wiring harness between C79 (male) and lamp	Repair or replace
NO				Defective contact or disconnection in wiring harness between C79 (female) (12) and C02 (female) (17)	Repair or replace
<div>4</div> <div>Is resistance between C02 (female) (17) and GND normal?</div> <div><ul style="list-style-type: none">• Min. 1 MΩ• Turn starting switch OFF.• Disconnect C02 and C79.</div>					
YES				Defective upper MDT	Replace
NO				Wiring harness between C02 (female) (17) and C79 (female) (12) short circuiting with chassis ground	Repair or replace

023S02

M-7 Related electric circuit diagram

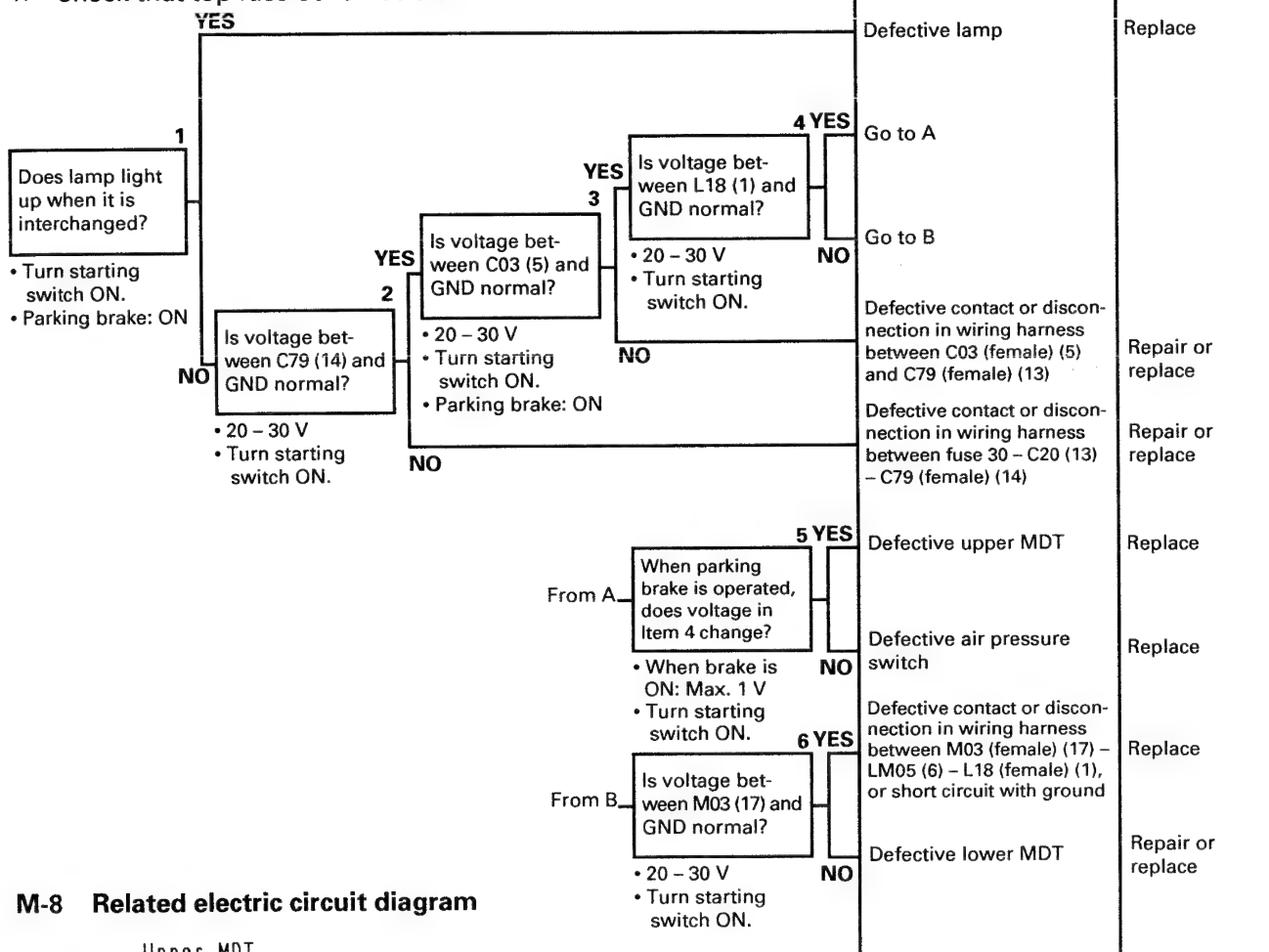


M-8 Defective lighting up of parking brake lamp

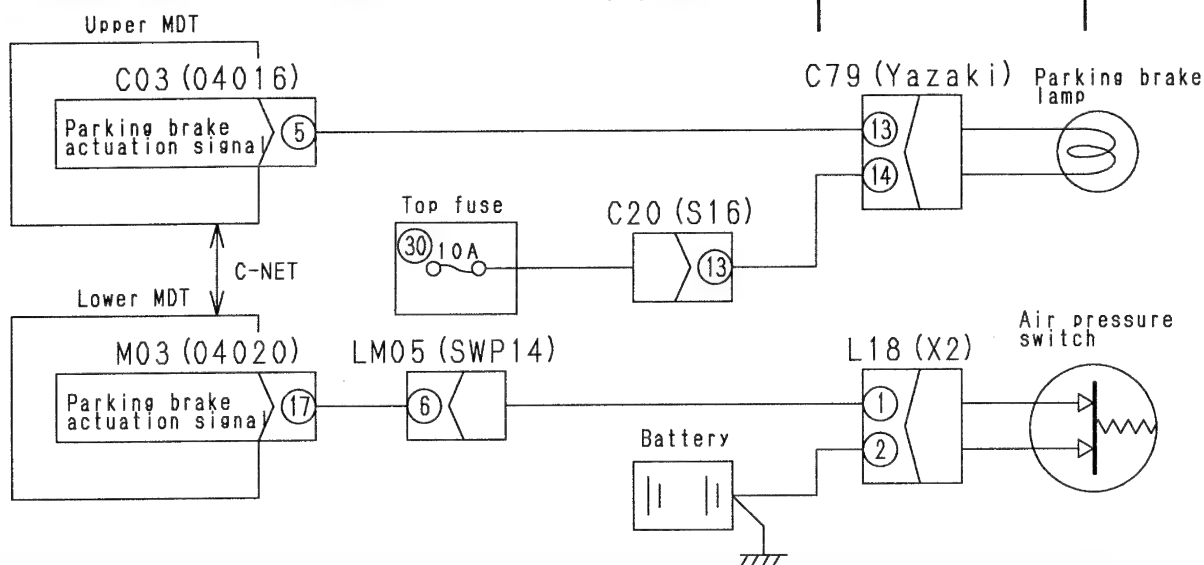
- ★ When no error code is displayed.
 - ★ When the actuation of the parking brake is normal.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
| | |

a) Parking brake lamp does not light up

- ★ Check that top fuse 30 is not blown.



M-8 Related electric circuit diagram



TKL00641

023S02

b) Parking brake lamp stays lighted up

			Cause	Remedy
<div><div><div>1</div><div>Is resistance between C03 (female) (5) and GND normal?</div><div><div>YES</div><div><div>• Min. 1 MΩ</div><div>• Turn starting switch OFF.</div><div>• Disconnect C03 and C79.</div></div></div><div>NO</div></div><div><div>2</div><div>Is resistance between L18 (female) (1) and GND normal?</div><div><div>YES</div><div><div>• Min. 1 MΩ</div><div>• Turn starting switch OFF.</div><div>• Disconnect L18 and M03.</div></div></div><div>NO</div></div><div><div>3</div><div>Is resistance between L18 (male) (1) and (2) normal?</div><div><div>YES</div><div></div></div><div>NO</div><div><div>• When parking brake is ON: Max. 1 Ω</div><div>• When brake is OFF: Min. 1 MΩ</div></div></div></div>			Defective upper MDT	Replace
			Defective air pressure switch	Replace
			Wiring harness between L18 (female) (1) – LM05 (6) – M03 (female) (17) short circuiting with chassis ground	Repair or replace
			Wiring harness between C03 (female) (5) and C79 (female) (13) short circuiting with chassis ground	Repair or replace

023S02

M-9 Abnormal display of fuel gauge

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Fuel level gauge display stays at Hi level

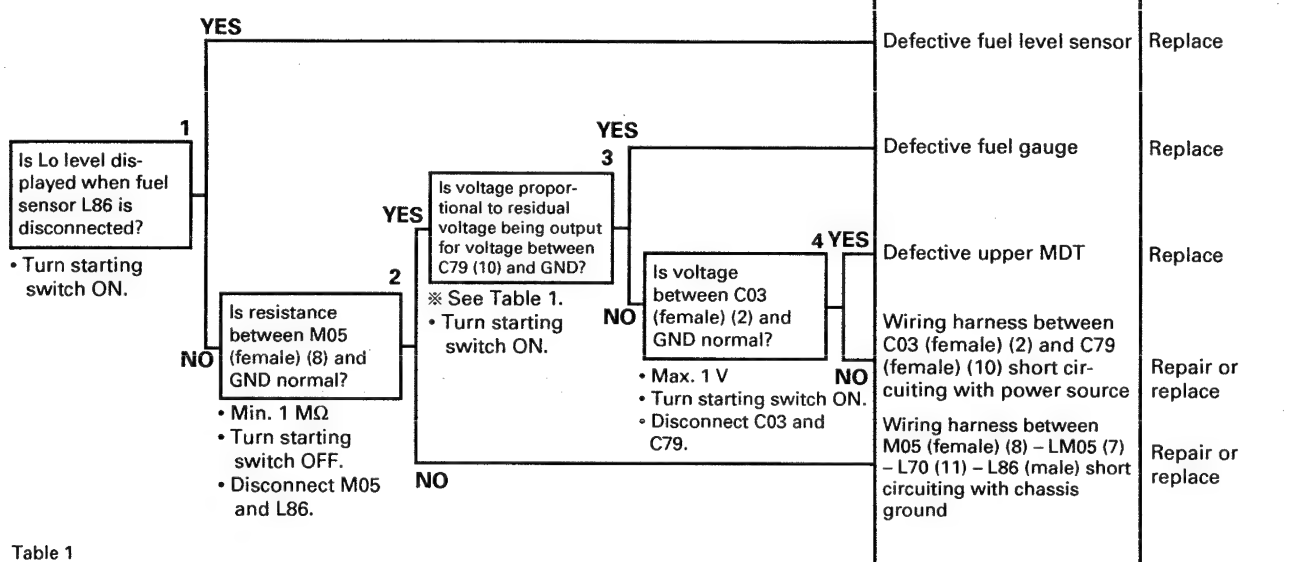
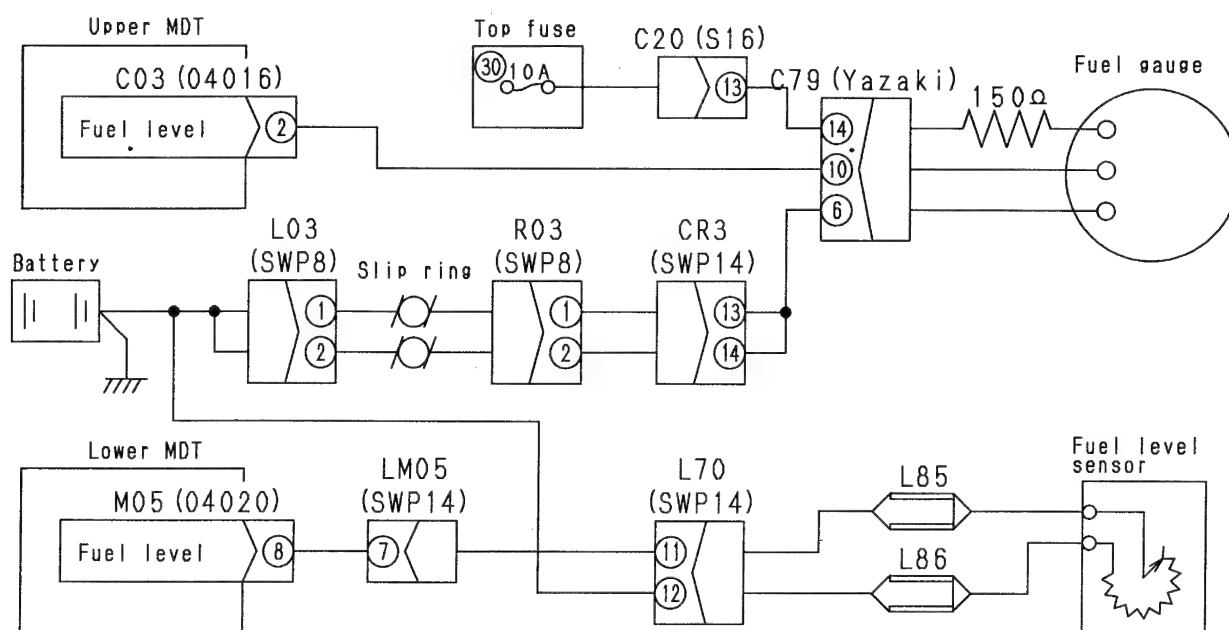


Table 1

Fuel level	Voltage (V)
FULL	Approx. 24 V
EMPTY	Max. 5 V

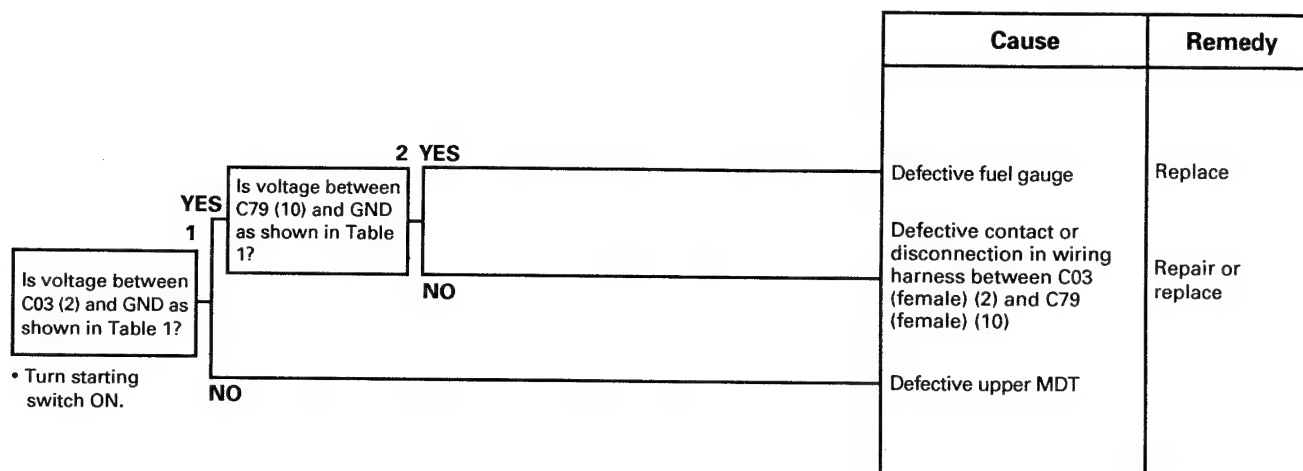
※ Judge the voltage proportional to the residual voltage between these points when troubleshooting.

M-9 Related electric circuit diagram



TKL00642

b) Fuel level gauge display stays at Lo level



c) Fuel level gauge display does not match actual fuel level

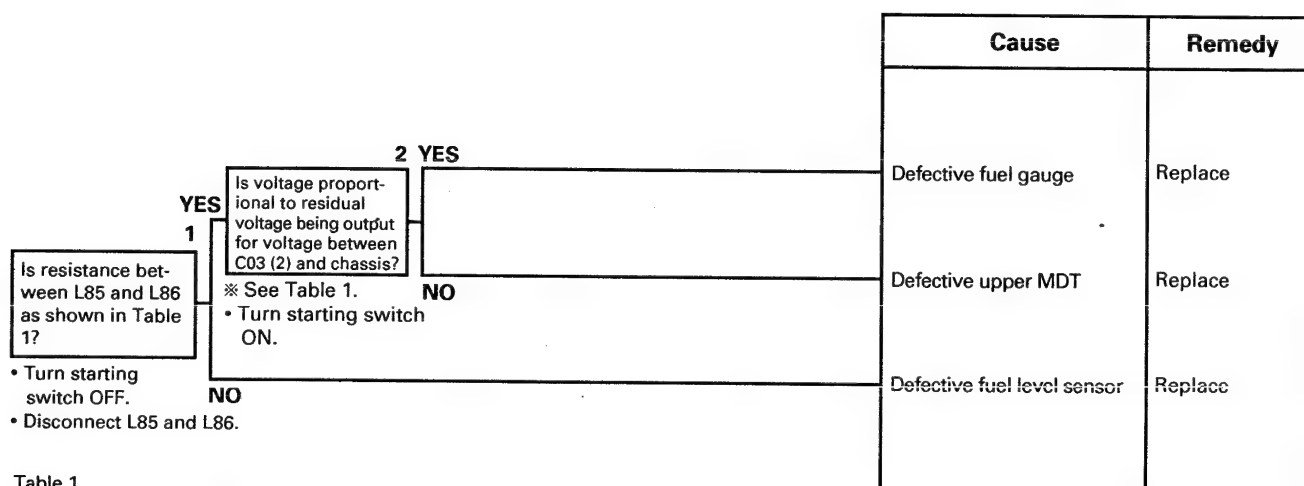


Table 1

Fuel level	Voltage (V)
FULL	Approx. 24 V
EMPTY	Max. 5 V

※ Judge the voltage proportional to the residual voltage between these points when troubleshooting.

M-10 Abnormal display of water temperature gauge

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Engine water temperature gauge display stays at Lo level

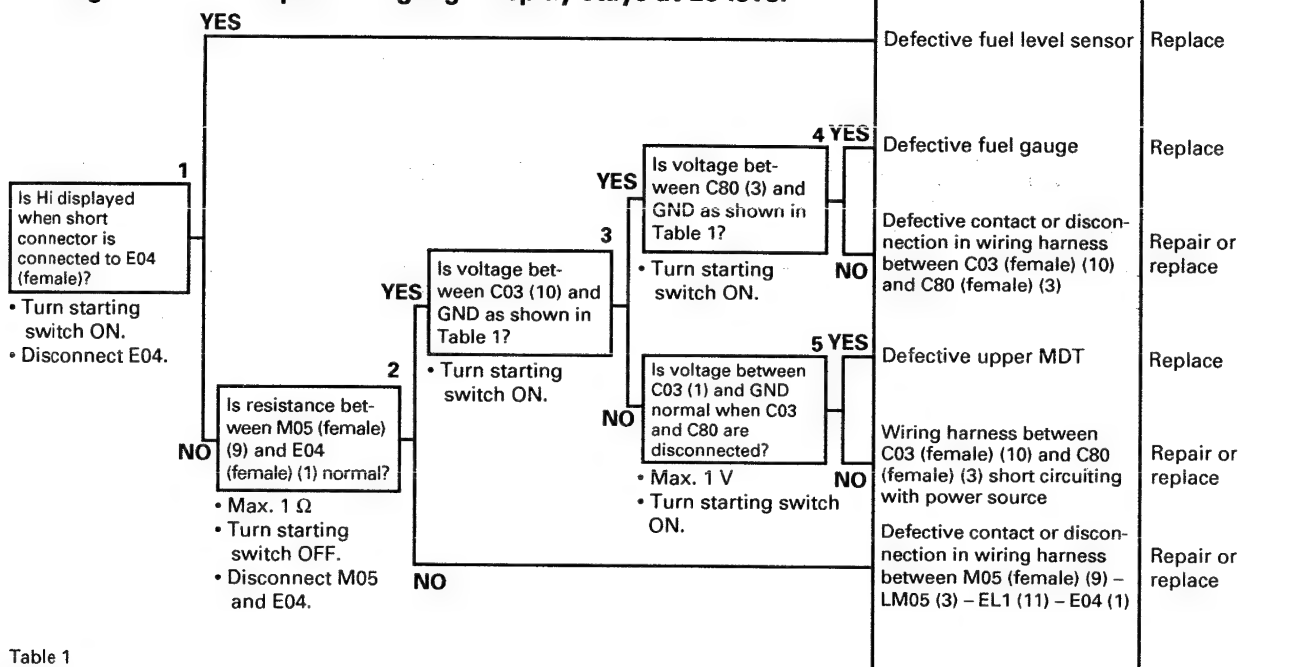
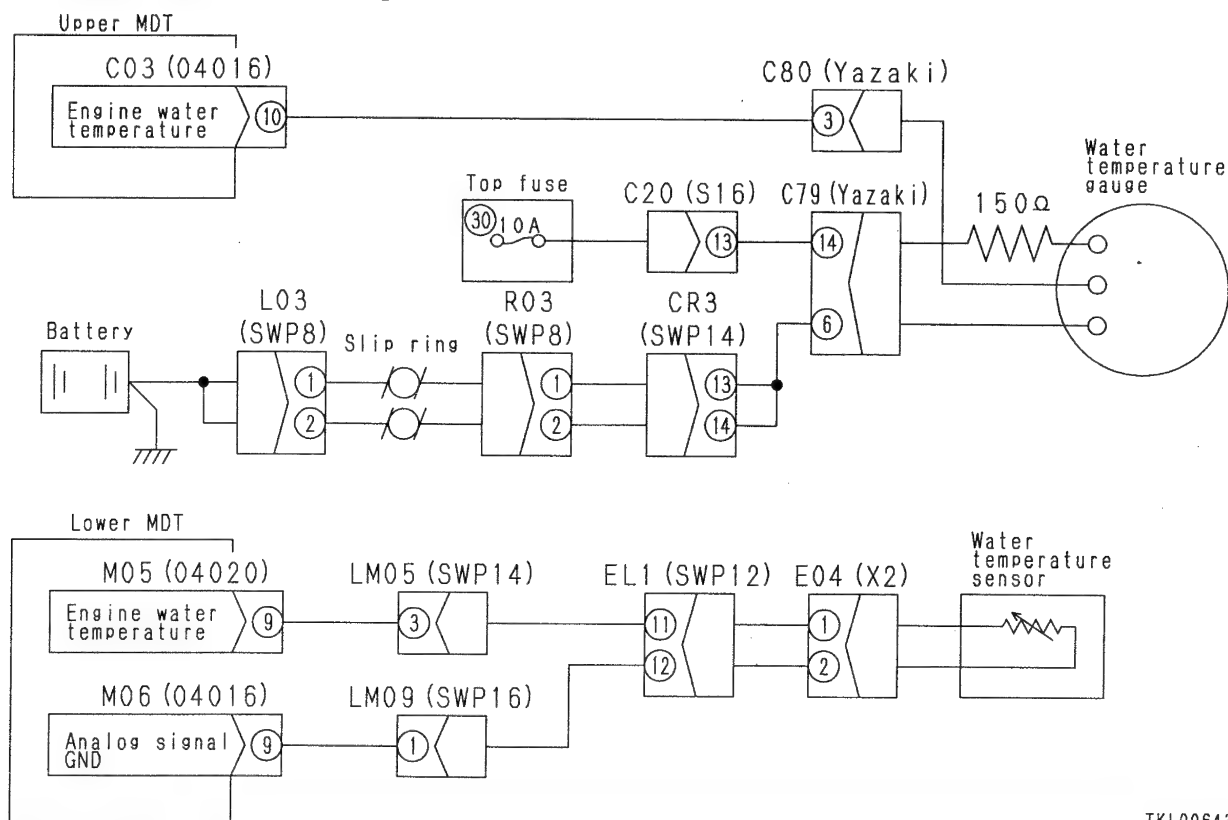


Table 1

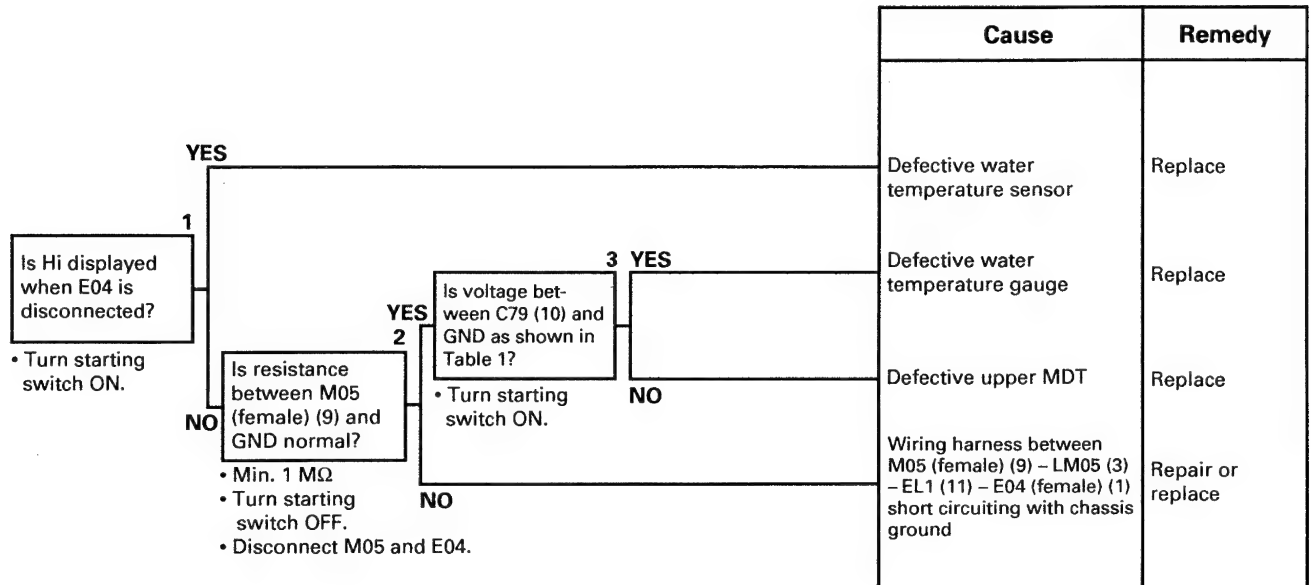
Water temperature	Voltage (V)
100°C	0.9 – 1.7
50°C	2.5 – 5.5

M-10 Related electric circuit diagram



TKL00643

b) Engine water temperature gauge display stays at Hi level



c) Engine water temperature gauge display does not match actual temperature

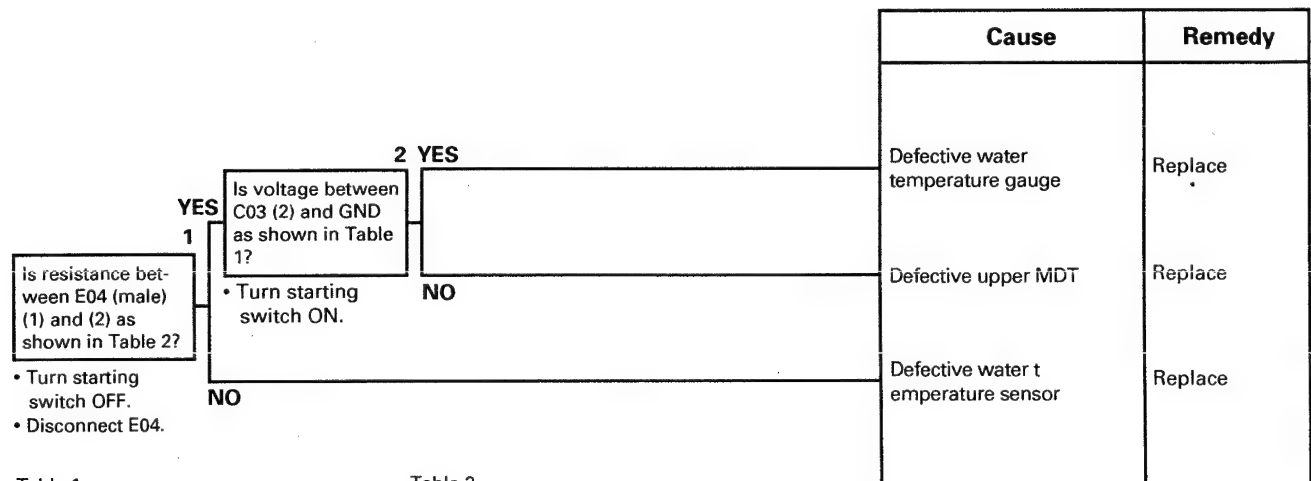


Table 1

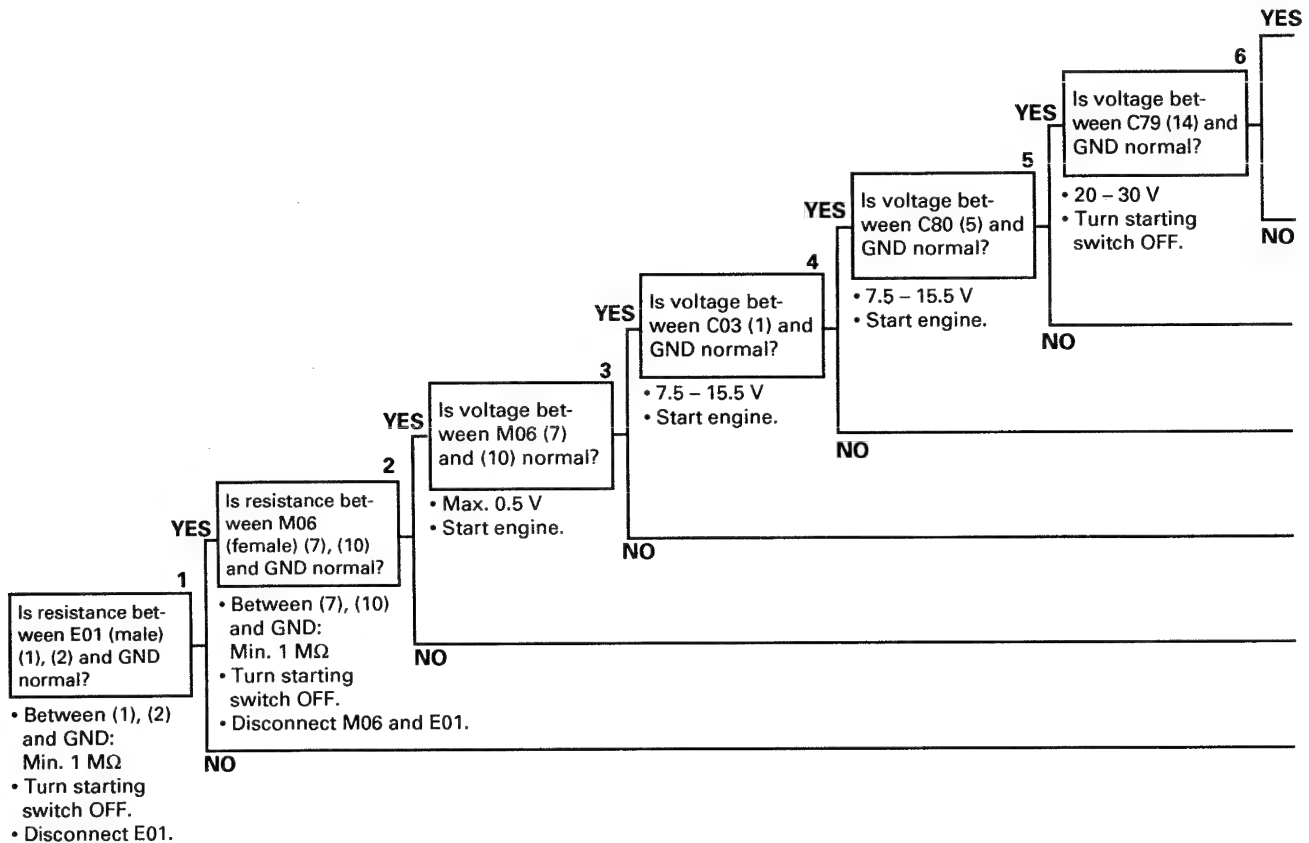
Water temperature	Voltage (V)
100°C	0.9 – 1.7
50°C	2.5 – 5.5

Table 2

Water temperature	Resistance value (kΩ)
100°C	3.5 – 4.0
25°C	37 – 50

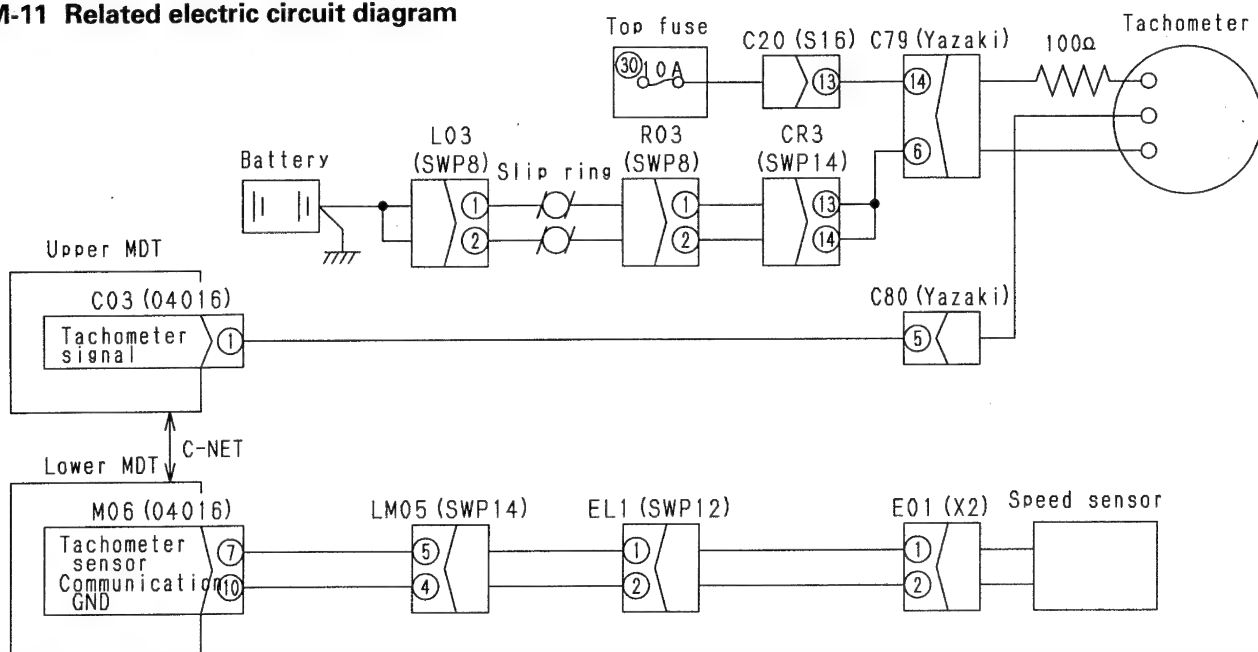
M-11 Tachometer does not work

- ★ When no error code is displayed.
- ★ Check that there is no looseness of the tachometer mount before starting troubleshooting.
- ★ Check that top fuse 30 is not blown.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

M-11 Related electric circuit diagram



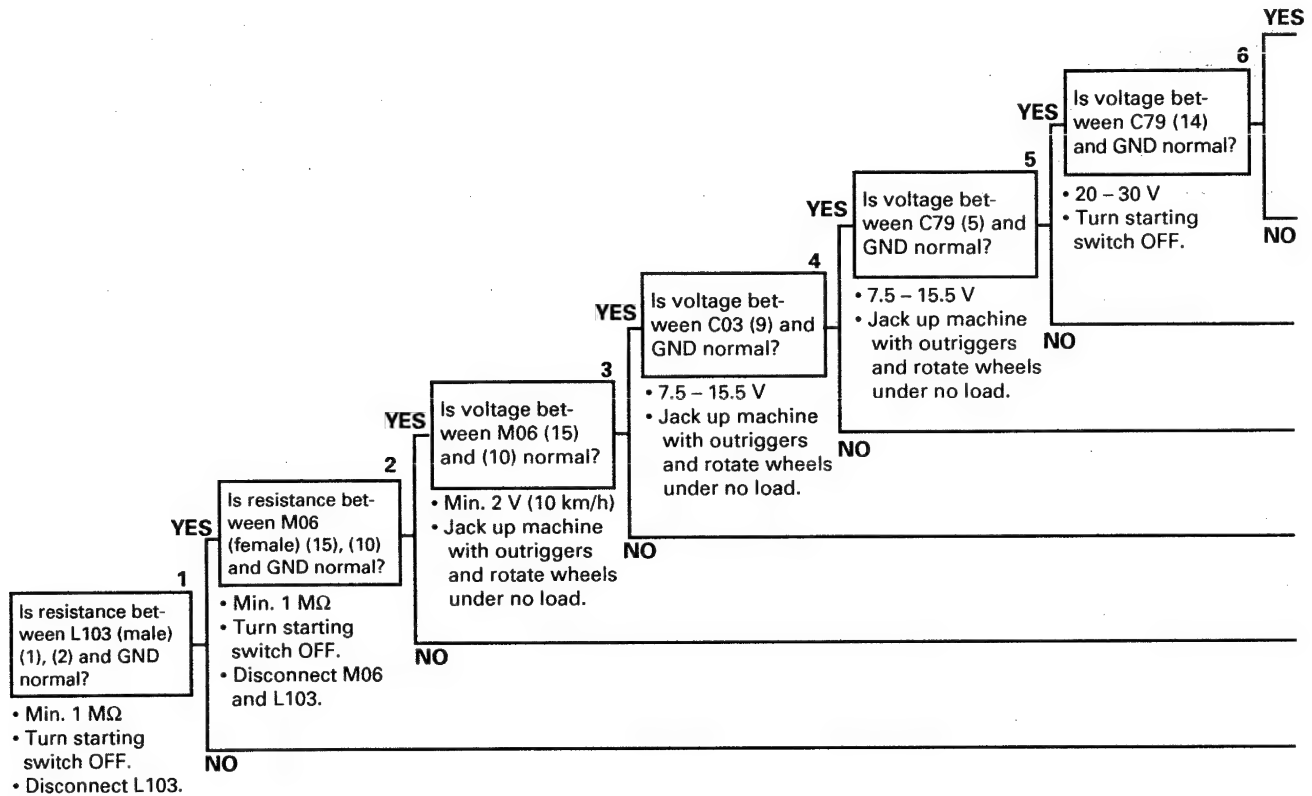
TKL00644

		Cause	Remedy
<p>Is resistance between C79 (female) (6) and R03 (female) (1), (2) normal?</p> <p>• Max. 1 Ω • Turn starting switch OFF. • Disconnect C79 and R03.</p>	<p>1</p> <p>YES</p> <p>Is resistance between L03 (male) (1), (2) and battery normal?</p> <p>• Max. 1 Ω • Turn starting switch OFF. • Disconnect L03.</p>	<p>2 YES</p> <p>Defective tachometer or defective contact between tachometer and C79, L80</p>	Replace
	NO	Defective contact or disconnection in wiring harness between L03 (male) (1)(2) and battery	Repair or replace
		Defective contact or disconnection in wiring harness between C79 (female) (6) – CR3 (13)(14) – R03 (female) (1)(2)	Repair or replace
		Defective contact or disconnection in wiring harness between top fuse 30 – C20 (13) – C79 (female) (14)	Repair or replace
		Defective contact or disconnection in wiring harness between C03 (female) (1) and C80 (female) (5)	Repair or replace
		Defective upper MDT	Replace
		Defective speed sensor	Replace
		Wiring harness between M06 (female) (7), (10) – LM05 (5), (4) – EL1 (1), (2) – E01 (female) (1), (2) short circuiting with chassis ground or short circuit between wiring harnesses	Repair or replace
		Defective speed sensor	Replace

023S02

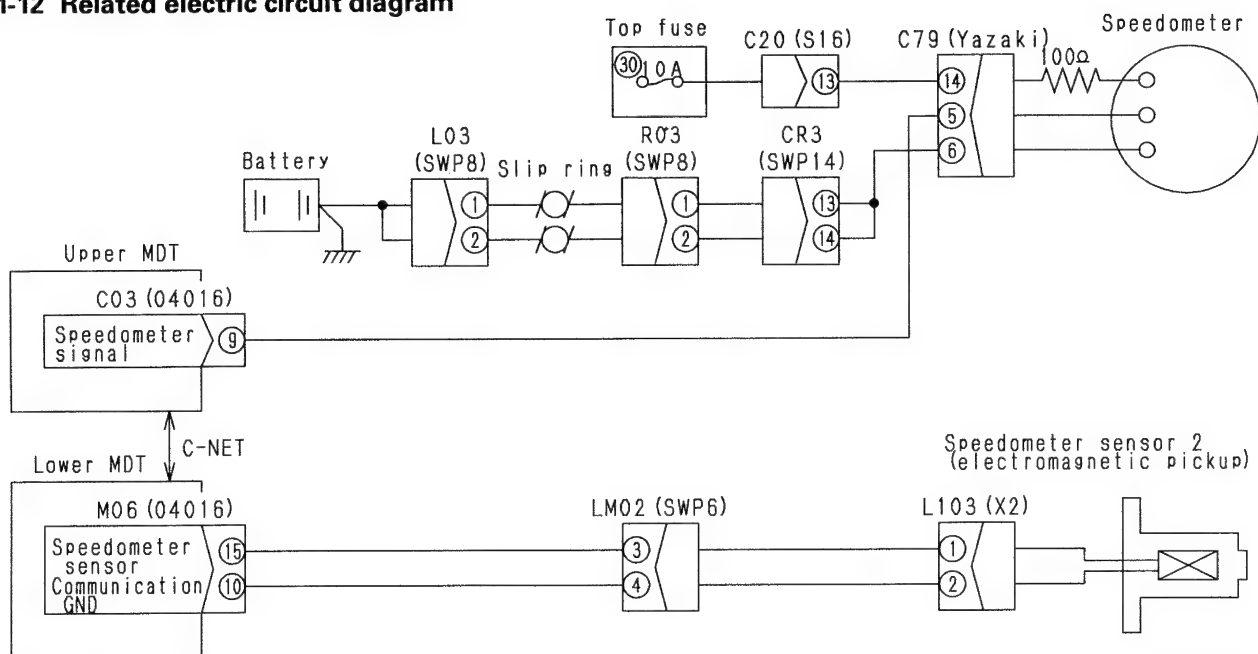
M-12 Speedometer does not work

- ★ When no error code is displayed.
- ★ Check that there is no looseness of the speedometer mount before starting troubleshooting.
- ★ Check that top fuse 30 is not blown.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

M-12 Related electric circuit diagram

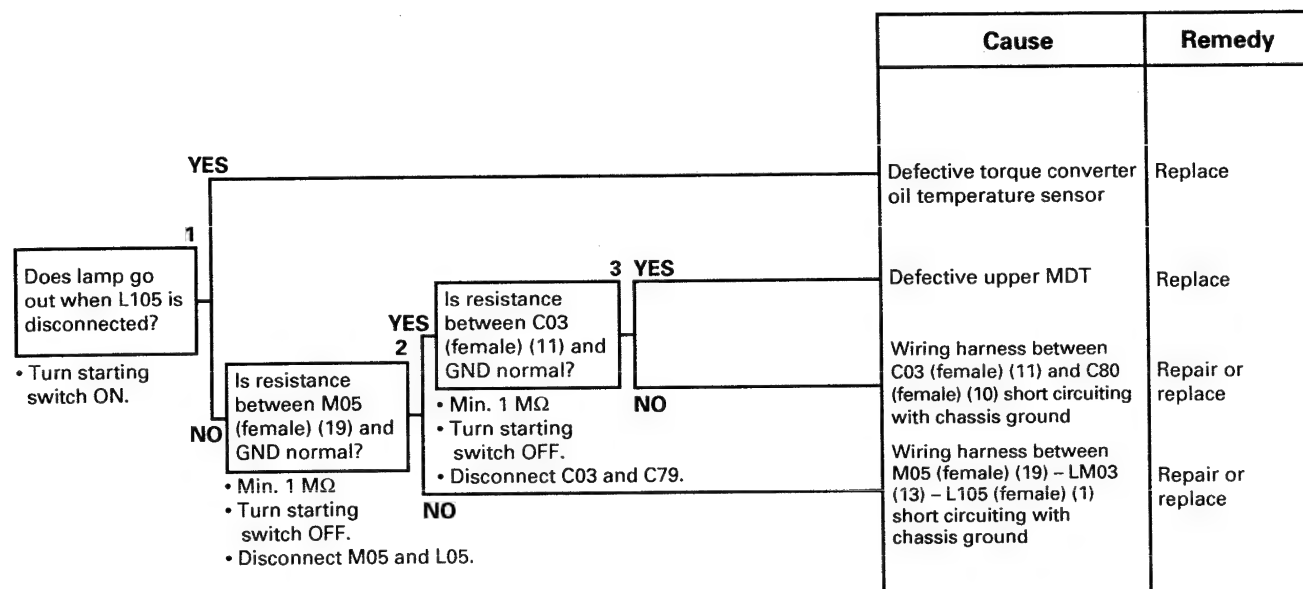


TKL00645

			Cause	Remedy		
<div>Is resistance between C79 (female) (6) and R03 (female) (1)(2) normal?</div> <div>• Max. 1 Ω</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect C79 and R03.</div>	1	YES	Is resistance between L03 (male) (1)(2) and battery normal?			
			2 YES		Defective speedometer or defective contact between speedometer and C79	Replace
			NO		Defective contact or disconnection in wiring harness between L03 (male) (1), (2) and battery	Repair or replace
					Defective contact or disconnection in wiring harness between C79 (female) (6) – CR3 (13), (14) - R03 (female) (1), (2)	Repair or replace
					Defective contact or disconnection in wiring harness between fuse 30 – C20 (13) – C79 (female) (14)	Repair or replace
					Defective contact or disconnection in wiring harness between C03 (female) (9) and C79 (female) (5)	Repair or replace
					Defective upper MDT	Replace
					Defective speed sensor	Replace
					Wiring harness between M06 (female) (15), (10) – LM02 (3), (4) – L103 (female) (1), (2) short circuiting with chassis ground or short circuit between wiring harnesses	Repair or replace
				Defective speed sensor	Replace	

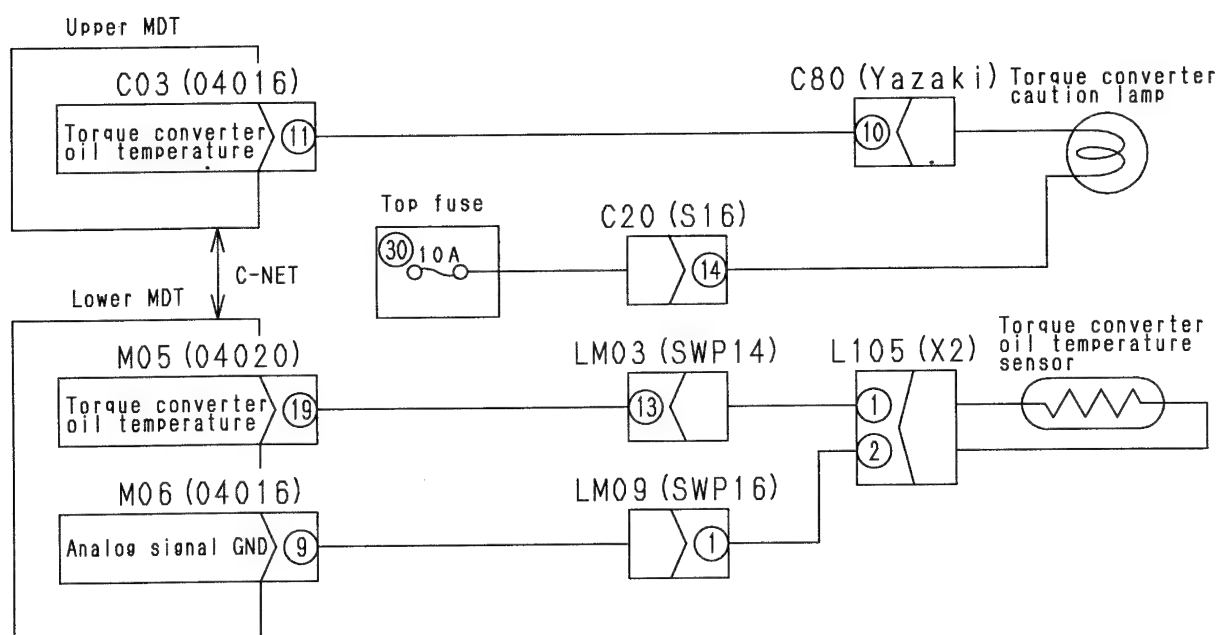
M-13 Torque converter oil temperature caution lamp lights up

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Note: The torque converter oil temperature caution lamp lights up only when an abnormality occurs. If there is a disconnection in the sensor or circuit when the abnormality occurs, the lamp does not light up.

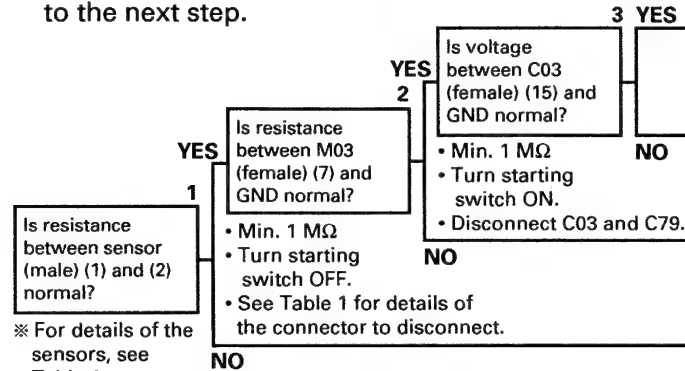
M-13 Related electric circuit diagram



TKL00646

M-14 Brake fluid level caution lamp lights up

- ★ When no error code is displayed.
- ★ When the brake fluid level and brake wear are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



※ For details of the sensors, see Table 1.

- When normal: Min. 1 MΩ
- When abnormal: Max. 1 Ω
- Turn starting switch ON.
- Disconnect sensor connector.

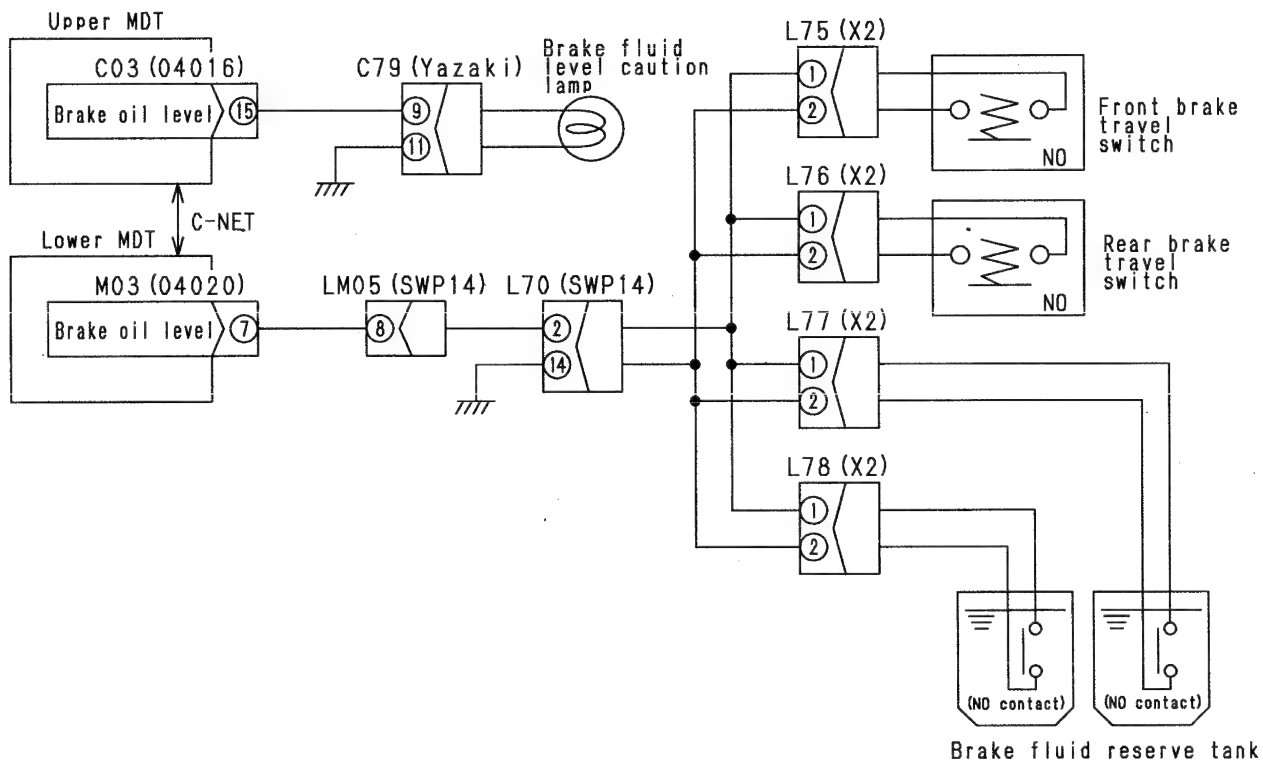
Table 1

Connector No.	Location of installation
L75	Front brake travel sensor
L76	Rear brake travel sensor
L77	Front brake fluid tank
L78	Rear brake travel sensor

Cause	Remedy
Defective upper MDT	Replace
Wiring harness between C03 (female) (15) and C79 (female) (9) short circuiting with power source	Repair or replace
Wiring harness between M03 (female) (7) – LM05 (8) – L70 (2) – sensor (see Table 1) short circuiting with chassis ground	Replace
Defective sensor where there is abnormality in resistance	Replace

Note: The brake fluid level caution lamp lights up only when an abnormality occurs in the brake fluid level or brake travel.
If there is a disconnection in the sensor or circuit when the abnormality occurs, the lamp does not light up.

M-14 Related electric circuit diagram



Brake fluid reserve tank

TKL00647

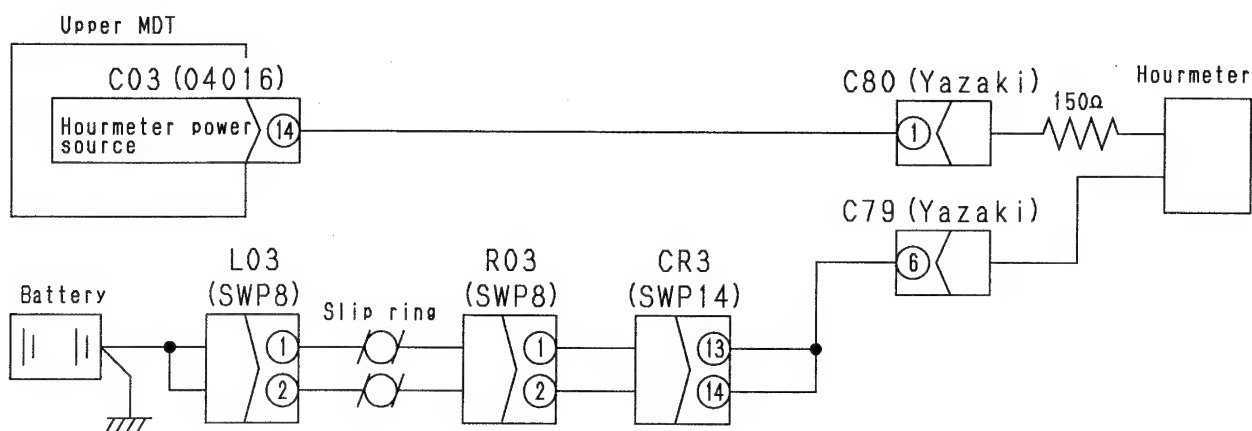
M-15 Hourmeter does not work

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<p>1 Is voltage between C80 (1) and GND normal?</p> <p>• 17 – 30 V</p> <p>• Start engine.</p> <p>YES</p> <p>2 Is resistance between C79 (female) (6) and R03 (female) (1), (2) normal?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect C79 and R03.</p> <p>YES</p> <p>3 Is resistance between L03 (male) (1), (2) and battery normal?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect L03.</p> <p>NO</p> <p>4 Is voltage between C03 (14) and GND normal?</p> <p>• 17 – 30 V</p> <p>• Start engine.</p> <p>NO</p>	YES	Defective hourmeter or defective contact between hourmeter and C79	Repair or replace
	NO	Defective contact or disconnection in wiring harness between L03 (male) (1), (2) and battery	Replace
	YES	Defective contact or disconnection in wiring harness between C79 (female) (6) – CR3 (13), (14) – R03 (female) (1), (2)	Repair or replace
	NO	Defective contact or disconnection in wiring harness between C80 (female) (1) – C03 (13), (14) (female) (14)	Replace
	NO	Defective upper MDT	Replace

023S02

M-15 Related electric circuit diagram



TKL00648

TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE)

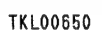
Electrical circuit diagram of power source, starting, preheating, and preparatory ground systems	20-1304
PTO solenoid system circuit diagram	20-1306
Electrical circuit diagram of brake system	20-1307
Electrical circuit diagram of steering system	20-1308
Electrical circuit diagram of suspension system	20-1310
Electrical circuit diagram of turn signal and swing flasher systems	20-1312
Electrical circuit diagram of lighting, horn, and auto-grease systems	20-1314
Electrical circuit diagram of night lighting system	20-1316
E- 1 Main power source is not supplied (reaches inlet port of fuse box)	20-1319
a) Power source direct from battery (NSW)	20-1319
b) Power source (SW) is not supplied when starting switch is turned ON	20-1320
E- 2 Engine does not start when starting switch is turned to START	20-1324
a) Starting motor does not turn	20-1324
b) Starting motor turns (engine stop motor system)	20-1328
E- 3 Engine does not stop	20-1330
E- 4 Preheating does not work	20-1331
E- 5 Abnormality in PTO solenoid system	20-1333
a) Does not switch to PTO (operation) mode (engine speed does not go down) (disconnection)	20-1333
b) PTO (operation) mode is not switched OFF (short circuit with power source)	20-1333
E- 6 Parking brake cannot be released or cannot be applied	20-1335
a) Parking brake cannot be released (disconnection)	20-1335
b) Parking brake cannot be applied (short circuit with power source)	20-1335
E- 7 Abnormality in rear steering CENTER detection limit switch system	20-1337
a) Always detects position other than rear CENTER (disconnection)	20-1337
b) Always detects rear steering CENTER (short circuit with chassis ground)	20-1337
E- 8 Abnormality in suspension lock system	20-1338
a) Suspension lock cannot be applied (short circuit with power source)	20-1338
b) Suspension lock cannot be released (disconnection)	20-1338
c) Anti-nosedive function does not work (anti-nosedive relay system)	20-1339
E- 9 Swing flasher does not flash (disconnection)	20-1340
E-10 Abnormality in emergency alarm buzzer system	20-1341
a) Emergency alarm buzzer does not sound (disconnection)	20-1341
b) Emergency alarm buzzer does not stop (short circuit with power source)	20-1341
E-11 Abnormality in monitor central buzzer system	20-1342
a) Monitor central buzzer does not sound (disconnection)	20-1342
b) Monitor central buzzer does not stop (short circuit with power source)	20-1342
E-12 Abnormality in moment limiter buzzer system	20-1343
a) Moment limiter buzzer does not sound (disconnection)	20-1343
b) Moment limiter buzzer does not stop (short circuit with power source)	20-1343

E-13	Horn does not sound or does not stop	20-1344
	a) Horn does not sound (disconnection)	20-1344
	b) Horn does not stop (short circuit with power source)	20-1345
E-14	Working lamps do not light up	20-1346
	a) No working lamp lights up	20-1346
	b) Working lamp on top of cab does not light up	20-1346
	c) Boom working lamp, working lamp do not light up	20-1347
E-15	Head lamp Hi beam does not light up or does not go out	20-1348
	a) Head lamp Hi beam does not light up (disconnection)	20-1348
	b) Head lamp Hi beam does not go out (short circuit with power source)	20-1349
E-16	Head lamp Lo beam does not light up or does not go out	20-1350
	a) Head lamp Lo beam does not light up (disconnection)	20-1350
	b) Head lamp Lo beam does not go out (short circuit with power source)	20-1351
E-17	Back-up lamp does not light up or does not go out	20-1352
	a) Back-up lamp does not light up (disconnection)	20-1352
	b) Back-up lamp does not go out (short circuit with power source)	20-1352
E-18	Stop lamp does not light up or does not go out	20-1353
	a) Stop lamp does not light up (disconnection)	20-1353
	b) Stop lamp does not go out (short circuit with power source)	20-1353
E-19	Side lamp, tail lamp, license lamp do not light up or do not go out	20-1354
	a) Side lamp, tail lamp, license lamp do not light up (disconnection)	20-1354
	b) Side lamp, tail lamp, license lamp do not go out (short circuit with power source)	20-1355
E-20	Room lamp does not light up	20-1356
E-21	Step lamp does not light up	20-1357
E-22	Abnormality in tachograph system	20-1358
	a) Tachograph does not work (speed indicator does not move)	20-1358
	b) Cannot be printed out on tachograph print sheet	20-1358
E-23	Centralized greasing cannot be carried out	20-1359
E-24	Greasing completion lamp does not light up	20-1359
E-25	Front wiper, front window washer do not work	20-1361
	a) Front wiper (Hi, Lo speed) does not work	20-1361
	b) Front wiper (intermittent) does not work	20-1361
	c) Front window washer does not work	20-1362
E-26	Roof wiper, roof window washer do not work	20-1363
	a) Roof wiper does not work	20-1363
	b) Roof wiper intermittent does not work	20-1363
	c) Roof window washer does not work	20-1364
E-27	Night lighting does not light up (outrigger telescope switch lighting does not light up)	20-1365

E-51	Defective air conditioner	20-1367
	Troubleshooting chart for air conditioner system	20-1367
E-51	a) Air conditioner does not work at all	20-1368
	a)-(1) Does not work at all, control panel LEDs do not light up	20-1368
	a)-(2) Troubleshooting of cooling circuit	20-1369
	a)-(3) Impossible to adjust air temperature	20-1370
	a)-(4) Compressor clutch does not come ON	20-1371
E-51	b) Defective cooling	20-1372
	b)-(1) Condenser fan motor does not turn.....	20-1372
	b)-(2) Troubleshooting of hot water circuit	20-1373
E-51	c) Defective heating	20-1374
E-51	d) No breeze comes from vent	20-1376
E-51	e) Impossible to adjust wind force	20-1378
E-51	f) Impossible to adjust air temperature	20-1379
E-51	g) Impossible to switch vents	20-1380
E-51	h) Impossible to switch FRESH/RECIRC	20-1381
E-51	i) Abnormal noise	20-1382
E-51	j) Water leaks from air conditioner unit	20-1383
	Additional information for troubleshooting of air conditioner	20-1384

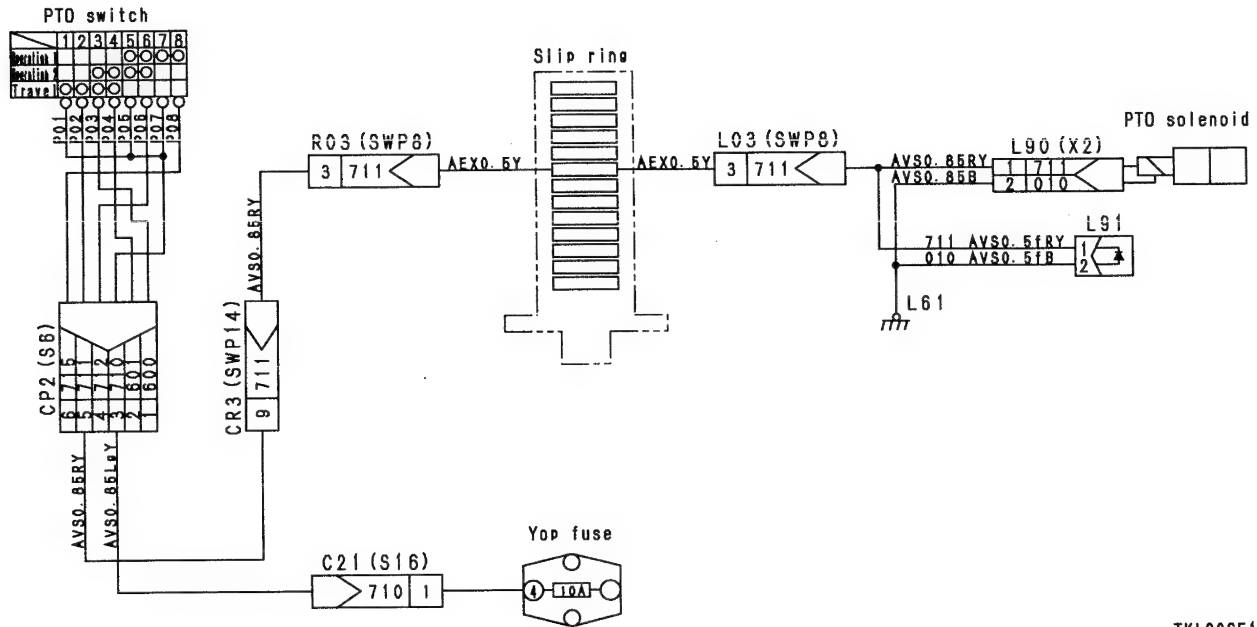
023S02





023S02

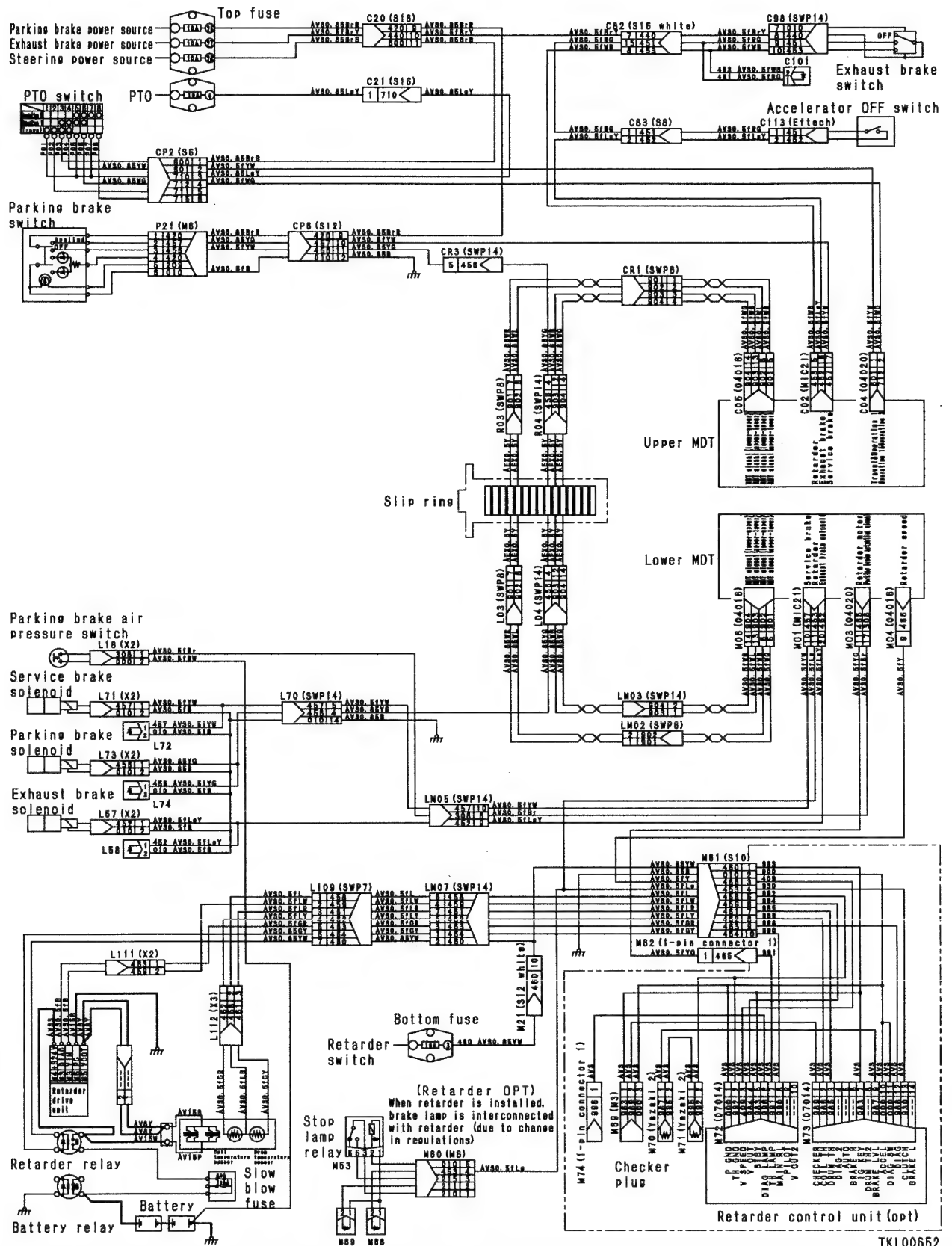
PTO SOLENOID SYSTEM CIRCUIT DIAGRAM



TKL00651

023S02

ELECTRICAL CIRCUIT DIAGRAM OF BRAKE SYSTEM

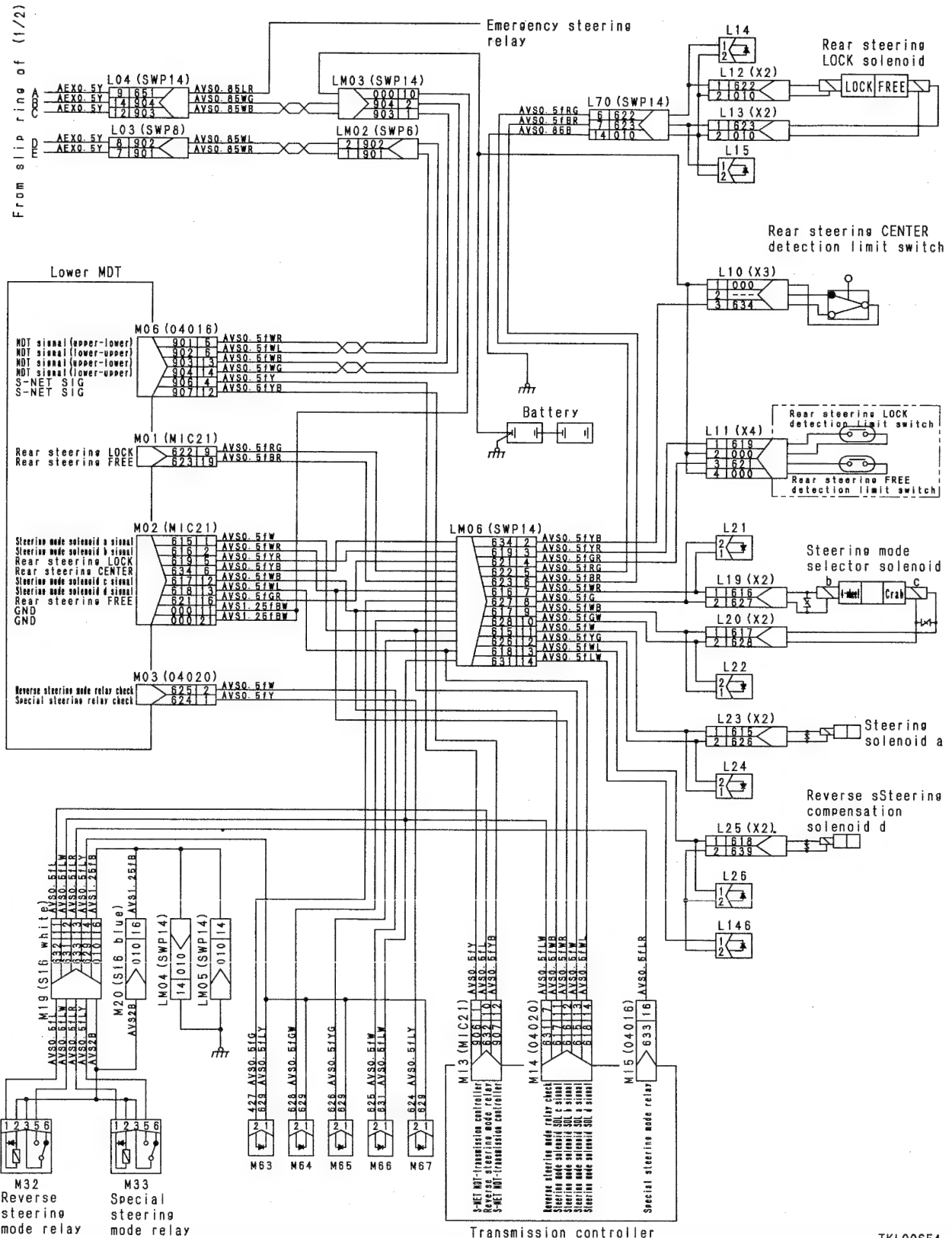


TKL00852

20-1308

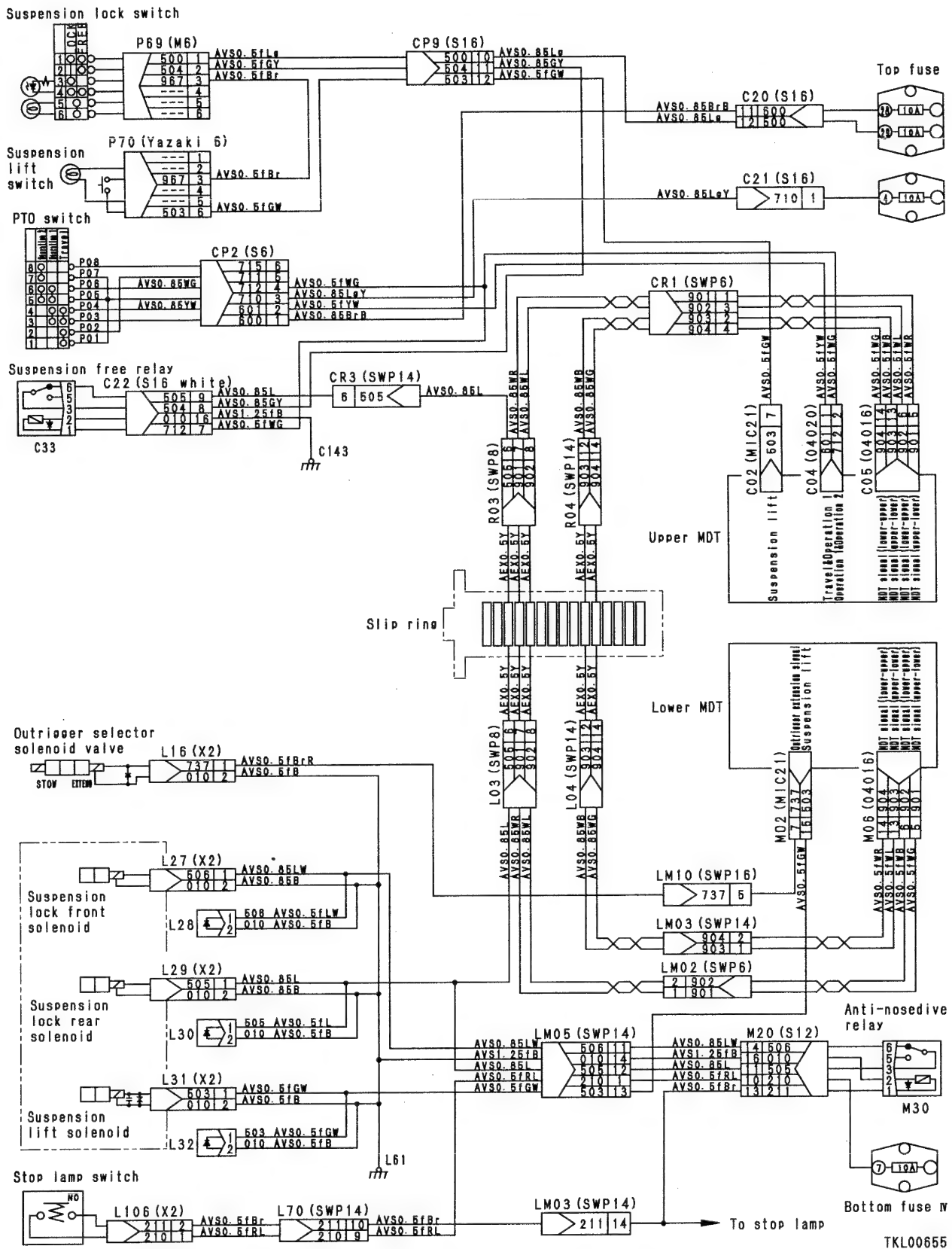


023S02



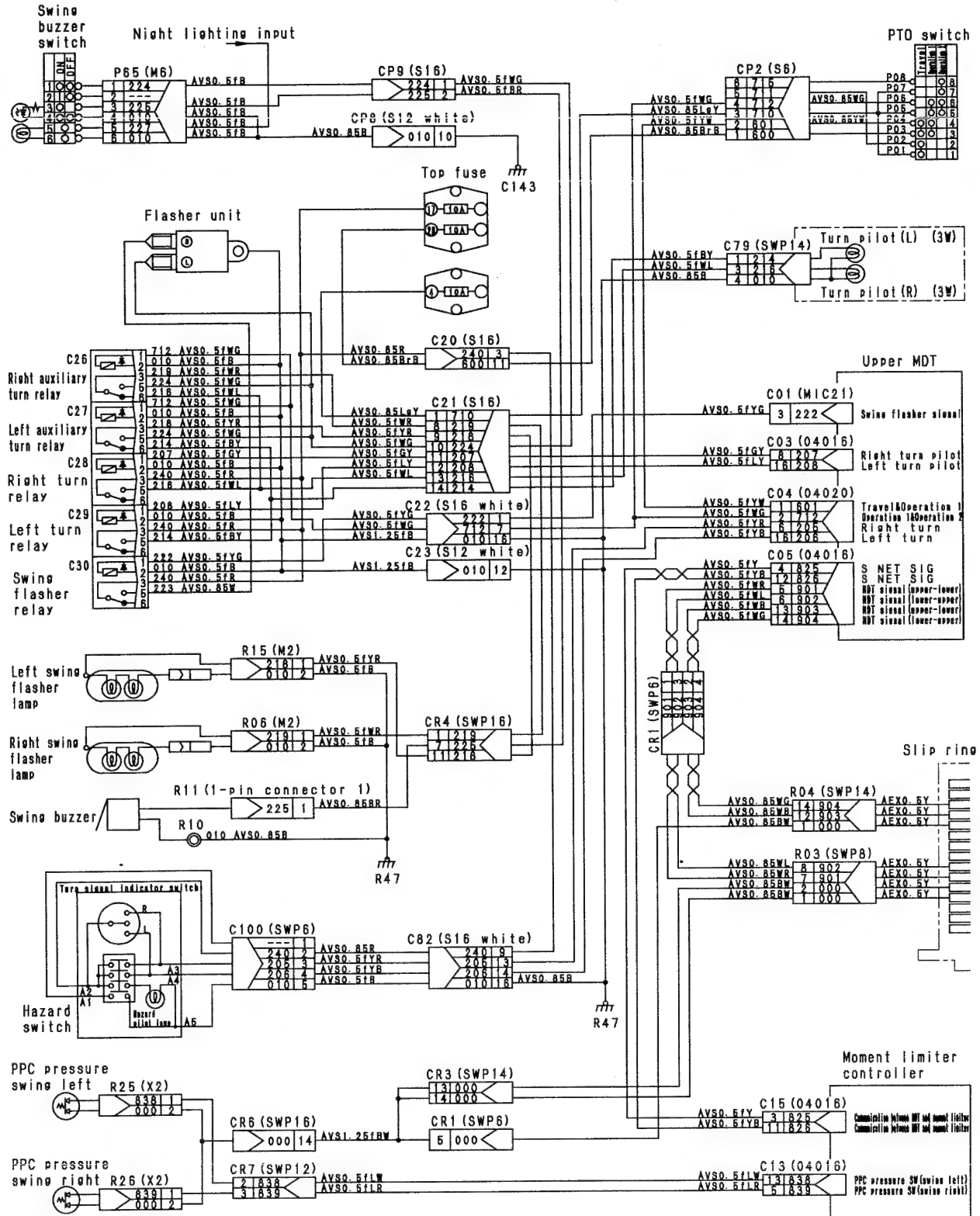
TKL00654

ELECTRICAL CIRCUIT DIAGRAM OF SUSPENSION SYSTEM



023S02

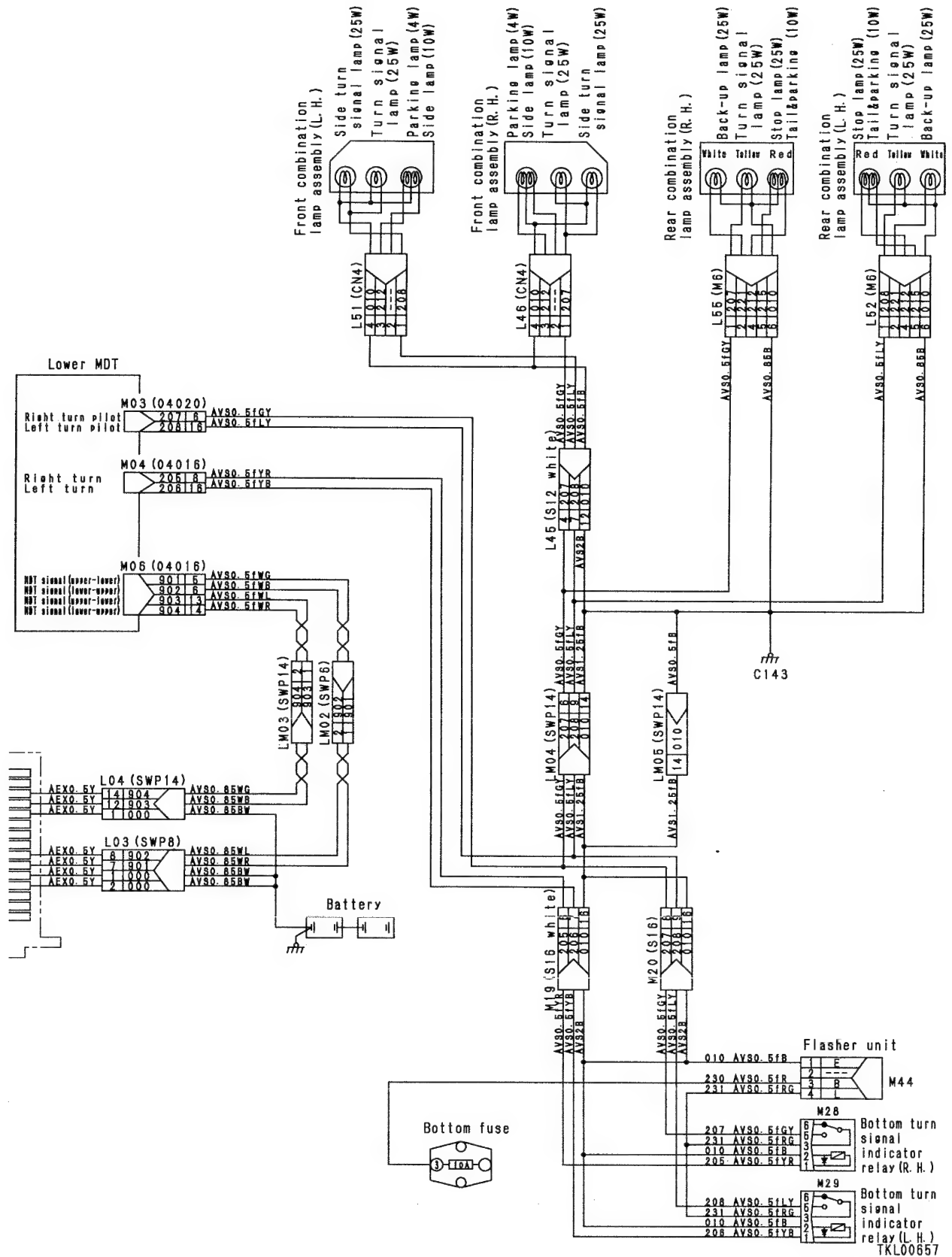
TKL00655

ELECTRICAL CIRCUIT DIAGRAM OF TURN SIGNAL AND SWING
FLASHER SYSTEMS

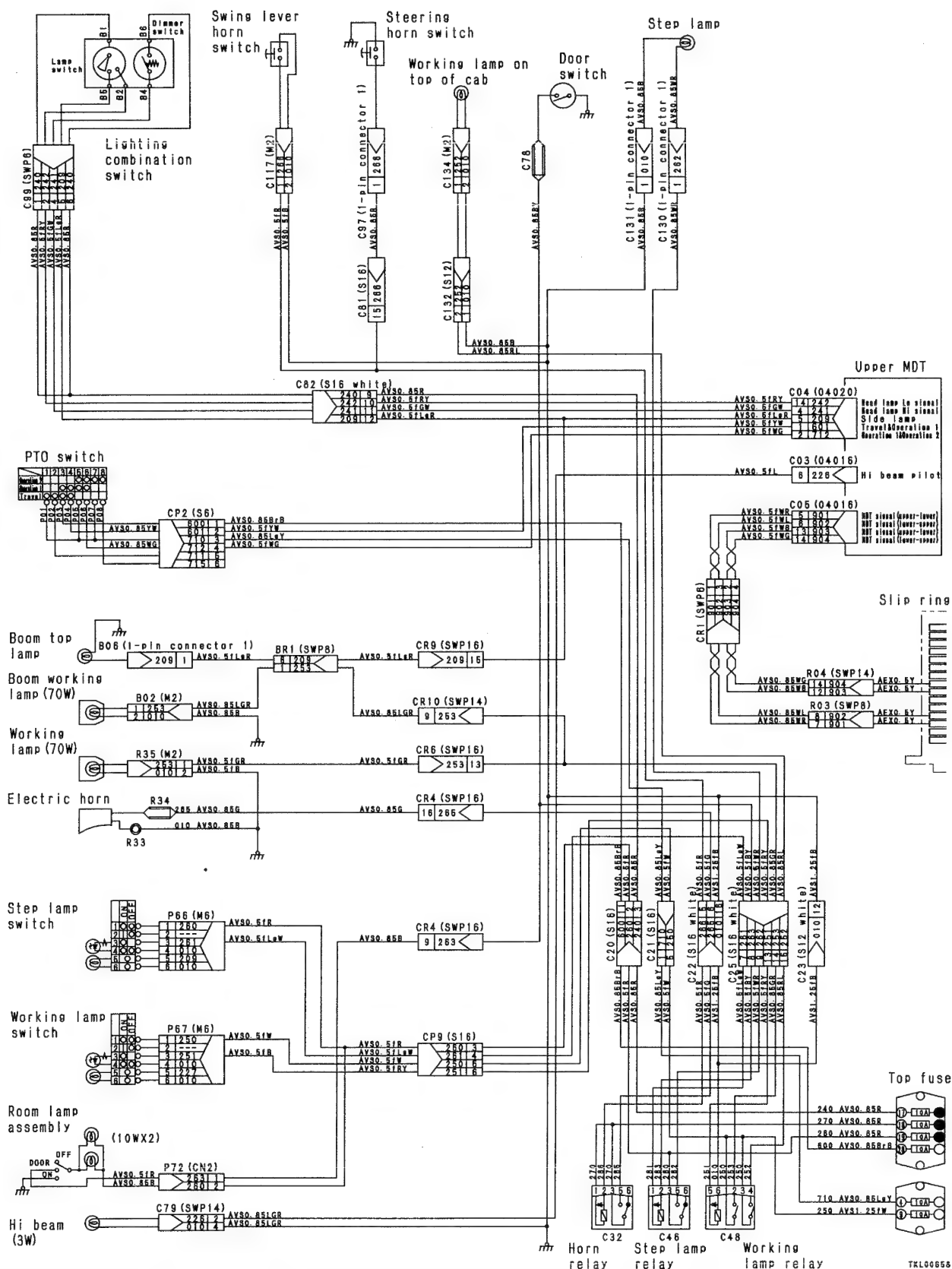
023S02

TKL00656

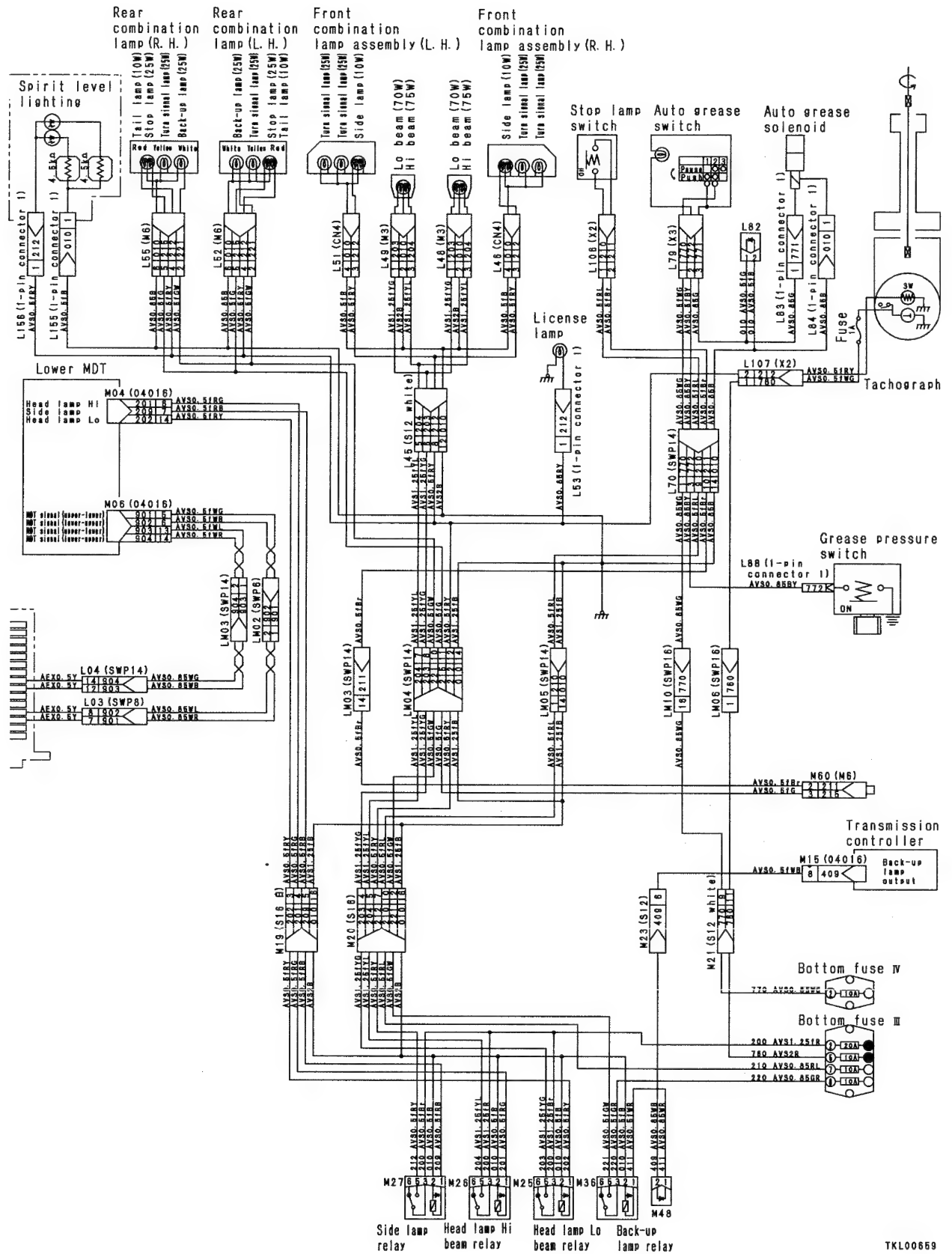
023S02



ELECTRICAL CIRCUIT DIAGRAM OF LAMP, HORN, AND GREASE SYSTEMS

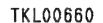


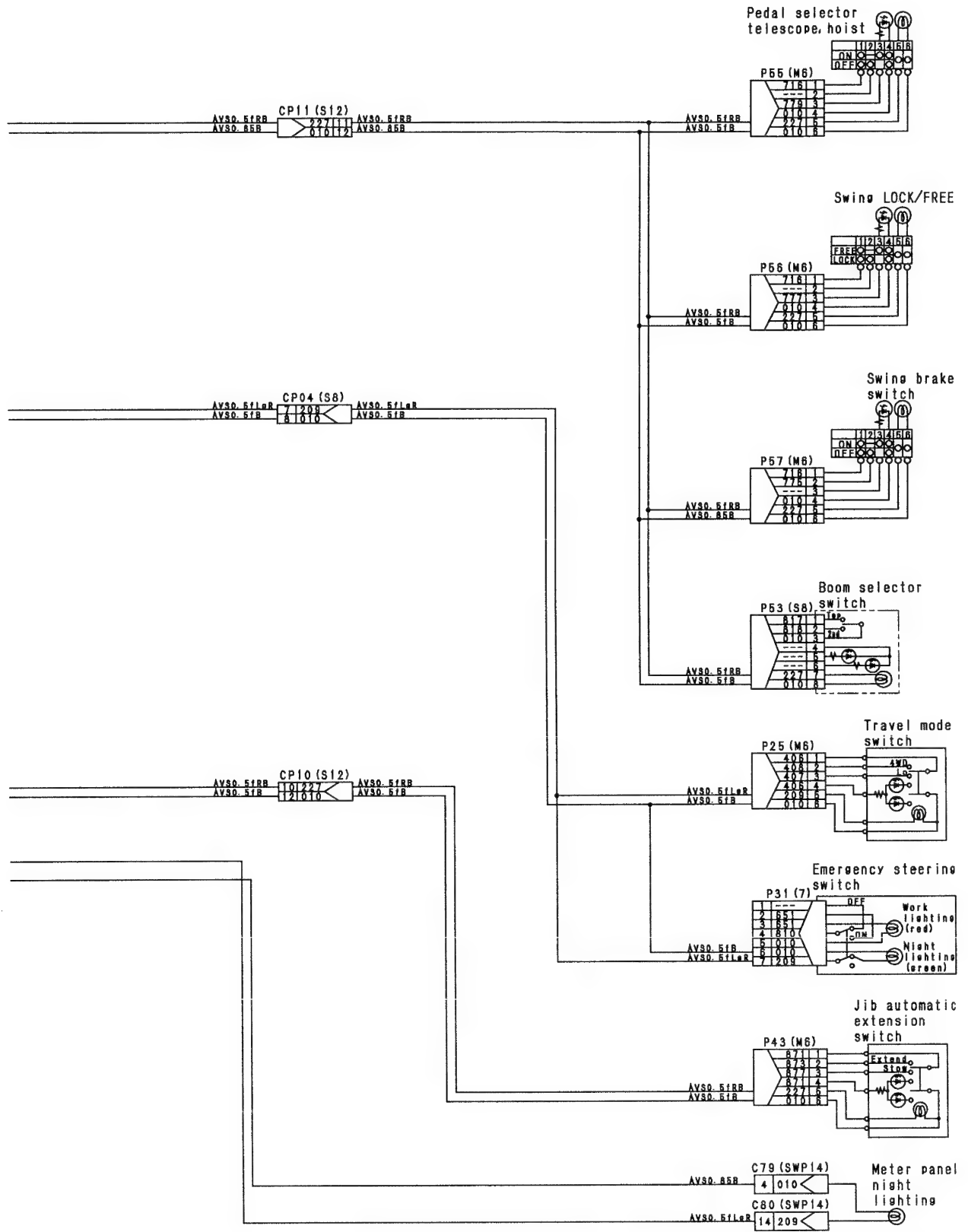
023S02



TKL00659

023S02





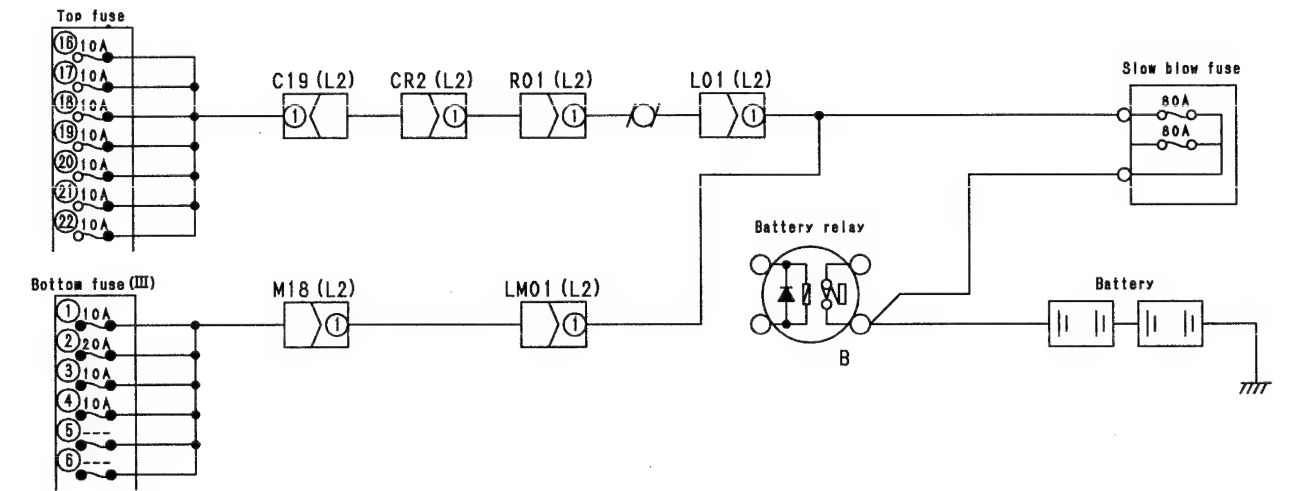
E-1 Main power source is not supplied (reaches inlet port of fuse box)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Power source direct from battery (NSW)

a) Power source direct from battery (NSW)			Cause	Remedy	
<div>1</div> <div>Does power source not enter top or bottom or both?</div>	Top only	<div>2</div> <div>(Bottom)</div> <div>Is voltage between L01 (1) and GND normal?</div>	<div>3 YES</div> <div>(Top)</div> <div>Is voltage between R01 (1) and GND normal?</div>	Defective contact or disconnection in wiring harness between top fuse inlet – C19 (1) – CR2 (1) – R01 (male) (1)	Repair or replace
			NO	Defective contact or disconnection in wiring harness between L01 (male) (1) – slip ring – R01 (female) (1), or defective slip ring	Repair or replace
			NO	Defective contact or disconnection in wiring harness between L01 (female) (1) and slow blow fuse	Repair or replace
	Bottom only			Defective contact or disconnection in wiring harness between bottom fuse inlet – M18 (1) – LM01 (1) – slow blow fuse outlet	Repair or replace
				Defective contact or disconnection in wiring harness between slow blow fuse outlet and L01 (LM01) (1)	Repair or replace
	Both	<div>4</div> <div>Is slow blow fuse normal?</div>	<div>5 YES</div> <div>Is voltage at slow blow fuse inlet normal?</div>	Defective contact or disconnection in wiring harness between battery (+) – battery relay (+) – slow blow fuse inlet	Repair or replace
NO			Blown slow blow fuse (80A)	Replace	

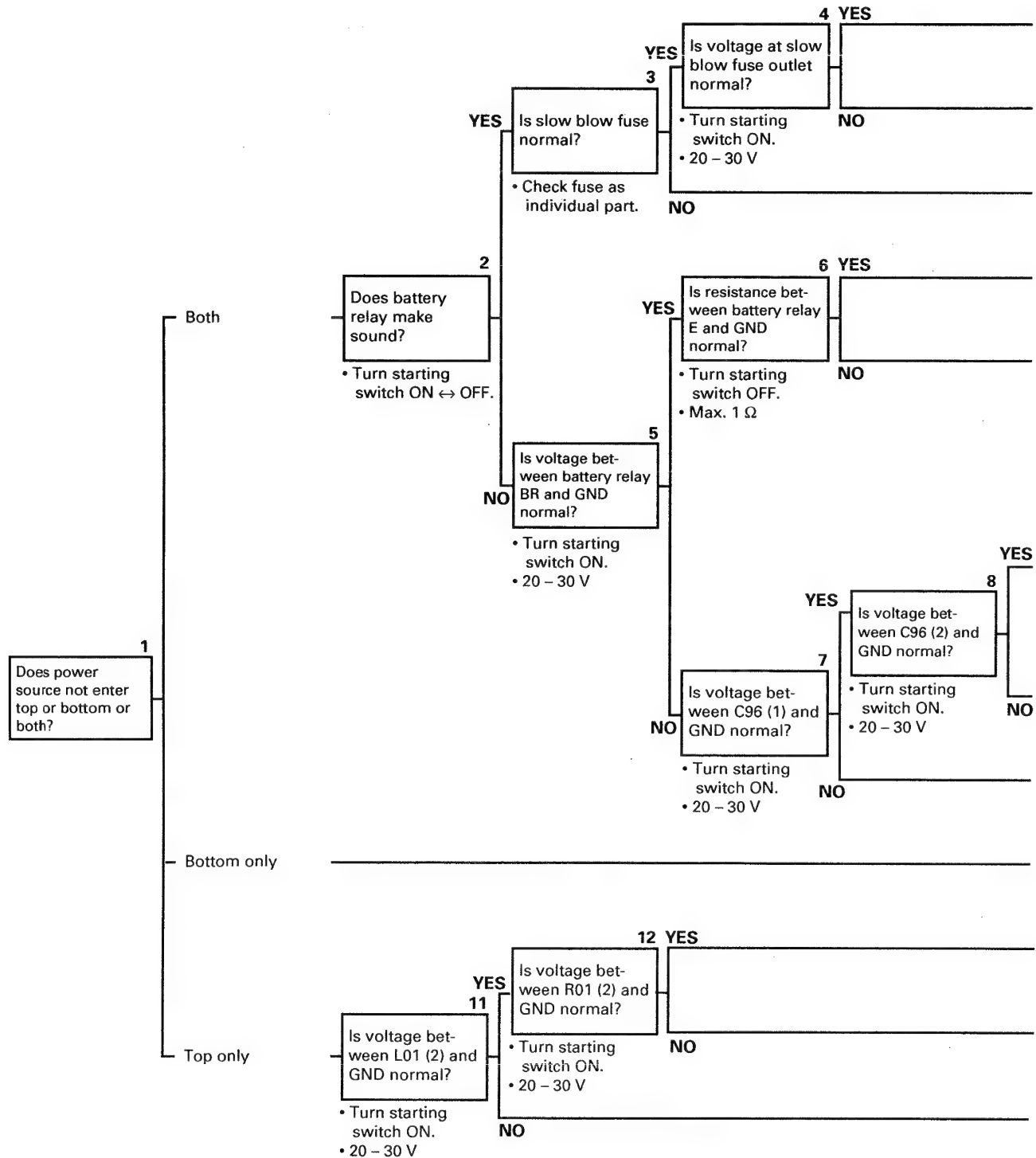
E-1 a) Related electric circuit diagram



TKL00662

b) Power source (SW) is not supplied when starting switch is turned ON

- ★ When no error code is displayed.
- ★ When the side lamps or turn signal lamps do not light up (if they do not light up, start troubleshooting from Section a)).
- ★ Check that top fuse 16 is not blown before starting troubleshooting.
(If the fuse is blown, check for a short circuit in the wiring harness given in the troubleshooting item.)

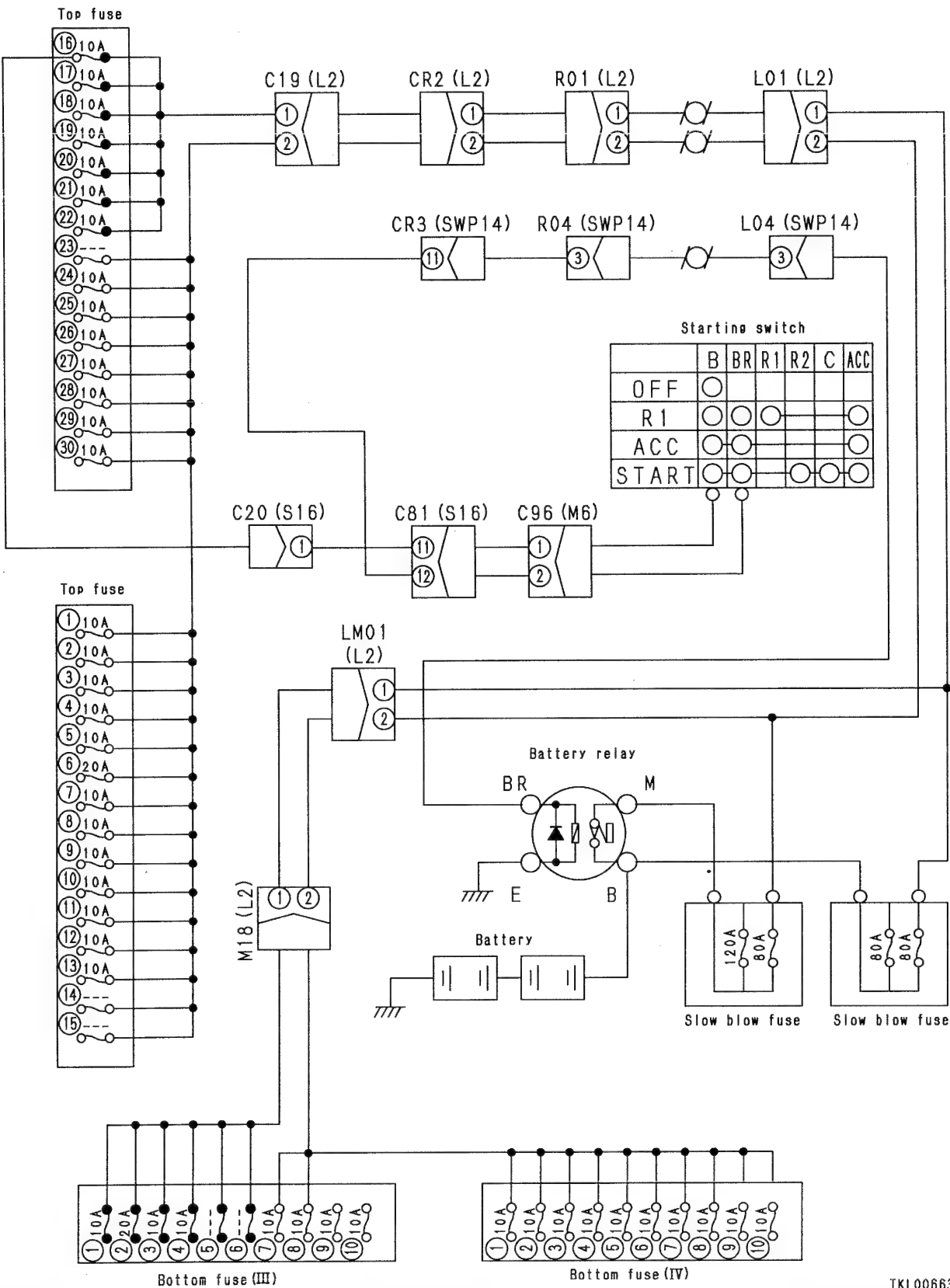


023S02

023S02

		Cause	Remedy
<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> 9 Is voltage between R04 (3) and GND normal? • Turn starting switch ON. • 20 – 30 V </div> <div style="margin-bottom: 10px;"> YES </div> <div style="margin-bottom: 10px;"> 10 Is voltage between L04 (3) and GND normal? • Turn starting switch ON. • 20 – 30 V </div> <div> NO </div> </div>		Defective contact or disconnection in wiring harness between slow blow fuse and LM01 (L01) (female) (2)	Repair or replace
		Defective contact or disconnection in wiring harness between battery relay M and slow blow fuse	Replace
		Blown slow blow fuse (80A)	Replace
		Defective battery relay	Repair or replace
		Defective contact or disconnection in wiring harness between battery relay E and GND	Repair or replace
	YES	Defective contact or disconnection in wiring harness between L04 (male) (3) and battery relay BR	Repair or replace
	NO	Defective contact or disconnection in wiring harness between R04 (male) (3) – slip ring – L04 (female) (3)	Repair or replace
		Defective contact or disconnection in wiring harness between R04 (female) (3) – CR3 (11) – C81 (12) – C96 (female) (2)	Replace
		Defective starting switch	Repair or replace
		Defective contact or disconnection in wiring harness between C96 (female) (1) – C81 (11) – C20 (1) – top fuse (16)	Repair or replace
		Defective contact or disconnection in wiring harness between slow blow fuse outlet – LM01 (1) – M18 (1) – bottom fuse inlet	Repair or replace
		Defective contact or disconnection in wiring harness between R01 (male) (2) – CR2 (2) – C19 (2) – top fuse inlet	Repair or replace
		Defective contact or disconnection in wiring harness between R01 (female) (2) – slip ring – L01 (male) (2)	Repair or replace
		Defective contact or disconnection in wiring harness between slow blow fuse outlet and L01 (female) (2)	Repair or replace

E-1 Related electric circuit diagram



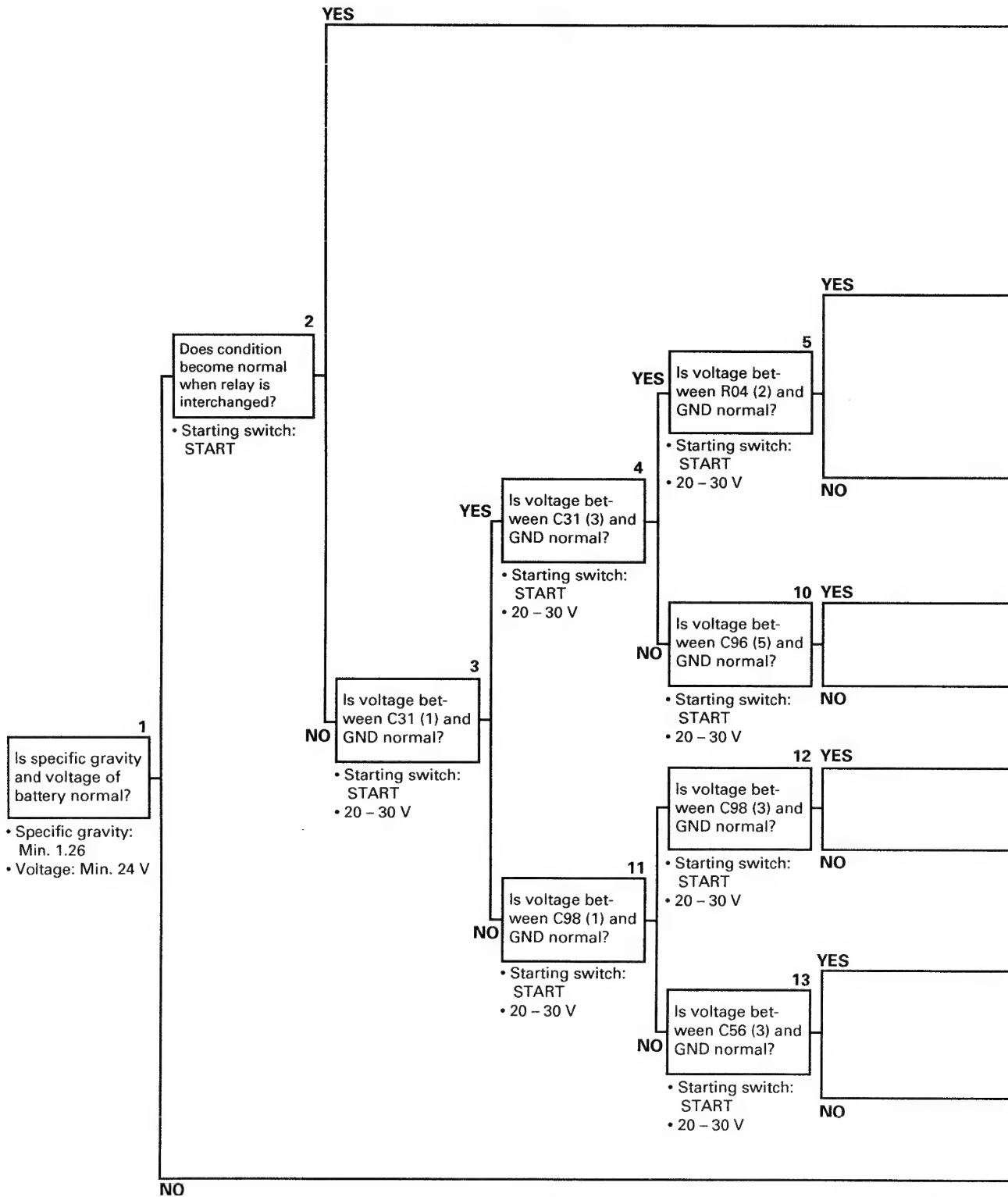
023S02

TKL00663

E-2 Engine does not start when starting switch is turned to START

- ★ When no error code is displayed.
- ★ Place the gear shift lever at N and the emergency gear shift switch at LOWER when carrying out troubleshooting.
- ★ When the electric system is normal.
- ★ Check that top fuse 24 is not blown.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

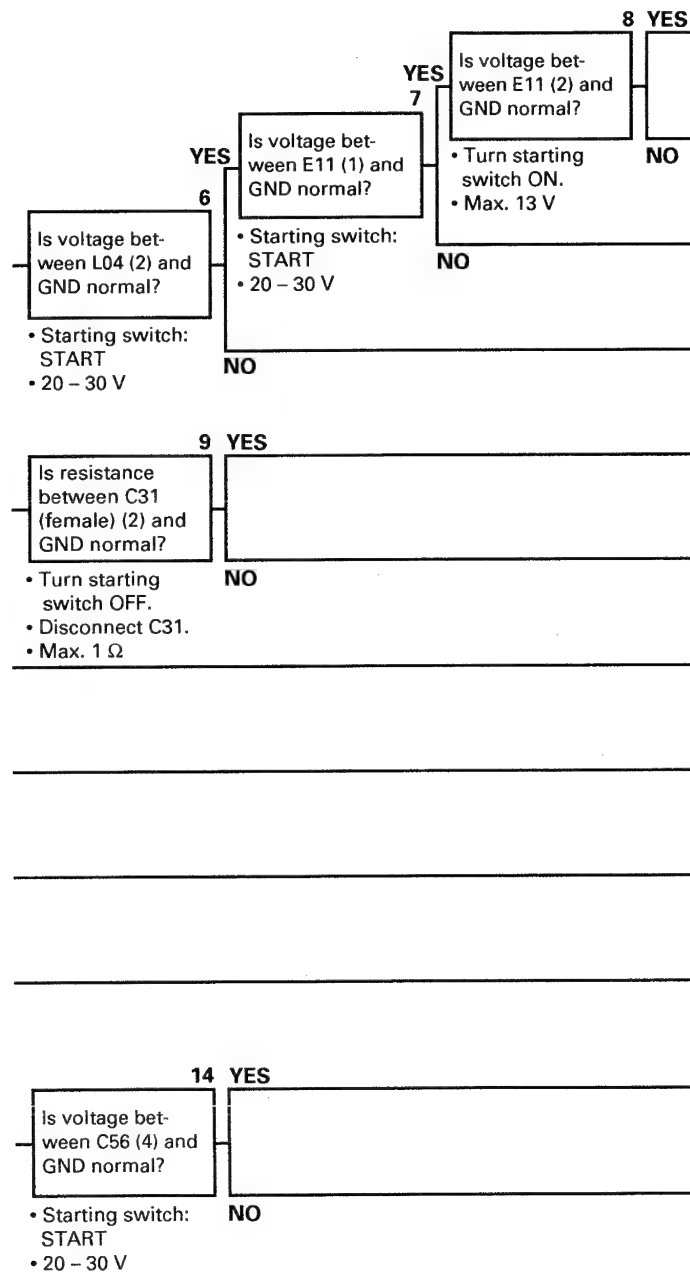
a) Starting motor does not turn



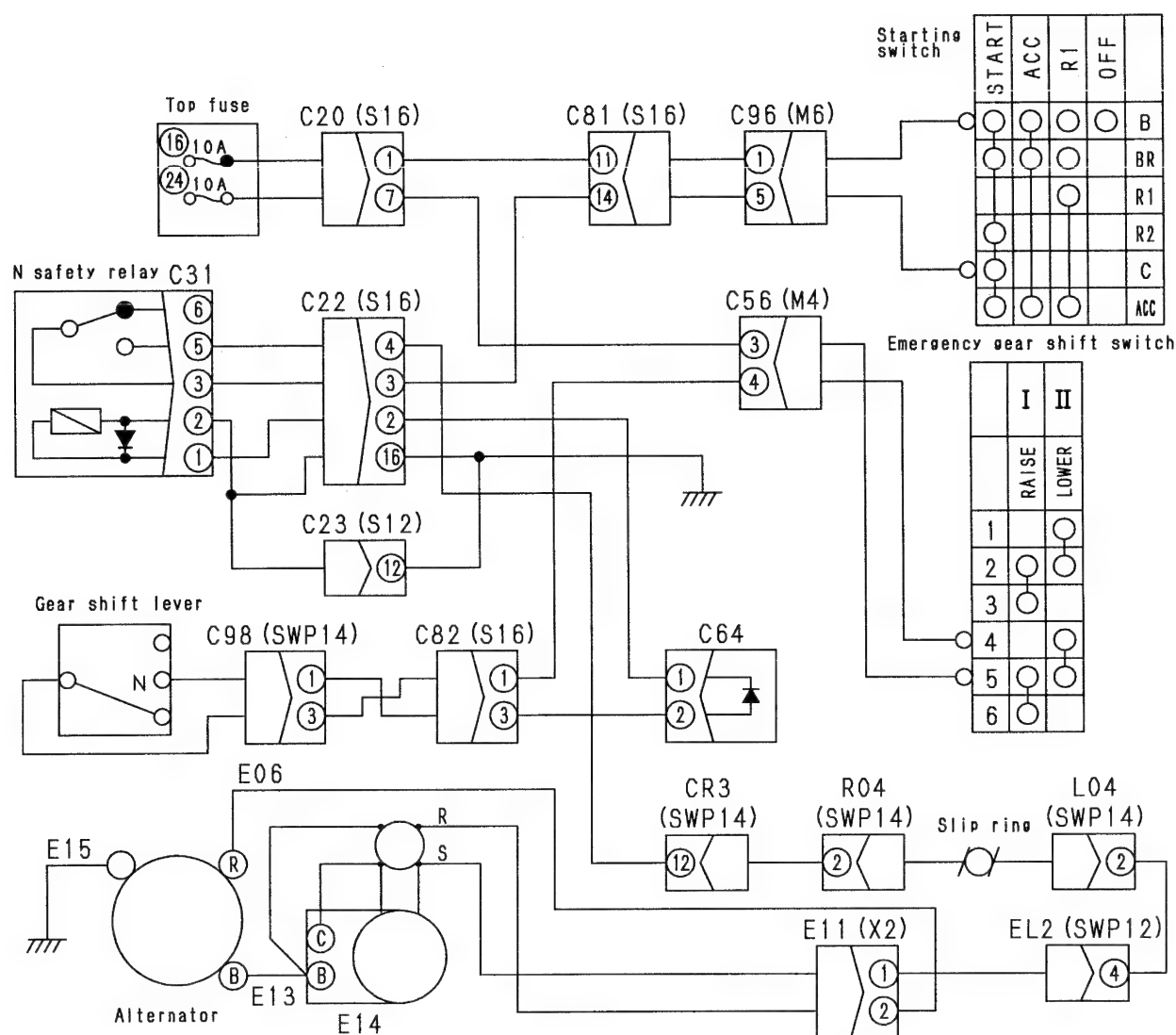
023S02

023S02

		Cause	Remedy
		Defective neutral safety relay	Replace
		Defective starting motor	Repair or replace
		Defective alternator	Repair or replace
		Defective contact or disconnection in wiring harness between L04 (male) (2) – EL2 (4) – E11 (female) (1)	Repair or replace
		Defective contact or disconnection in wiring harness between R04 (male) (3) – slip ring – L04 (female) (2)	Repair or replace
		Defective contact or disconnection in wiring harness (including relay) between C31 (female) (5) – C22 (4) – CR3 (12) – R04 (female) (2)	Repair or replace
		Defective contact or disconnection in wiring harness between C31 (female) (2) – C23 (12) – GND	Repair or replace
		Defective contact or disconnection in wiring harness between C96 (female) (5) – C81 (14) – C22 (3) – C31 (female) (3)	Repair or replace
		Defective starting switch	Replace
		Defective contact or disconnection in wiring harness between C31 (female) (1) – C22 (2) – C82 (3) – C98 (female) (3)	Repair or replace
		Defective gear shift lever	Repair or replace
		Defective contact or disconnection in wiring harness between C56 (female) (4) – C82 (1) – C98 (female) (1)	Repair or replace
		Defective emergency gear shift switch	Replace
		Defective contact or disconnection in wiring harness between fuse 24 – C20 (7) – C56 (female) (3)	Repair or replace
		Lack of battery capacity	Repair or replace



E-2 a) Related electric circuit diagram



TKL00664

023S02

b) Starting motor turns (engine stop motor system)

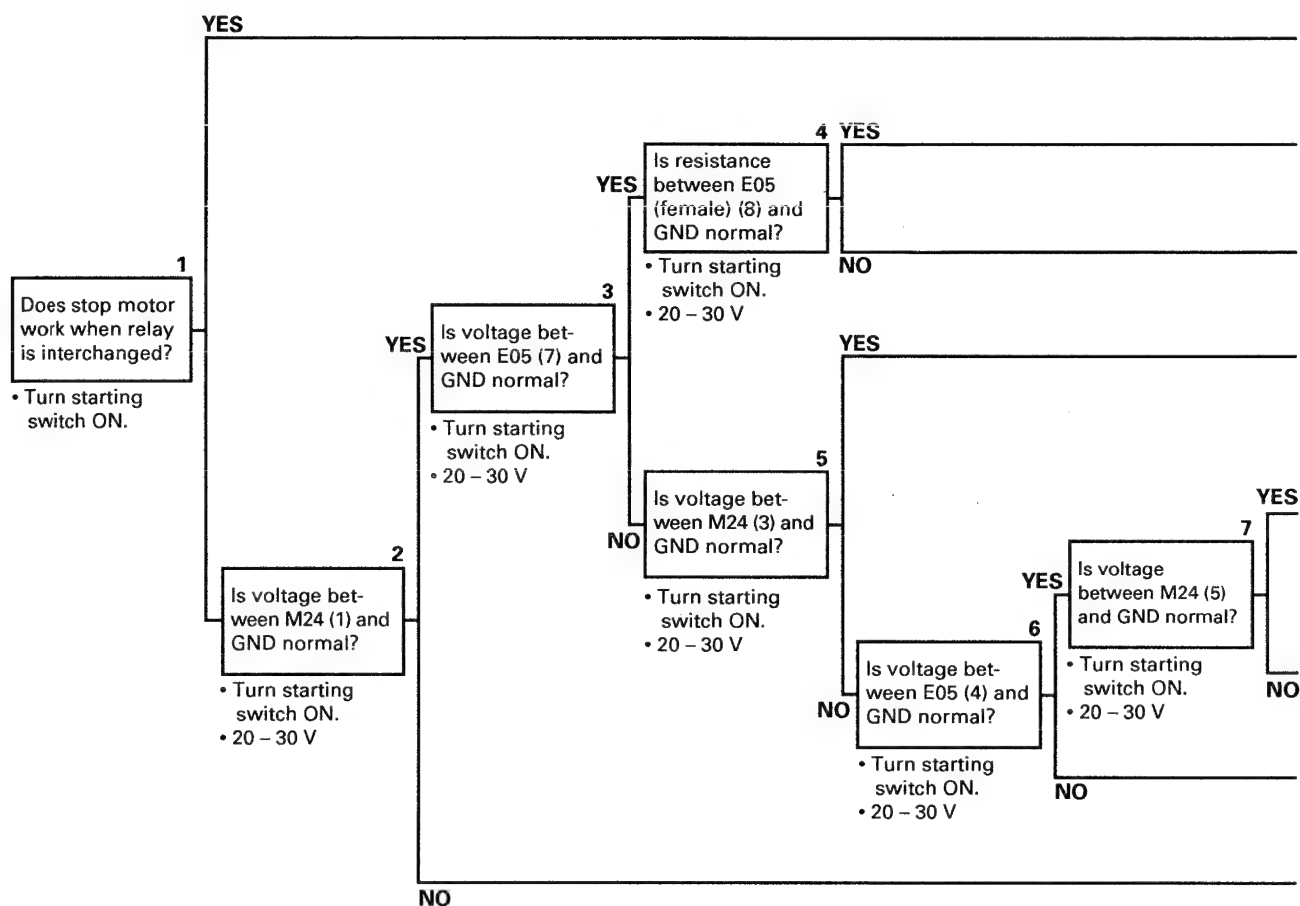
★ When no error code is displayed.

★ Check that bottom fuse III-1 is not blown.

(If the fuse is blown, check for a short circuit in the wiring harness given in the troubleshooting item.)

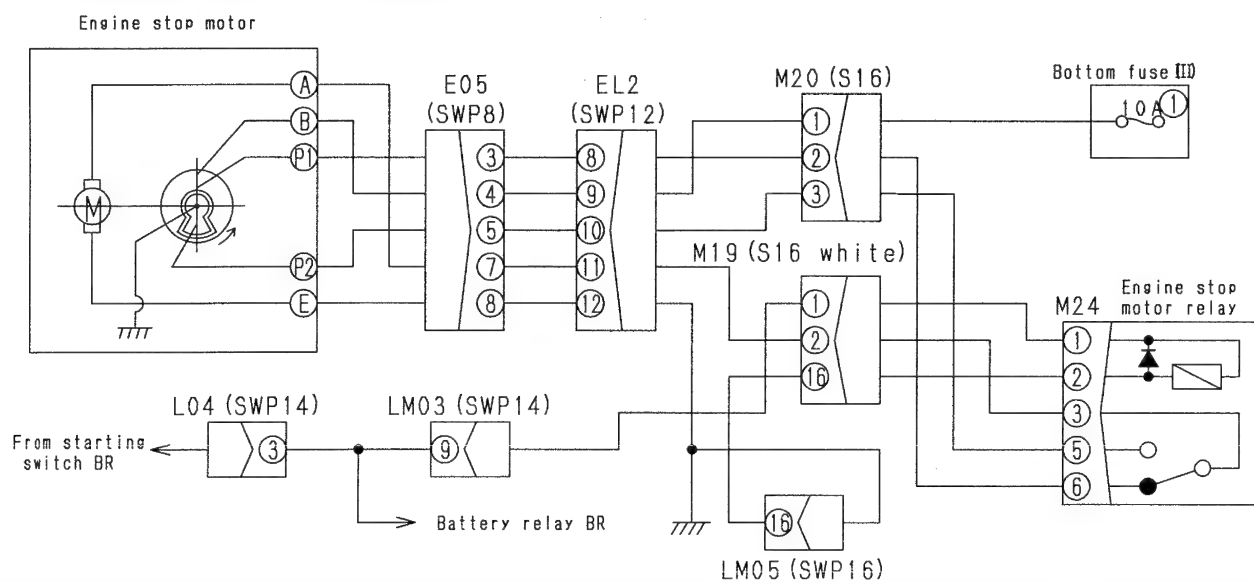
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.



023S02

E-2 a) Related electric circuit diagram



TKL00665

		Cause	Remedy
		Defective engine stop motor relay	Replace
		Defective engine stop motor	Replace
		Defective contact or disconnection in wiring harness between E05 (female) (8) – EL2 (12) – GND	Repair or replace
		Defective contact or disconnection in wiring harness between M24 (female) (3) – M19 (2) – EL2 (11) – E05 (female) (7)	Repair or replace
		Defective contact or disconnection in wiring harness between M24 (female) (5) – M20 (3) – EL2 (10) – E05 (female) (5)	Repair or replace
		Defective contact or disconnection in wiring harness between M24 (female) (2) – N19 (16) – LM05 (16) – GND	Repair or replace
		Defective engine stop motor	Replace
		Defective contact or disconnection in wiring harness between bottom fuse III-1 – M20 (1) – EL2 (9) – E05 (female) (4)	Repair or replace
		Defective contact or disconnection in wiring harness between M24 (female) (1) – M19 (1) – LM03 (9) – L04 (female) (3)	Repair or replace

8 YES	
Is resistance between M24 (female) (2) and GND normal?	
<ul style="list-style-type: none">• Turn starting switch OFF.• Disconnect M24.	NO

023S02

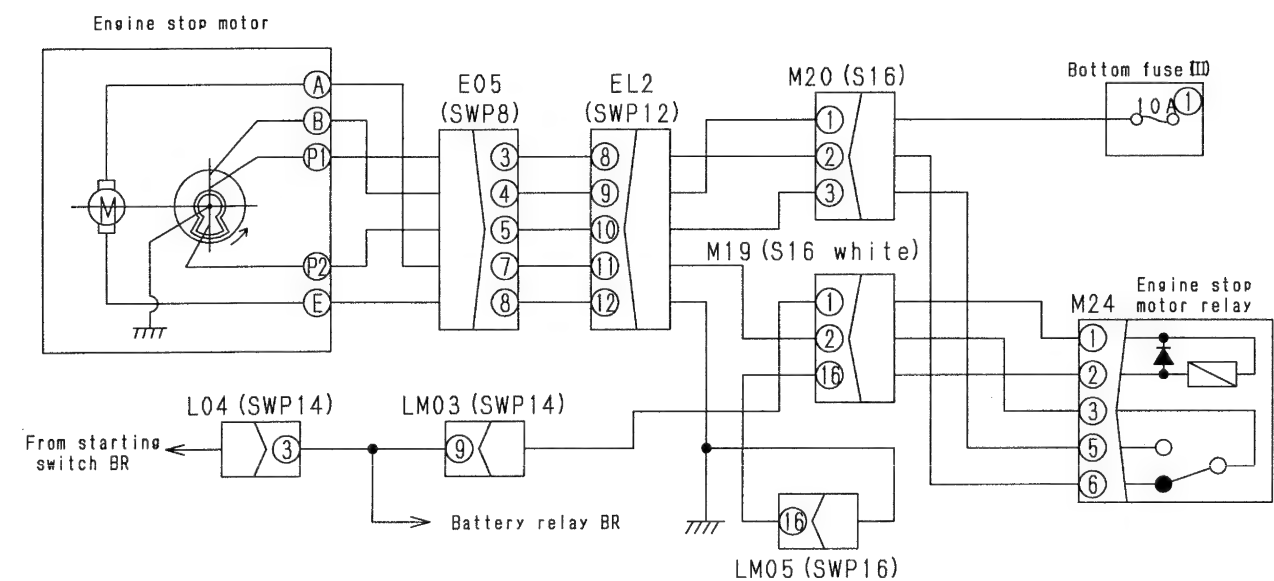
E-3 Engine does not stop

- ★ When no error code is displayed.
- ★ When switching power source ON ↔ OFF is normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div> <div>1</div> <div>Does condition become normal when relay is interchanged?</div> <div>• Turn starting switch OFF.</div> </div> <div> <div>2</div> <div>Is voltage between E05 (7) and GND normal?</div> <div>• Turn starting switch ON → OFF.</div> <div>• 20 – 30 V</div> </div> <div> <div>3</div> <div>Is resistance between E05 (female) (8) and GND normal?</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect E05.</div> <div>• Max. 1 Ω</div> </div> <div> <div>4</div> <div>Is voltage between E05 (3) and GND normal?</div> <div>• Turn starting switch ON → OFF.</div> <div>• 20 – 30 V</div> </div> <div> <div>5</div> <div>Is voltage between M24 (6) and GND normal?</div> <div>• Turn starting switch ON → OFF.</div> <div>• 20 – 30 V</div> </div>	YES	Defective engine stop relay	Replace
	NO	Defective engine stop motor	Replace
	YES	Defective contact or disconnection in wiring harness between E05 (female) (8) – EL2 (12) – GND	Repair or replace
	NO	Defective contact or disconnection in wiring harness between E05 (female) (7) – EL2 (11) – M19 (2) – M24 (female) (3)	Repair or replace
	NO	Defective contact or disconnection in wiring harness between E05 (female) (3) – EL2 (8) – M20 (2) – M24 (female) (3)	Repair or replace
	NO	Defective engine stop motor	Replace

023S02

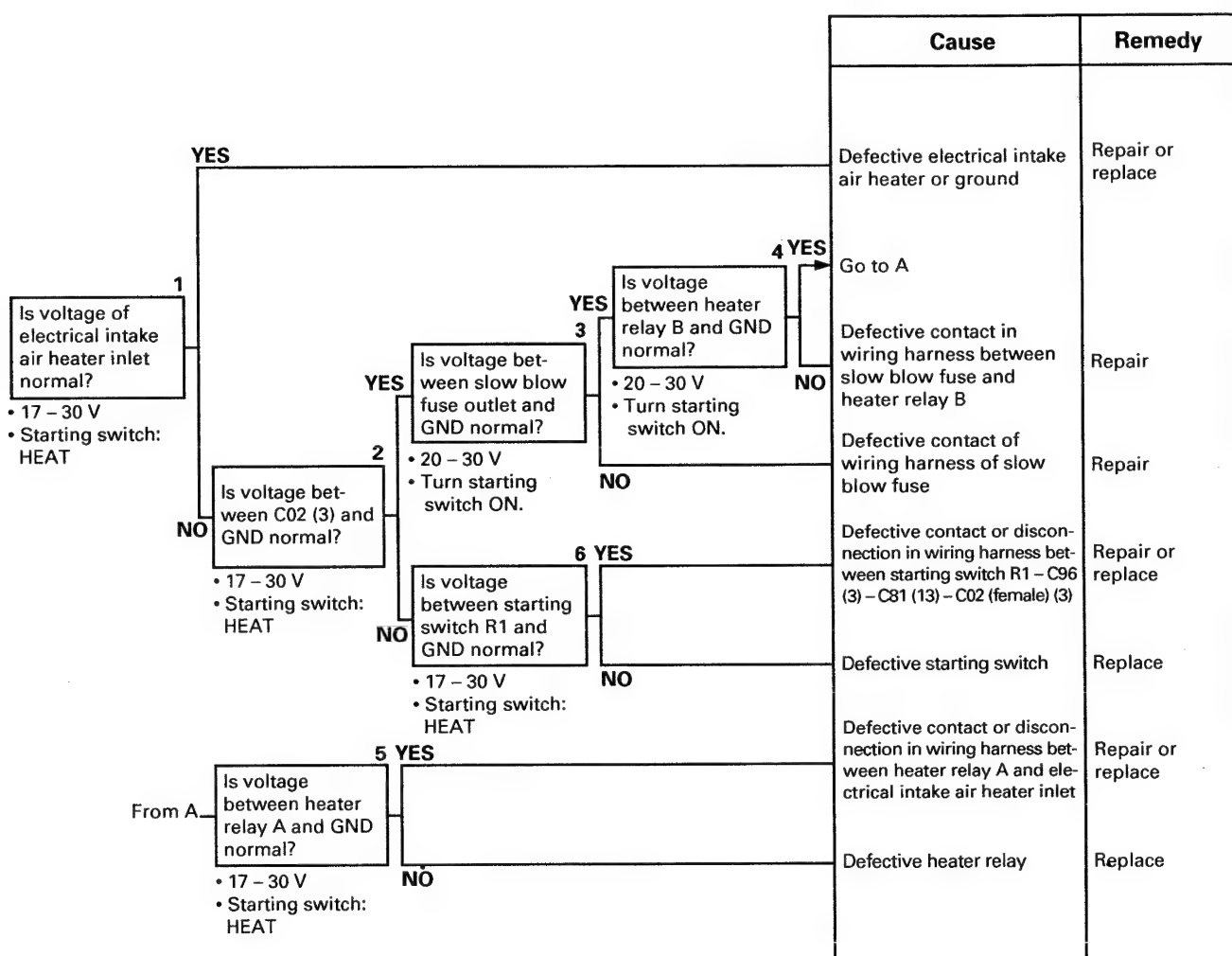
E-3 Related electric circuit diagram



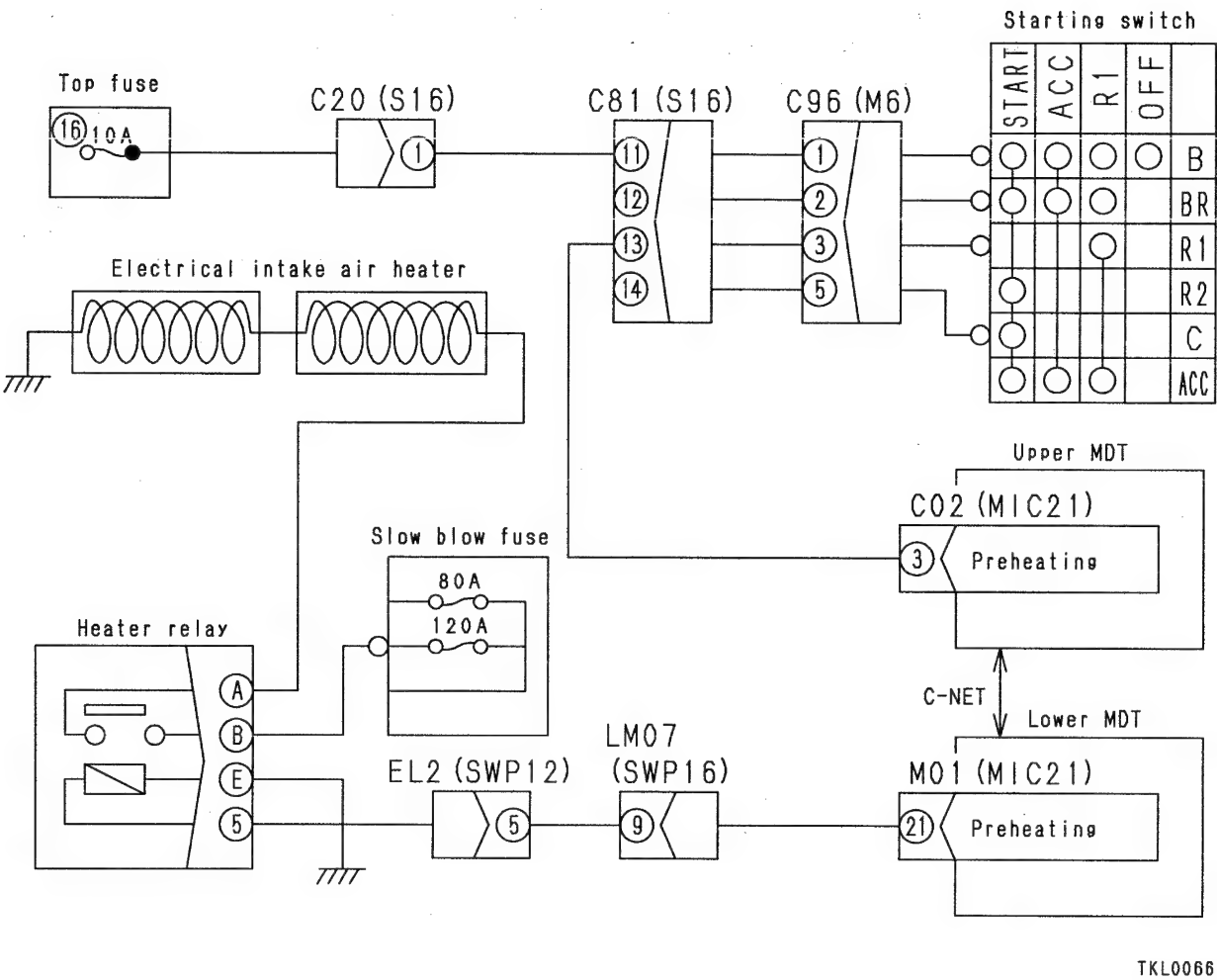
TKL00665

E-4 Preheating does not work

- ★ When no error code is displayed. (If any error code is displayed, carry out troubleshooting for that system first.)
- ★ When switching power source ON ↔ OFF is normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that top fuse 16 and slow blow fuse 120A are not blown.
(If the fuse is blown, check for a short circuit in the wiring harness given in the troubleshooting item.)



E-4 Related electric circuit diagram

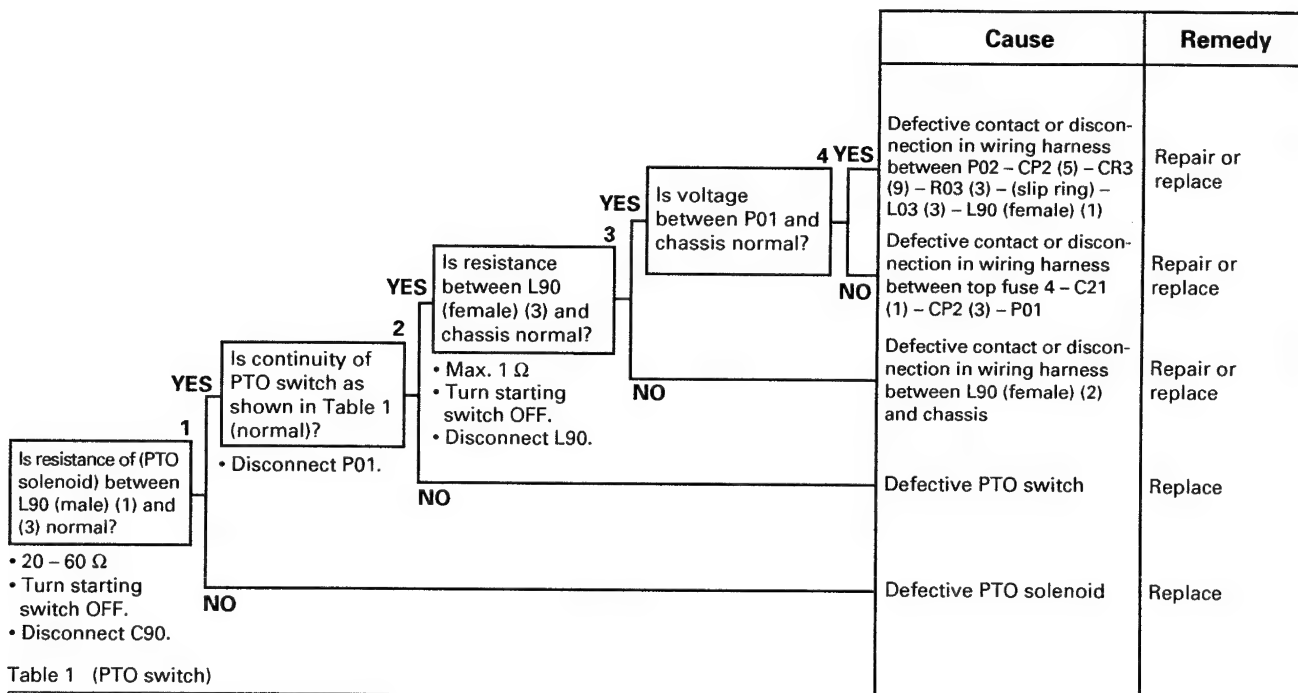


023S02

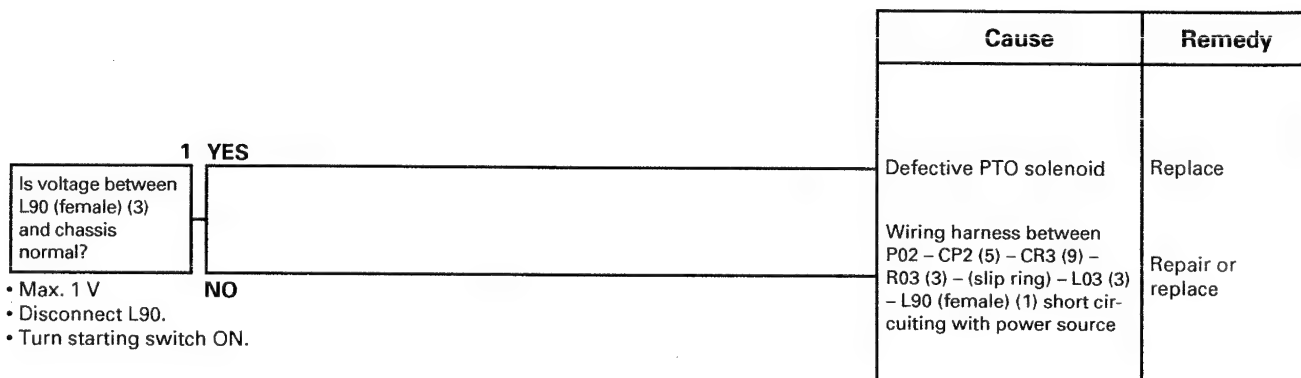
E-5 Abnormality in PTO solenoid system

a) Does not switch to PTO (operation) mode (engine speed does not go down) (disconnection)

- ★ Check that top fuse 4 is normal before starting troubleshooting.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ When slip ring is normal.

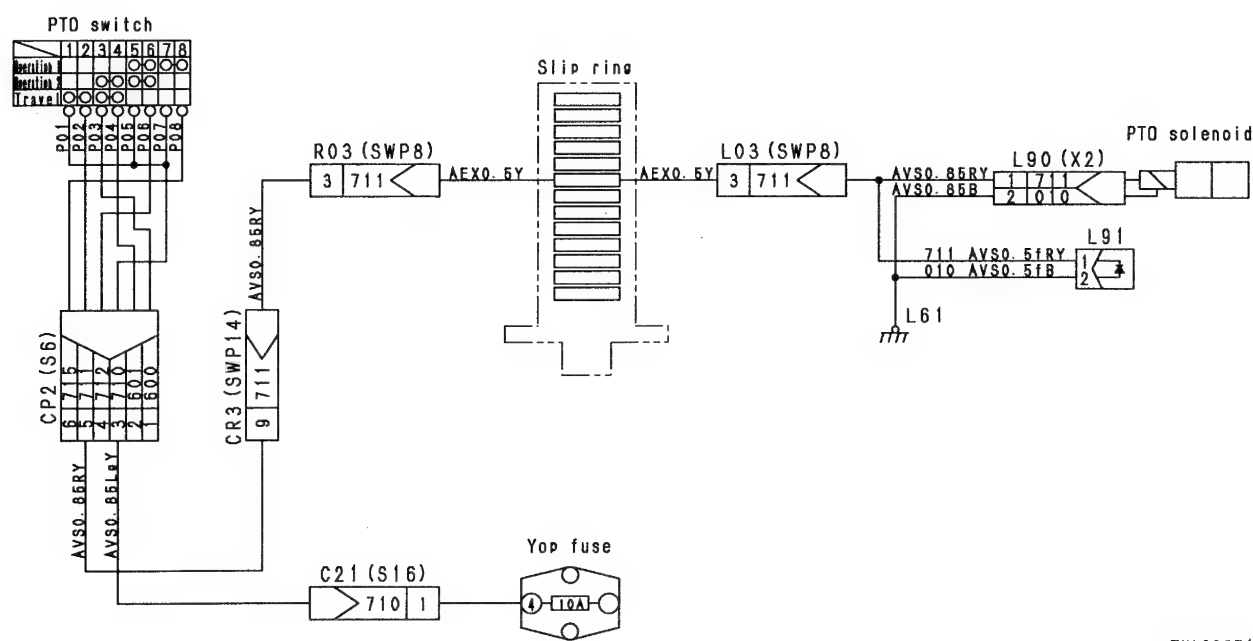


b) PTO (operation) mode is not switched OFF (short circuit with power source)



023S02

E-5 Related electric circuit diagram



TKL00651

E-6 Parking brake cannot be released or cannot be applied

- ★ When no error code is displayed.
- ★ Check that top fuse 26 is normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Parking brake cannot be released (disconnection)

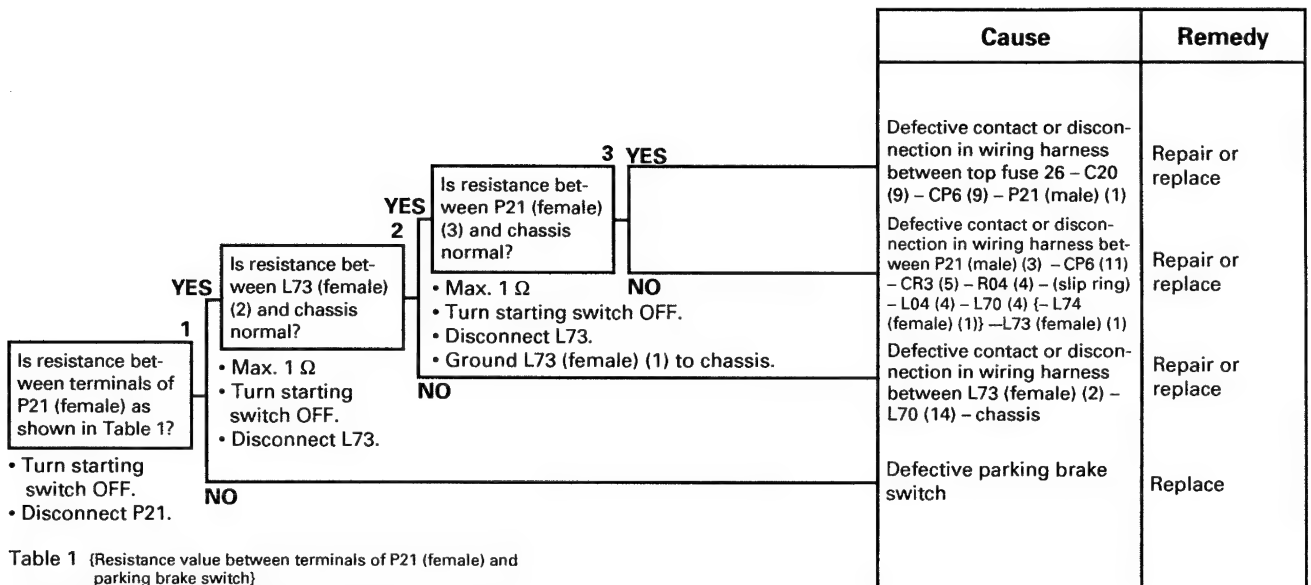
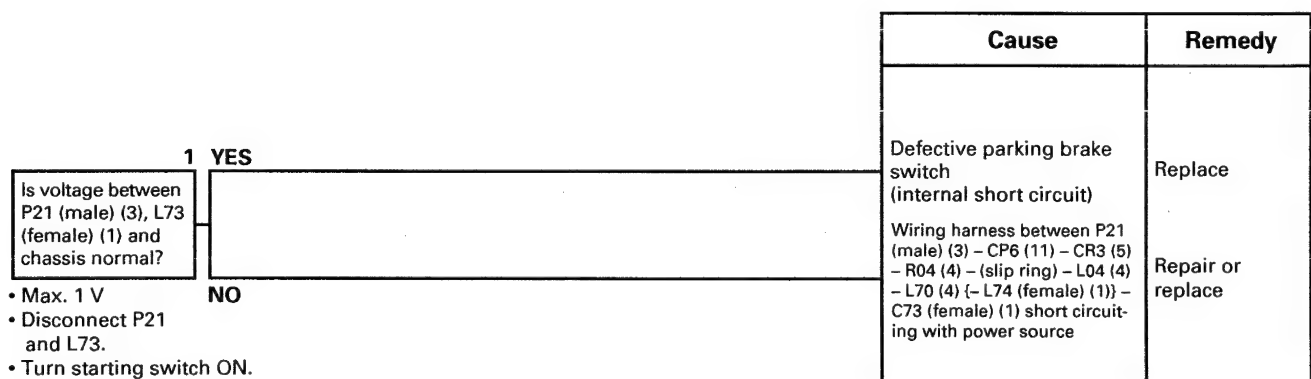


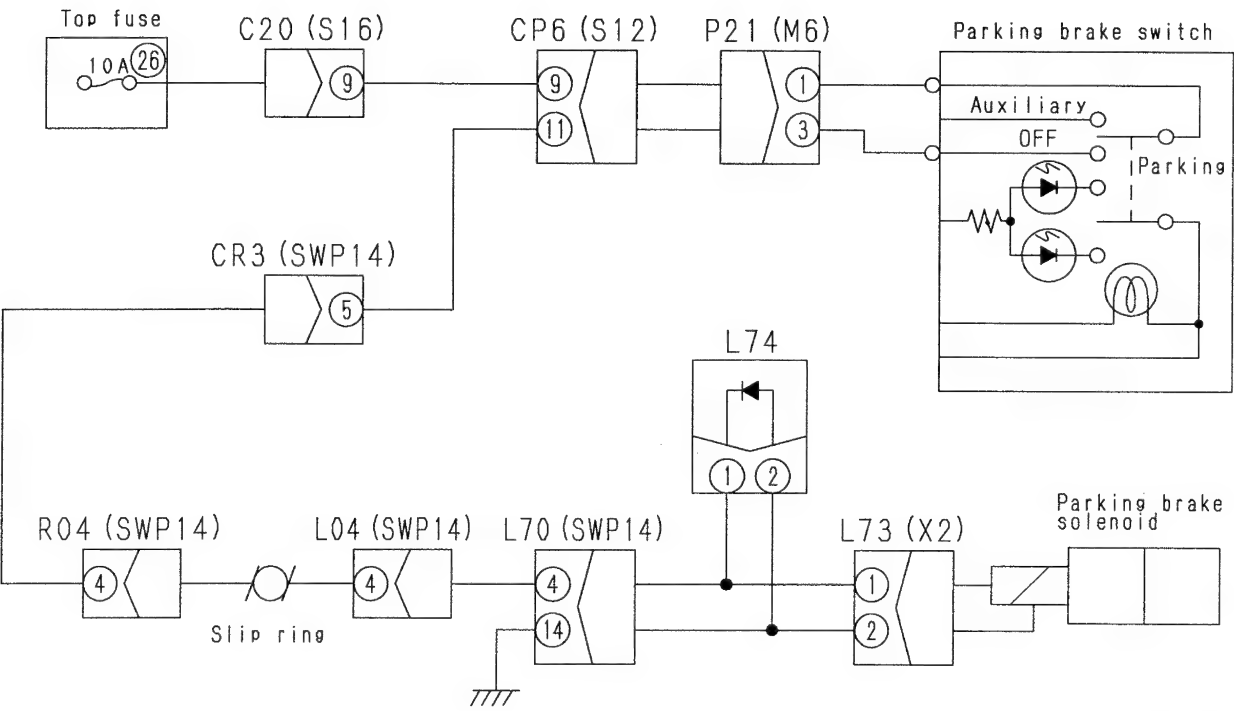
Table 1 {Resistance value between terminals of P21 (female) and parking brake switch}

P21 (female) terminal	Auxiliary	Parking	OFF
Between (1) – (2)	Max. 1 Ω	Min. 1 M Ω	Min. 1 M Ω
Between (1) – (3)	Min. 1 M Ω	Min. 1 M Ω	Max. 1 Ω
Between (2) – (3)	Min. 1 M Ω	Min. 1 M Ω	Min. 1 M Ω

b) Parking brake cannot be applied (short circuit with power source)



E-6 Related electric circuit diagram



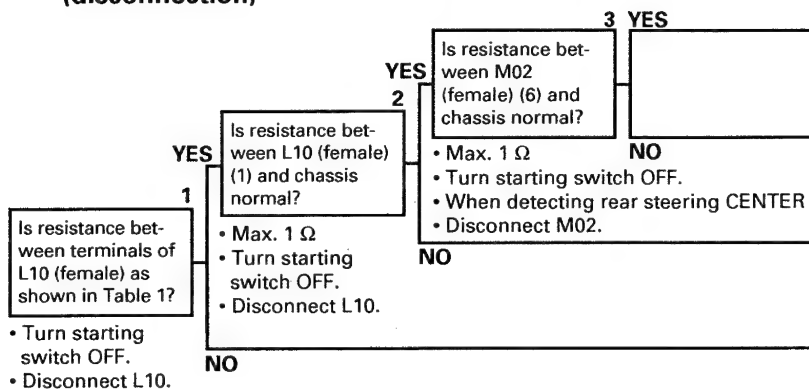
TKL00667

E-7 Abnormality in rear steering CENTER detection limit switch system

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

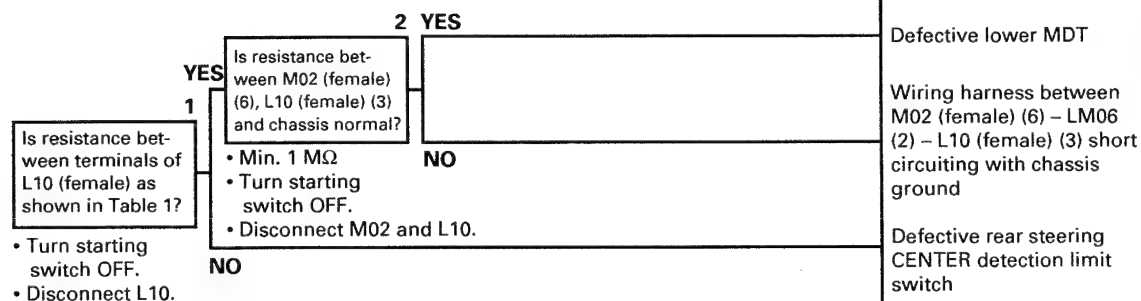
★ Always connect any disconnected connectors before going on to the next step.

a) Always detects position other than rear CENTER (disconnection)



Cause	Remedy
Defective lower MDT	Repair or replace
Defective contact or disconnection in wiring harness between M02 (female) (6) – LM06 (2) – L10 (female) (3)	Repair or replace
Defective contact or disconnection in wiring harness between L10 (female) (1) and chassis	Repair or replace
Defective rear steering CENTER detection limit switch	Replace

b) Always detects rear steering CENTER (short circuit with chassis ground)

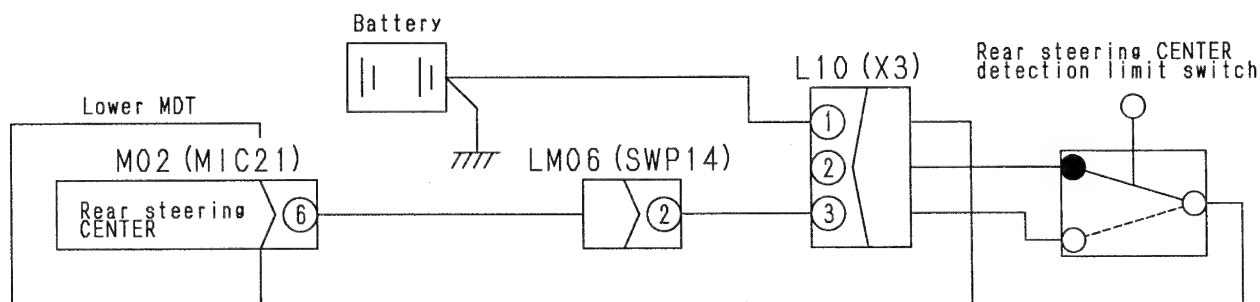


Cause	Remedy
Defective lower MDT	Repair or replace
Wiring harness between M02 (female) (6) – LM06 (2) – L10 (female) (3) short circuiting with chassis ground	Repair or replace
Defective rear steering CENTER detection limit switch	Replace

Table 1 (Resistance value between terminals of L10 (female) and rear steering CENTER detection limit switch)

L10 (female) terminal	When detecting rear steering CENTER	When not detecting rear steering CENTER
Between (1) – (2)	Min. 1 M Ω	Min. 1 M Ω
Between (1) – (3)	Min. 1 M Ω	Max. 1 Ω
Between (2) – (3)	Max. 1 Ω	Min. 1 M Ω

E-7 Related electric circuit diagram

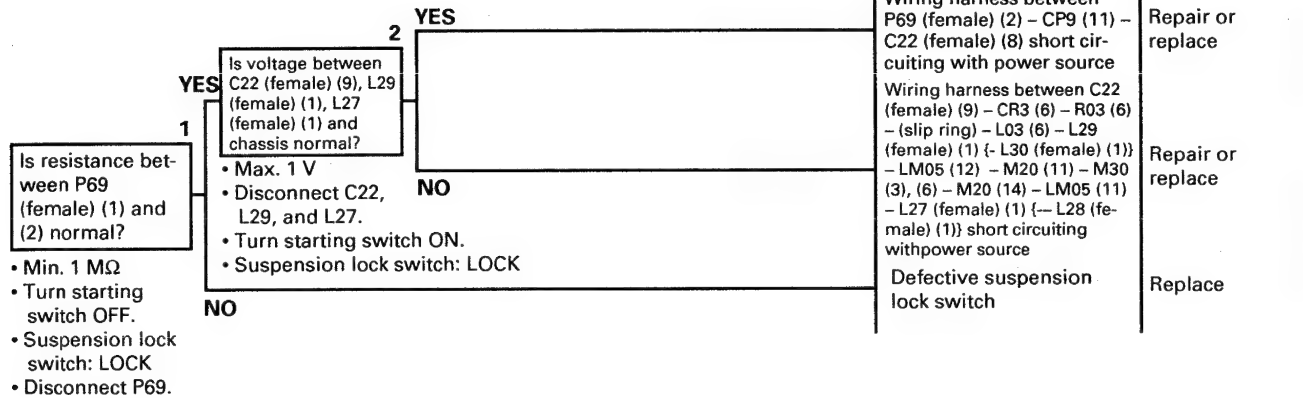


TKL00668

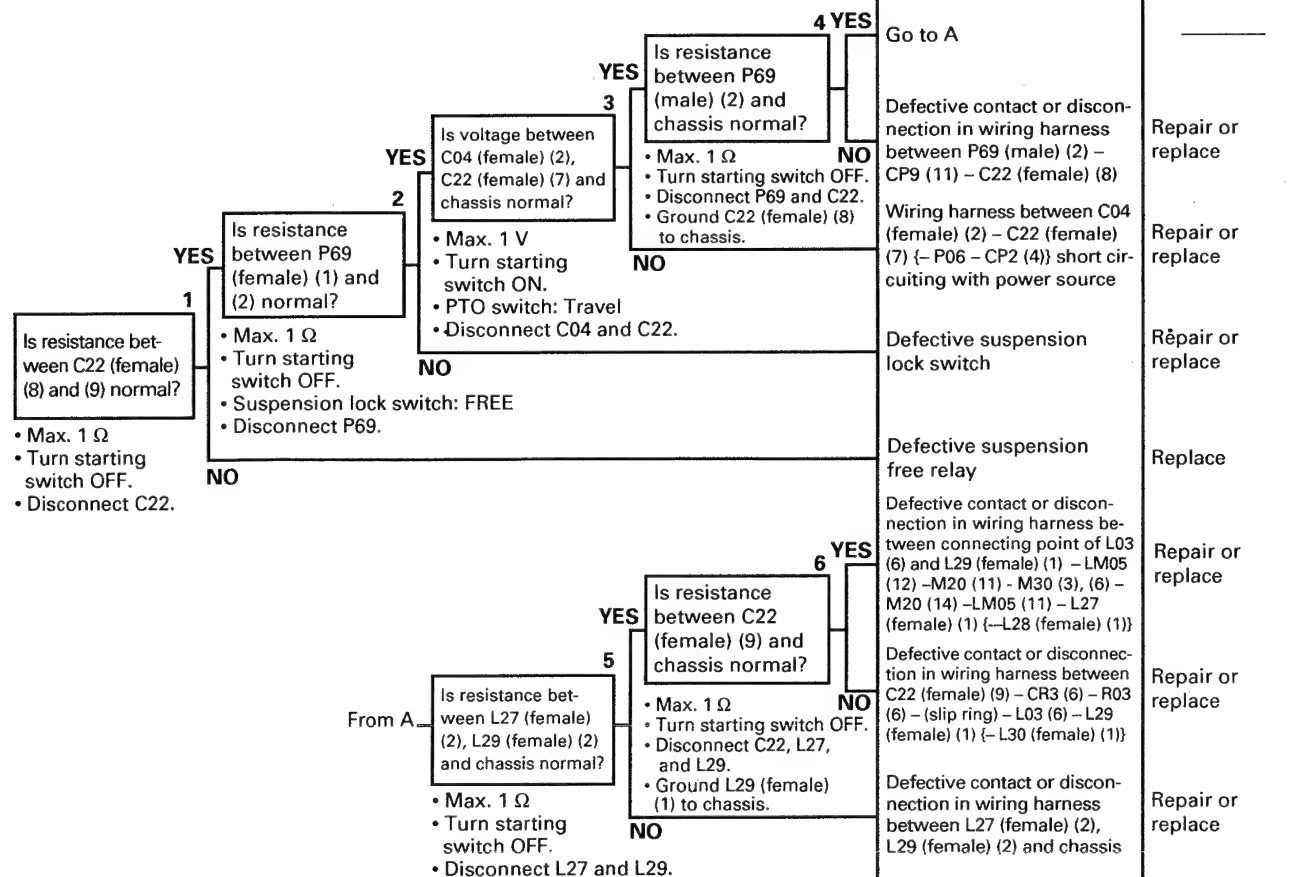
E-8 Abnormality in suspension lock system

- ★ Check that top fuse 28 and bottom fuse IV-7 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Suspension lock cannot be applied (short circuit with power source)



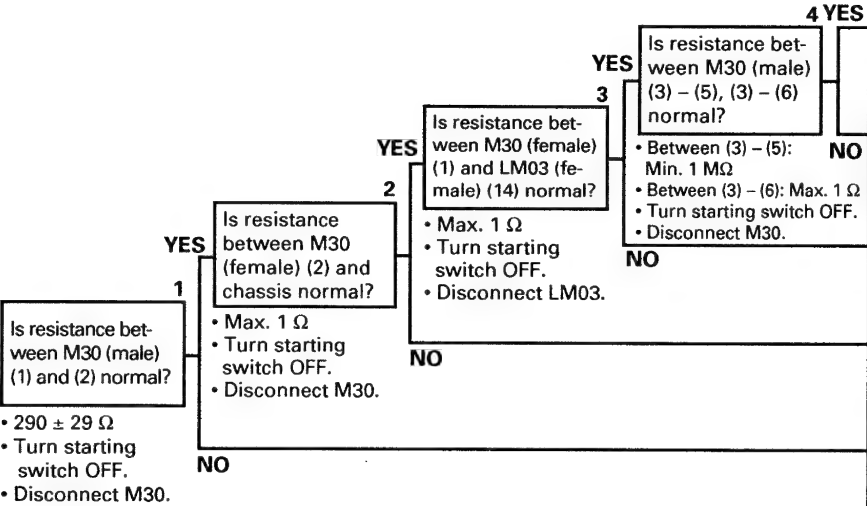
b) Suspension lock cannot be released (disconnection)



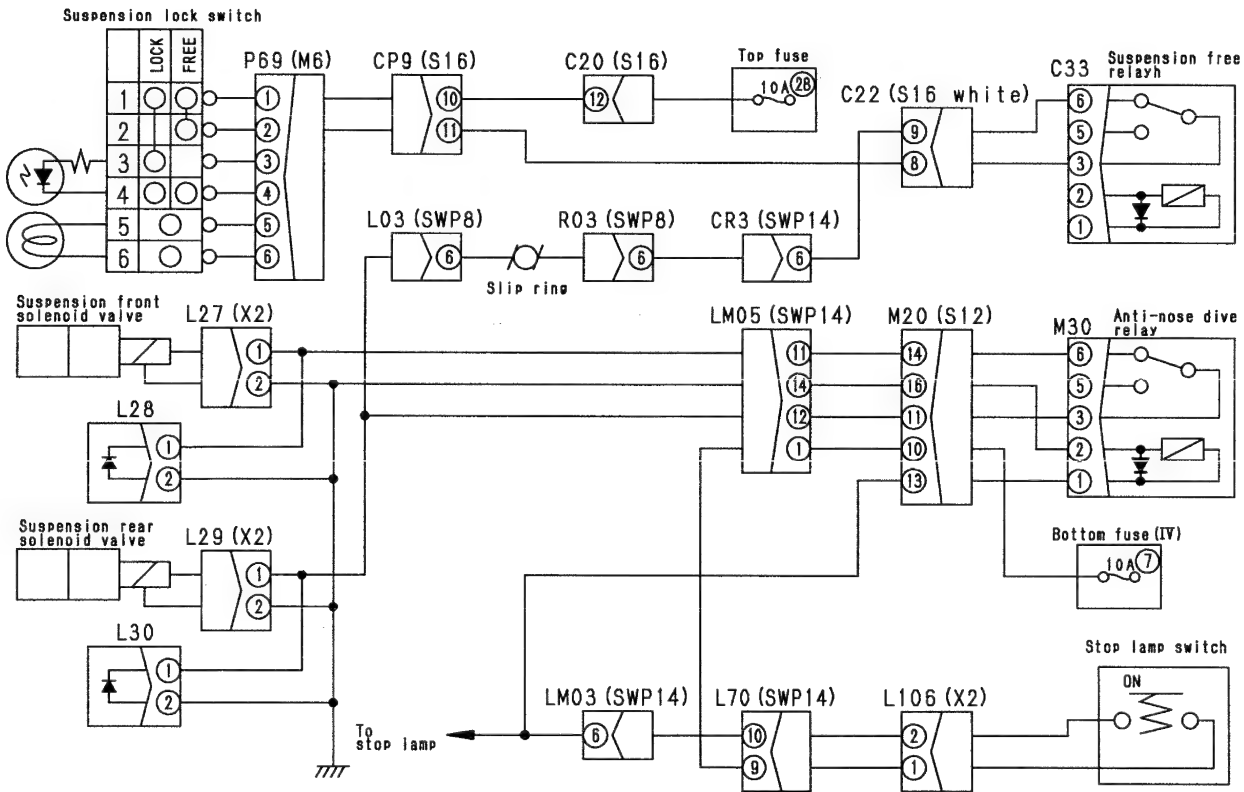
023S02

c) Anti-nosedive function does not work
(anti-nosedive relay system)

Cause	Remedy
<p>Go to Section a)</p>	
<p>Defective anti-nosedive relay</p>	<p>Repair or replace</p>
<p>Defective contact or disconnection in wiring harness between M30 (female) (1) and LM03 (female) (14)</p>	<p>Repair or replace</p>
<p>Defective contact or disconnection in wiring harness between M30 (female) (2) and chassis</p>	<p>Repair or replace</p>
<p>Defective anti-nose dive relay</p>	<p>Replace</p>



E-8 Related electric circuit diagram



TKL00669

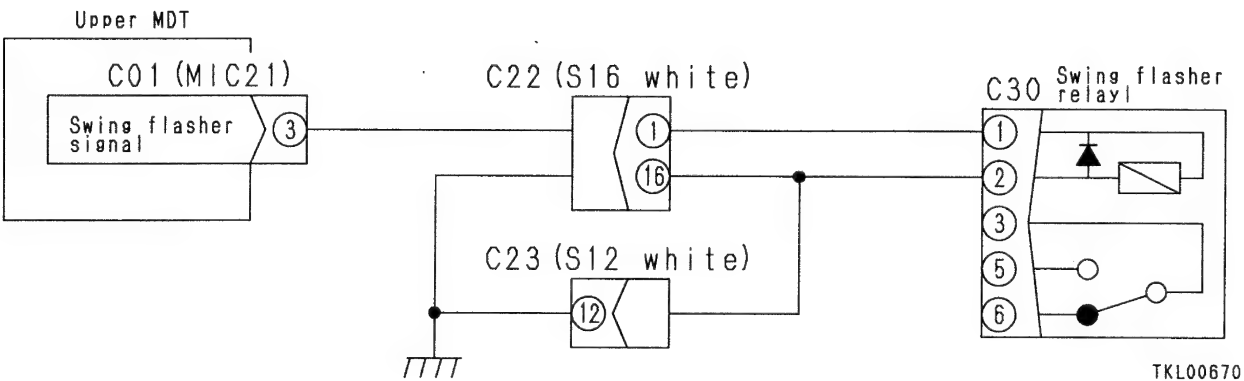
E-9 Swing flasher does not flash (disconnection)

- ★ When no error code is displayed.
- ★ When no display is given for MDTU error E40 (short circuit with chassis ground), E80 (short circuit with power source), MDTL error E5E, E5F (short circuit with chassis ground), E9E, E9F (short circuit with power source), ECE, ECF (disconnection).
- ★ Troubleshooting is carried out while the abnormality is being generated, so when the connector is disconnected and the T-adaptor is inserted, or when the T-adaptor is removed and the connector is connected again to its original position, if the error code is not displayed on the monitor, the system has been reset.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div>1 YES</div> <div>Is voltage between C01 (female) (3), C30 (female) (1) and chassis normal?</div> <div>• Max. 1 V</div> <div>• Disconnect C01 and C30.</div> <div>• Turn starting switch ON.</div>	YES	Defective upper MDT	Repair or replace
	NO	Defective contact or disconnection in wiring harness between C01 (female) (3) – C22 (1) – C30 (female) (1)	Repair or replace

023S02

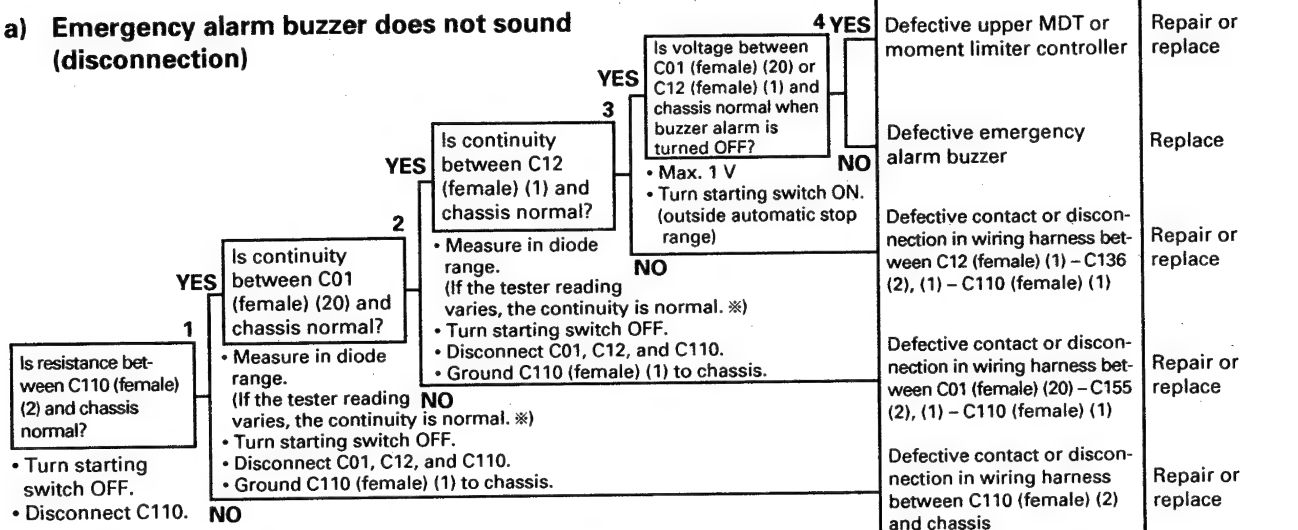
E-9 Related electric circuit diagram



E-10 Abnormality in emergency alarm buzzer system

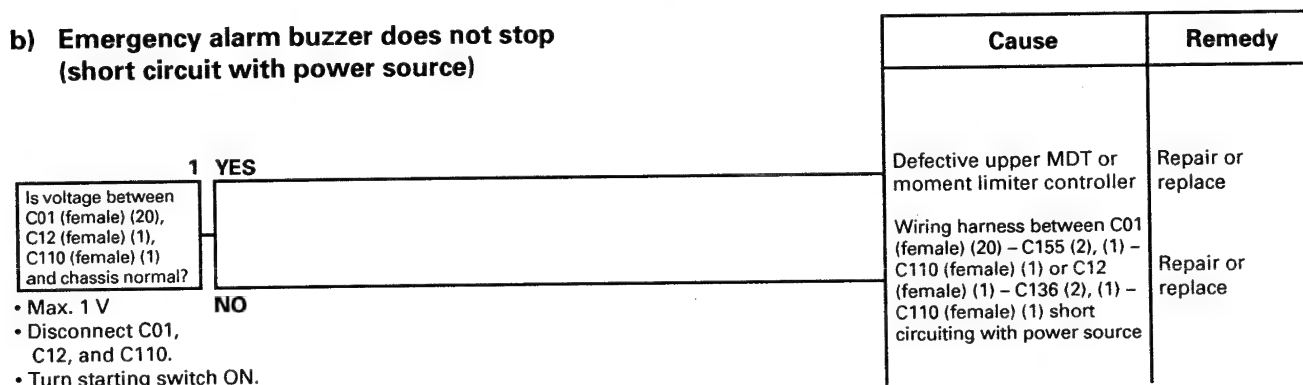
- ★ When error code (MDTU error code E4D) is not displayed.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Emergency alarm buzzer does not sound (disconnection)

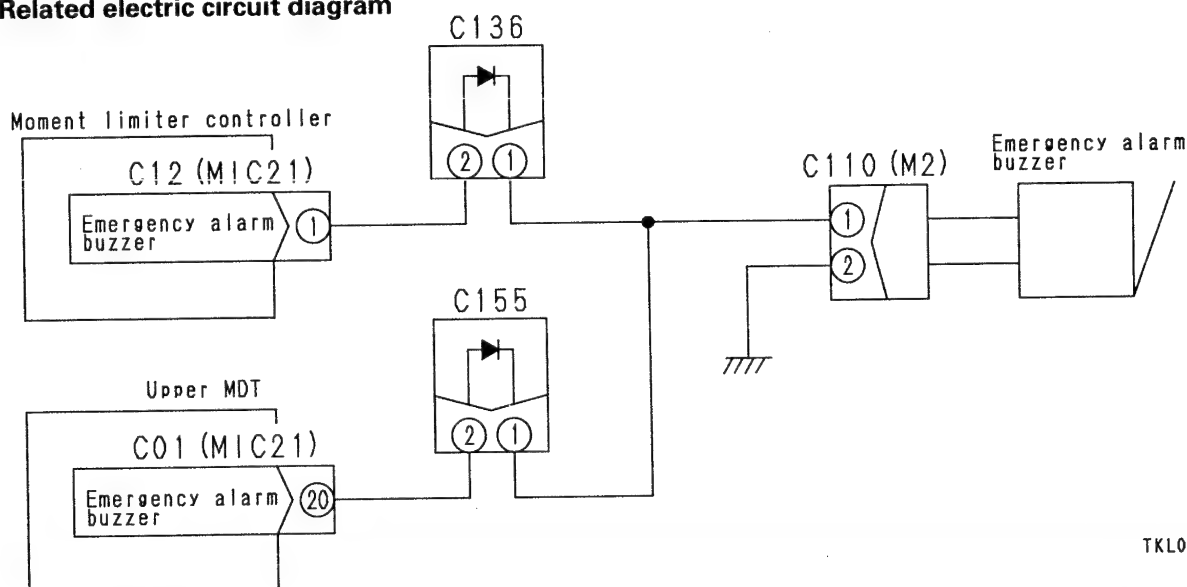


※ With a normal tester, if it is switched to the diode range, the voltage of the internal battery is displayed. To check wiring harnesses containing a diode, judgement is made from the following:
 “If there is no change there is no continuity” or “If there is change there is continuity”.

b) Emergency alarm buzzer does not stop (short circuit with power source)



E-10 Related electric circuit diagram

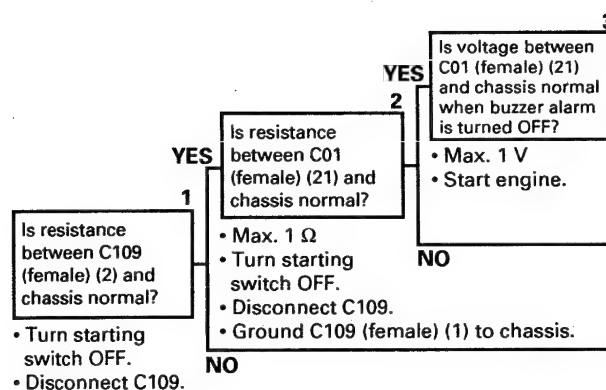


TKL00671

E-11 Abnormality in monitor central buzzer system

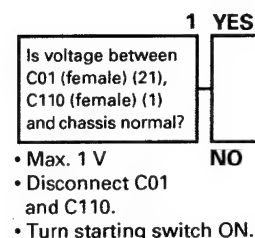
- ★ When error code (MDTU error E4F) is not displayed.
 - ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- | Cause | Remedy |
|-------|--------|
|-------|--------|

a) Monitor central buzzer does not sound (disconnection)



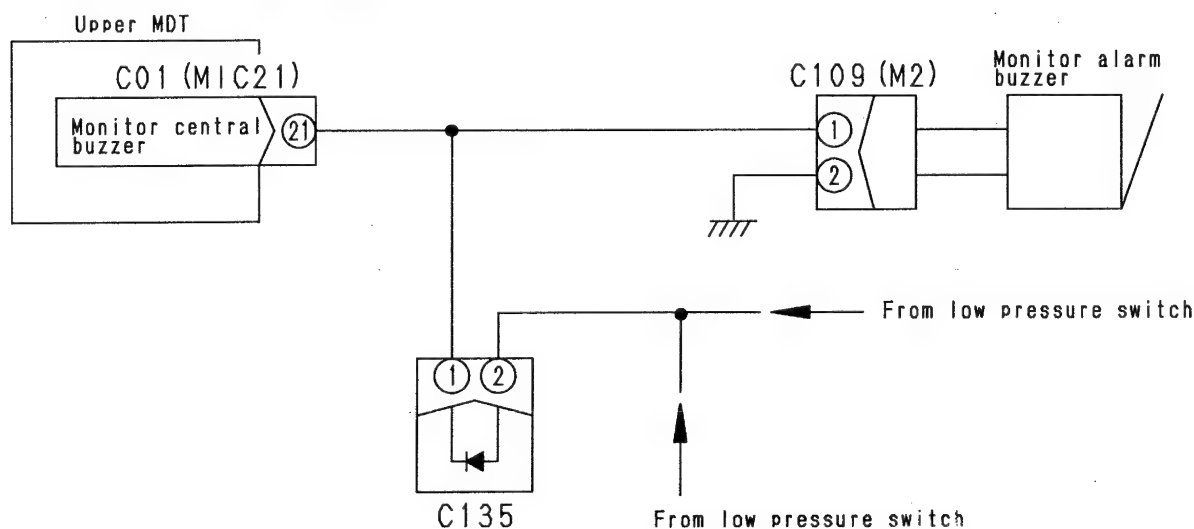
Cause	Remedy
Defective upper MDT	Repair or replace
Defective monitor central buzzer	Repair or replace
Defective contact or disconnection in wiring harness between C01 (female) (21) and C110 (female) (1)	Repair or replace
Defective contact or disconnection in wiring harness between C110 (female) (2) and chassis	Repair or replace

b) Monitor central buzzer does not stop (short circuit with power source)



Cause	Remedy
Defective upper MDT	Replace
Wiring harness between C01 (female) (21) and C110 (female) (1) short circuiting with power source	Repair or replace

E-11 Related electric circuit diagram

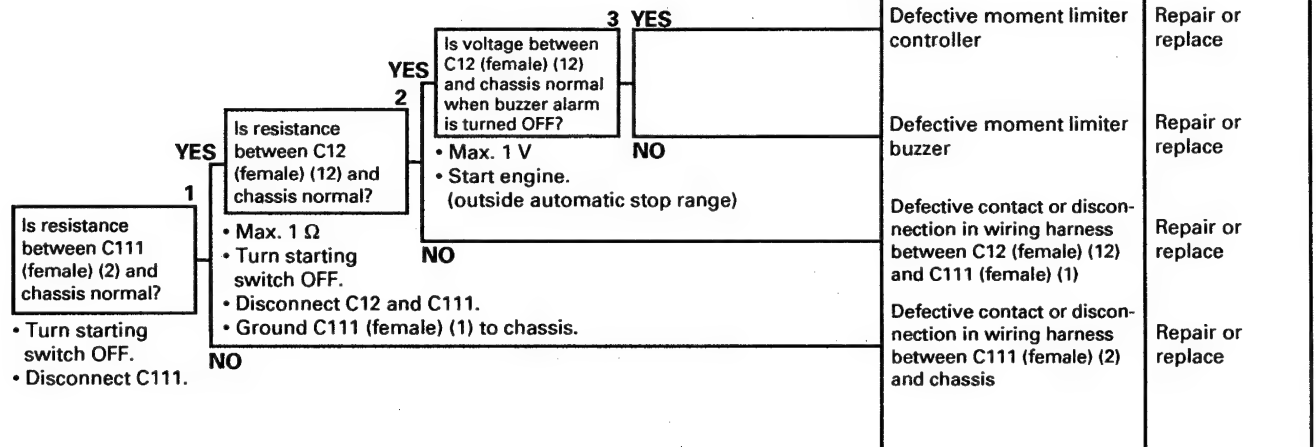


TKL00672

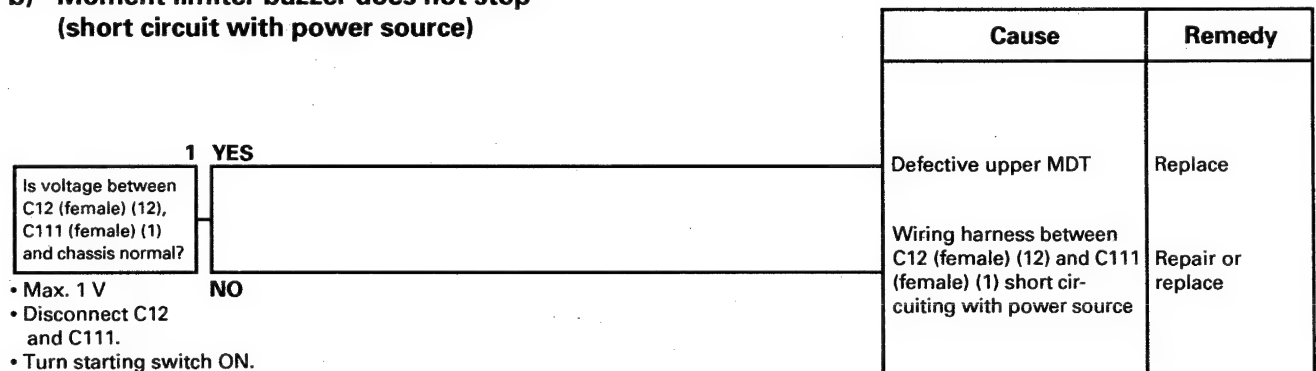
E-12 Abnormality in moment limiter buzzer system

- ★ When error code (OSS error code E5C) is not displayed.
- ★ After the abnormality occurs, if the starting switch is turned OFF and then turned ON again, and the error code is not displayed on the monitor, the system has been reset.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

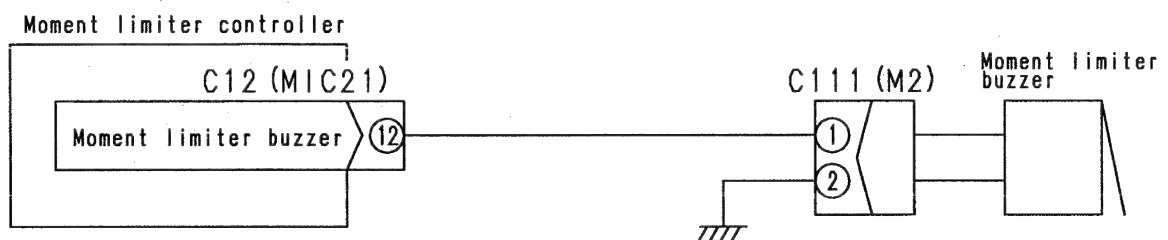
a) Moment limiter buzzer does not sound (disconnection)



b) Moment limiter buzzer does not stop (short circuit with power source)



E-12 Related electric circuit diagram



TKL00673

023S02

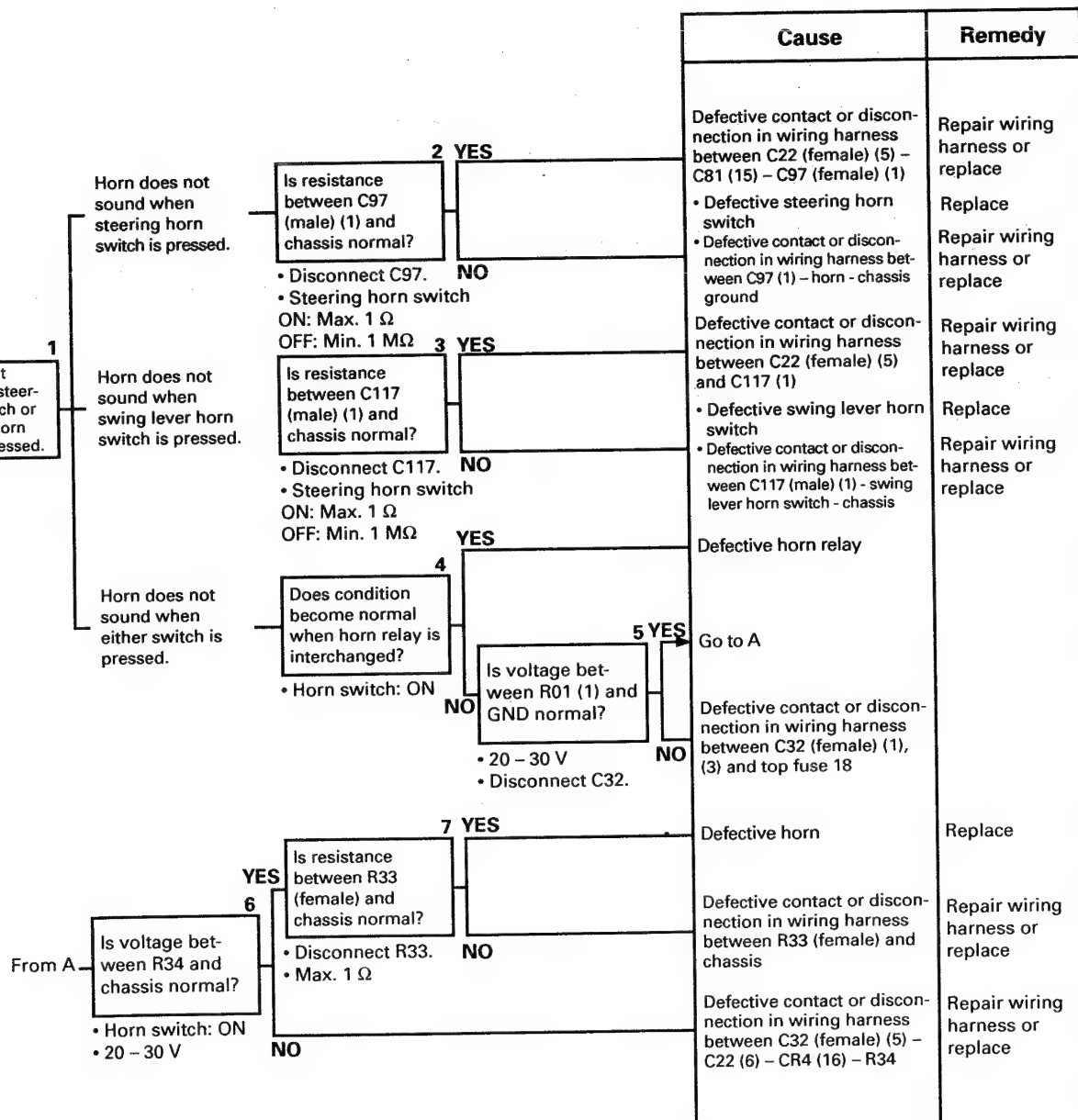
E-13 Horn does not sound or does not stop

a) Horn does not sound (disconnection)

- ★ Check that top fuse 18 is not blown.

(If the fuse is blown, check for a short circuit with the chassis ground between C32 (1) and (3) – fuse, between C23 (2) – C22 (5) – C117 (1) – swing lever horn switch, between C22 (5) – C81 (15) – C97 (1) – steering horn switch, and between C32 (5) – C22 (6) – CR4 (16) – R34.)

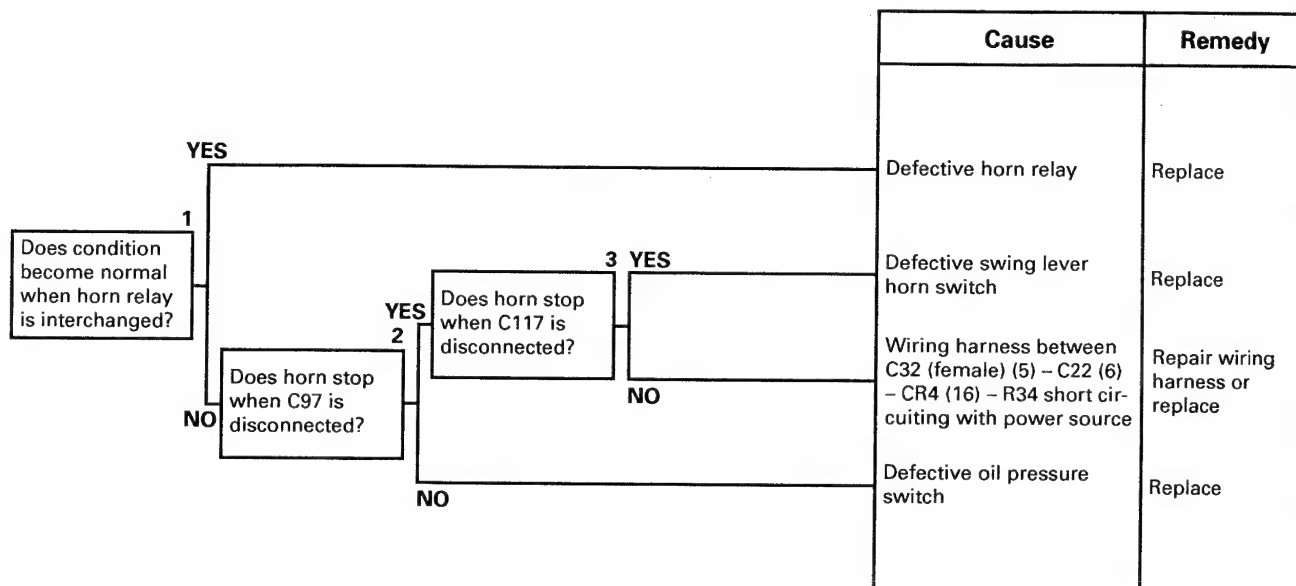
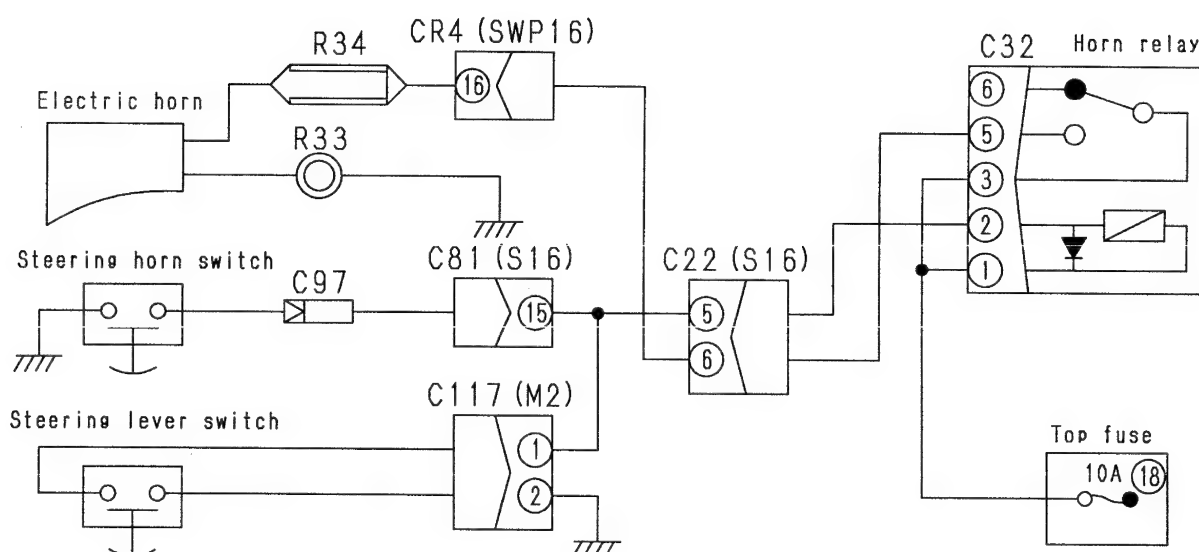
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on to the next step.



023S02

b) Horn does not stop (short circuit with power source)

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

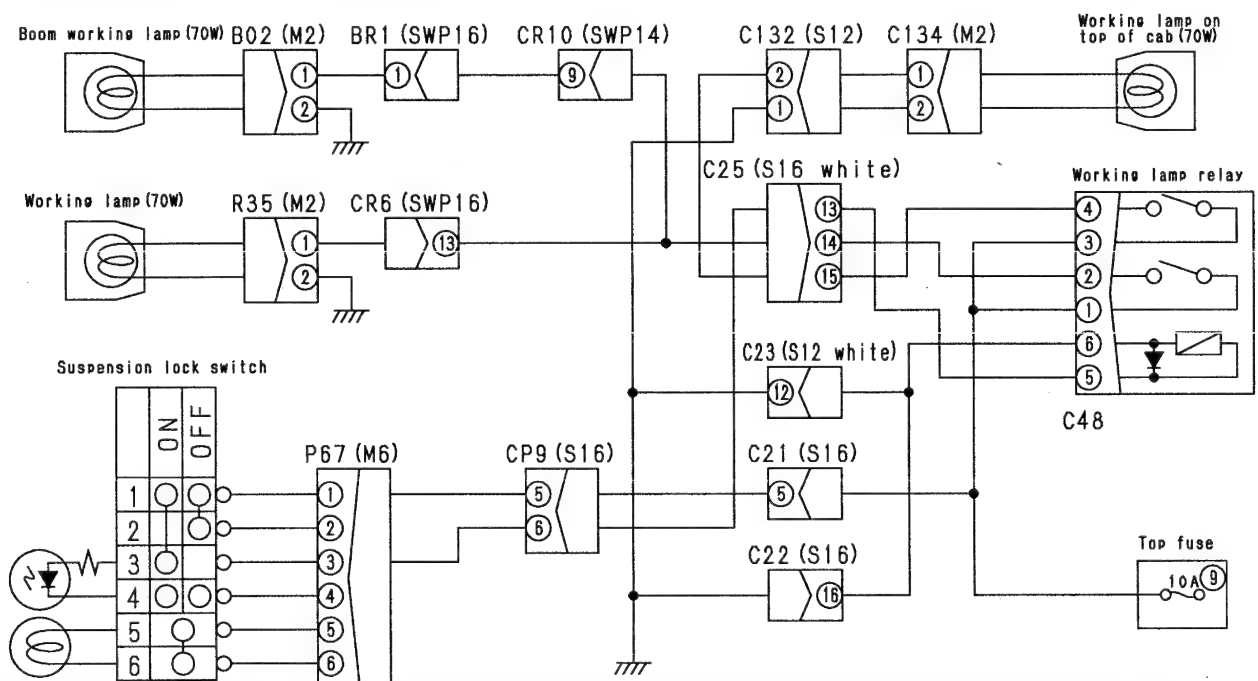

E-13 Related electric circuit diagram


TKL00674

c) Boom working lamp, working lamp do not light up

c) Boom working lamp, working lamp do not light up			Cause	Remedy
<div>1</div> <div>Does one lamp light up or do both lamps not light up?</div> <div>Only boom working lamp does not light up.</div> <div>2</div> <div>Is boom working lamp normal?</div> <div>• Check visually.</div> <div>YES</div> <div>3</div> <div>Is resistance between B02 (female) (2) and chassis normal?</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect B02.</div> <div>• Max. 1 Ω</div> <div>NO</div> <div>Only working lamp does not light up.</div> <div>4</div> <div>Is working lamp normal?</div> <div>• Check visually.</div> <div>YES</div> <div>5</div> <div>Is resistance between R35 (female) (2) and chassis normal?</div> <div>• Turn starting switch OFF.</div> <div>• Disconnect R35.</div> <div>• Max. 1 Ω</div> <div>NO</div> <div>Both boom working lamp and working lamp do not light up.</div> <div>6</div> <div>Is the condition become normal when working lamp relay is interchanged?</div> <div>• Turn starting switch ON.</div> <div>• Working lamp switch: ON</div> <div>YES</div> <div>NO</div>	Defective contact or disconnection in wiring harness between B02 (female) (1) – BR1 (1) – CR10 (9) – C25 (male) (14)	Repair wiring harness or replace		
	Disconnection in wiring harness between B02 (female) (2) and chassis	Repair wiring harness or replace		
	Defective boom working lamp	Replace		
	Defective contact or disconnection in wiring harness between R35 (female) (1) – CR6 (13) – C25 (male) (14)	Repair wiring harness or replace		
	Disconnection in wiring harness between R35 (female) (2) and chassis	Repair wiring harness or replace		
	Defective working lamp	Replace		
	Defective working lamp relay	Replace		
	Defective contact or disconnection in wiring harness between C48 (female) (2) – C25 (14) – CR10 (male) (9) or CR6 (female) (13)	Repair wiring harness or replace		

E-14 Related electric circuit diagram

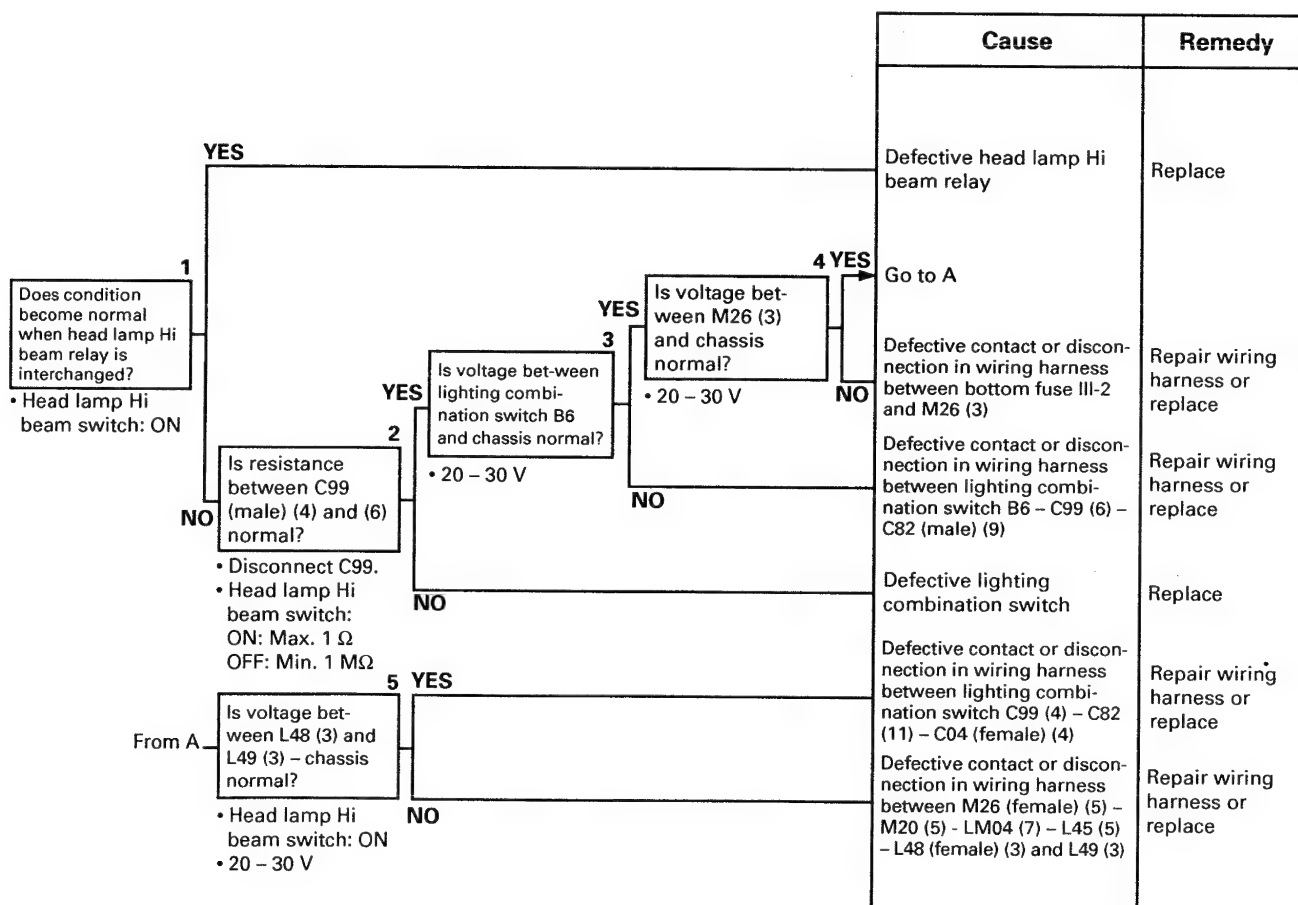


TKL00675

E-15 Head lamp Hi beam does not light up or does not go out

a) Head lamp Hi beam does not light up (disconnection)

- ★ When no error code is displayed.
- ★ When head lamp Hi beam does not light up on either the left or right (when head lamp Hi beam bulb is normal).
- ★ When head lamp Lo beam lights up.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that top fuse 17 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between top fuse 17 – C20 (3) – C82 (9) – C99 (6) – lighting switch combination B6, and between lighting switch combination B4 – C99 (4) – C82 (11) – C04 (4).)
- ★ Check that bottom fuse III-12 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between bottom fuse III-12 – M26 (3), and between M26 (5) – M20 (5) – LM04 (7) – L45 (5) – L48 (3) or L49 (3).)

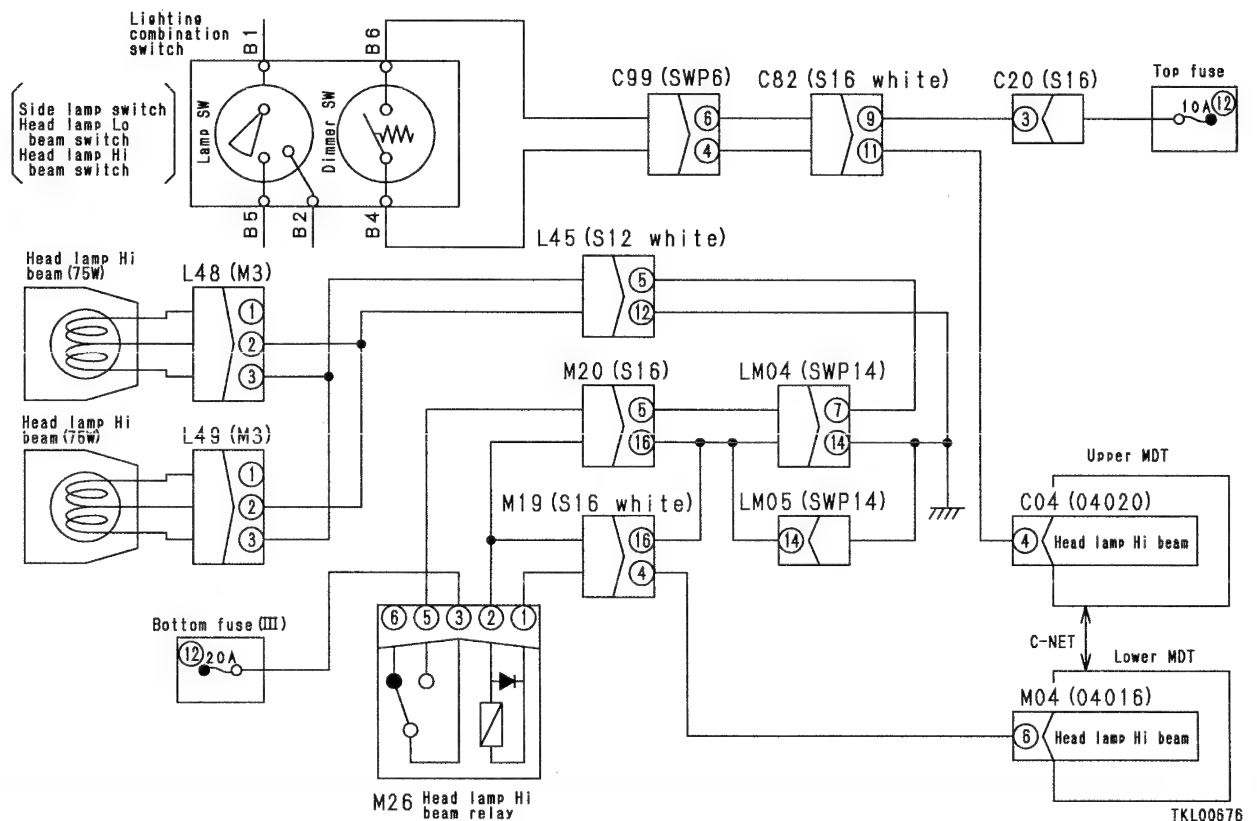


023S02

b) Head lamp Hi beam does not go out (short circuit with power source)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

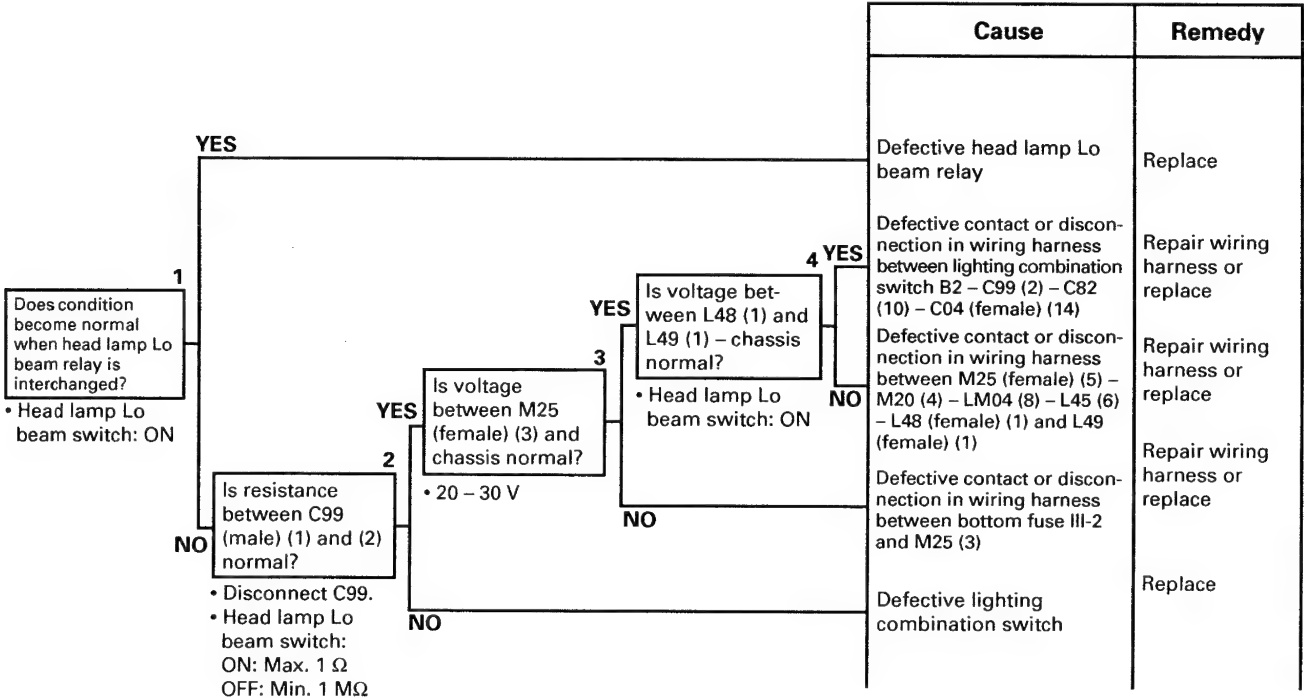
	Cause	Remedy
<p>1 YES</p> <p>Does condition become normal when head lamp Hi beam relay is interchanged?</p> <p>• Head lamp Hi beam switch: ON</p> <p>NO</p> <p>2 YES</p> <p>Is resistance between C99 (male) (4) and (6) normal?</p> <p>• Disconnect C99.</p> <p>• Head lamp Hi beam switch: ON: Max. 1 Ω</p> <p>OFF: Min. 1 MΩ</p> <p>NO</p> <p>3 YES</p> <p>Is voltage between C04 (4) and chassis normal?</p> <p>• Head lamp Hi beam switch: OFF</p> <p>NO</p>	<p>Defective head lamp Hi beam relay</p> <p>Wiring harness between L48 (female) (3) and L49 (female) (3) – L45 (5) – LM04 (7) – M20 (5) – M26 (female) (5) short circuiting with power source</p> <p>Wiring harness between lighting combination switch B4 – C99 (4) – CB2 (11) – C04 (female) (4) short circuiting with power source</p> <p>Defective lighting combination switch</p>	<p>Replace</p> <p>Repair wiring harness or replace</p> <p>Repair wiring harness or replace</p> <p>Replace</p>

E-15 Related electric circuit diagram


E-16 Head lamp Lo beam does not light up or does not go out

a) Head lamp Lo beam does not light up (disconnection)

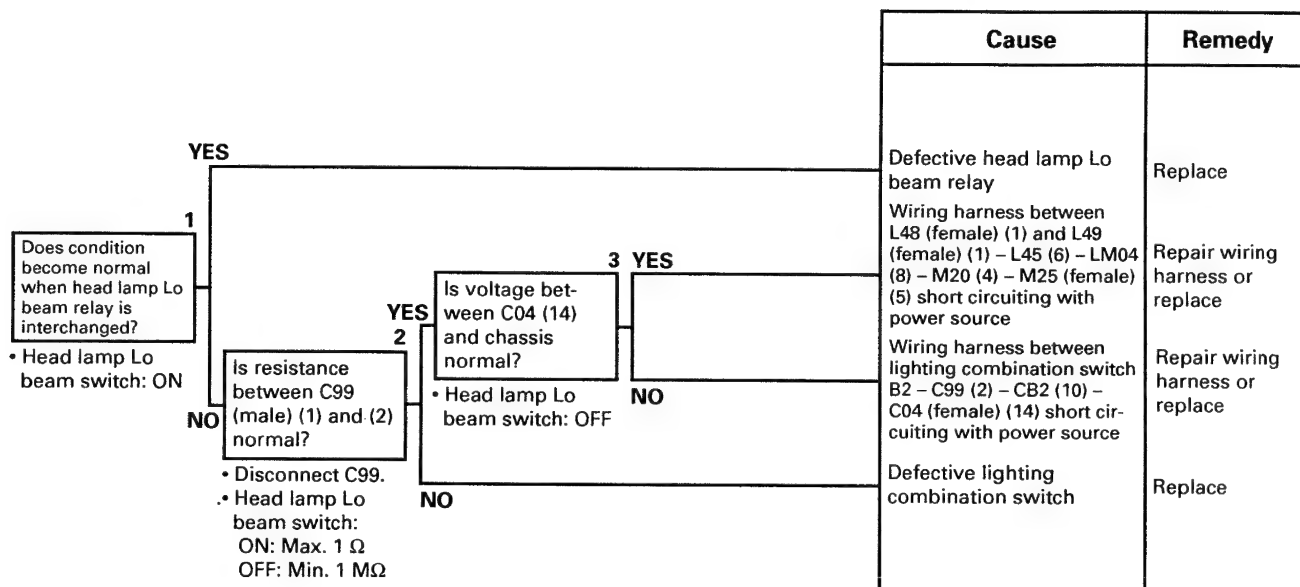
- ★ When no error code is displayed.
- ★ When the head lamp Lo beam does not light up on either the left or right (when the head lamp Lo beam bulb is normal).
- ★ When the head lamp Hi beam and side lamp light up.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that top fuse 2 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between top fuse 2 – C20 (3) – C82 (9) – C99 (6) – lighting switch combination 131, and between lighting switch combination B2 – C99 (2) – C82 (10) – C04 (14).)
- ★ Check that bottom fuse III-12 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between bottom fuse III-12 – M25 (3), and between M25 (5) – M20 (4) – LM04 (8) – L45 (6) – L48 (1) or L49 (1).)



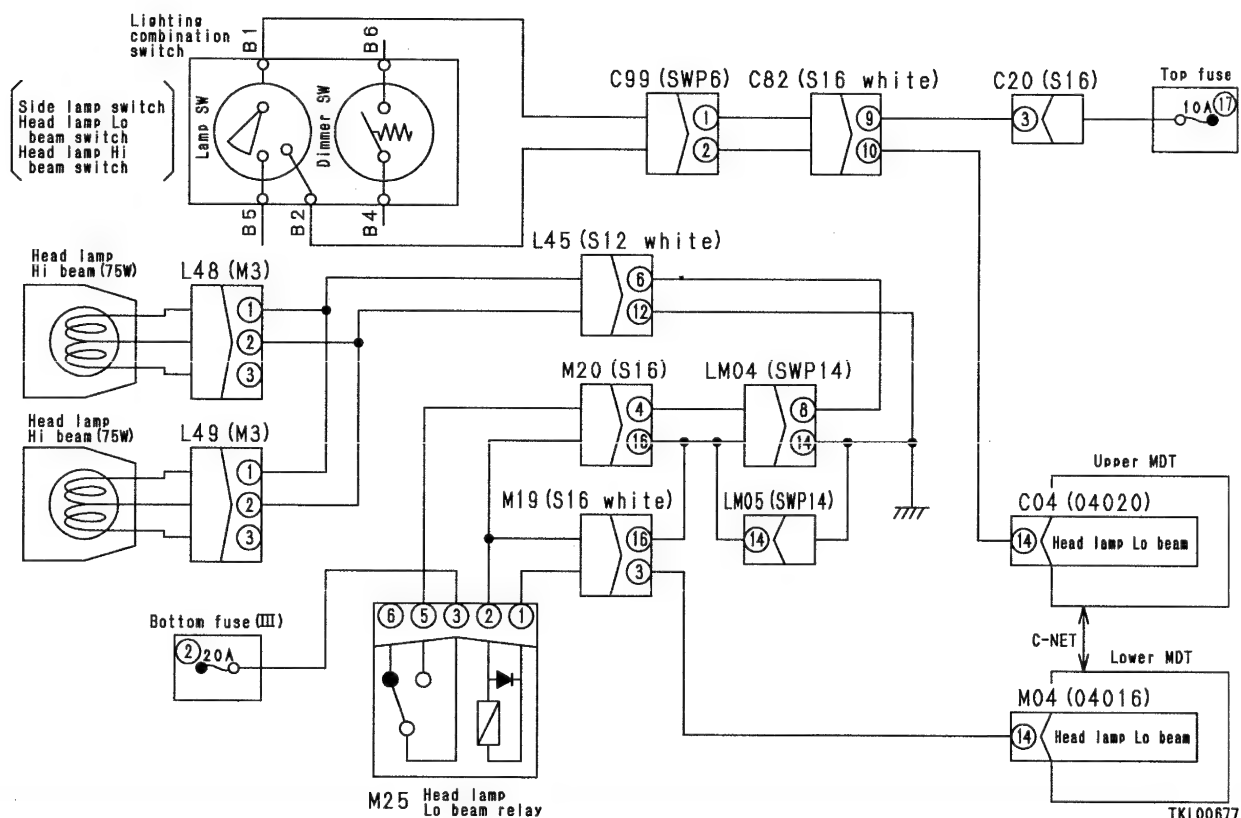
023S02

b) Head lamp Hi beam does not go out (short circuit with power source)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



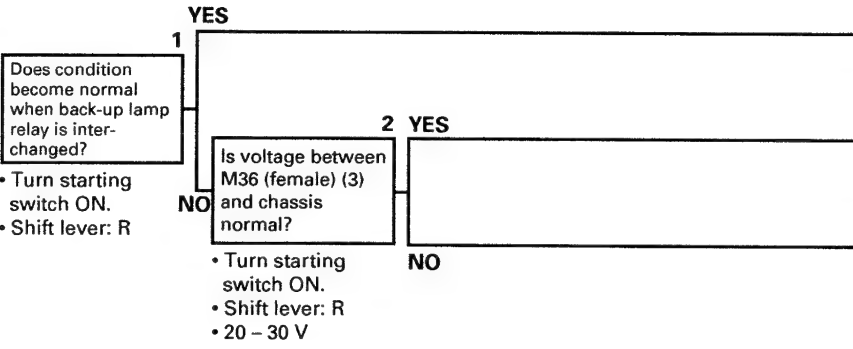
E-16 Related electric circuit diagram



E-17 Back-up lamp does not light up or does not go out

a) Back-up lamp does not light up (disconnection)

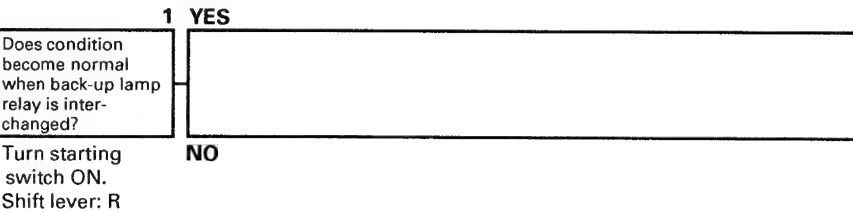
- ★ When no error code is displayed.
- ★ When input signal up to transmission controller is normal.
- ★ When the back-up lamp does not light up on either the left or right (when the back-up lamp bulb is normal).
- ★ Check that bottom fuse III-8 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between fuse – M36 (3), and between M36 (5) – M20 (12) – LM04 (10) – L52 (2) or L55 (2).)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Cause	Remedy
Defective back-up lamp relay	Replace
Defective contact or disconnection in wiring harness between M36 (female) (5) – M20 (12) – LM04 (10) – L52 (female) (2) or L55 (female) (2)	Repair wiring harness or replace
Disconnection in wiring harness between bottom fuse III-8 and M36 (female) (3)	Repair wiring harness or replace

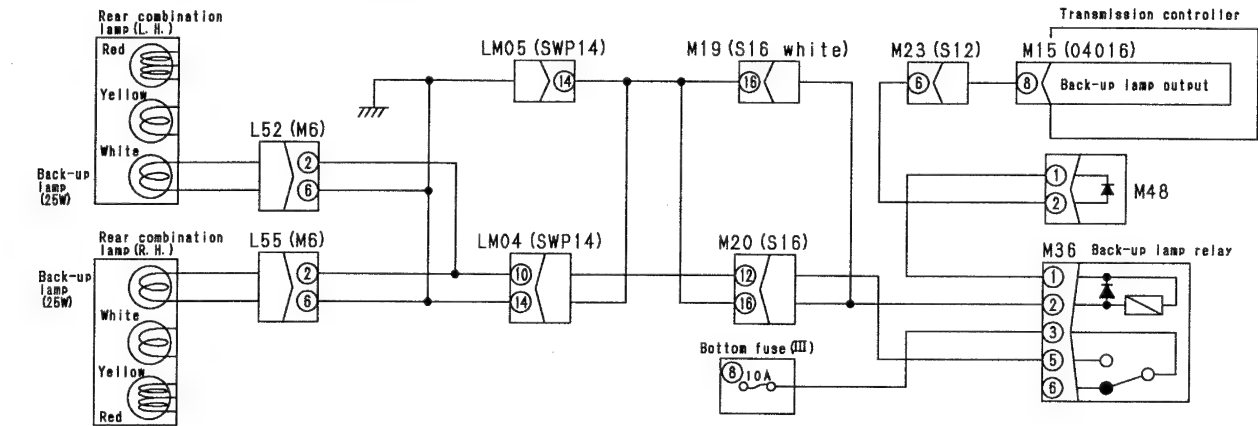
b) Back-up lamp does not go out (short circuit with power source)

- ★ When no error code is displayed.
- ★ When input signal up to transmission controller is normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



Cause	Remedy
Defective back-up lamp relay	Replace
Wiring harness between L52 (female) (2) or L55 (female) (2) – LM04 (10) – M20 (12) – M36 (female) (5) short circuiting with power source	Repair wiring harness or replace

E-17 Related electric circuit diagram



TKL00678

E-18 Stop lamp does not light up or does not go out

a) Stop lamp does not light up (disconnection)

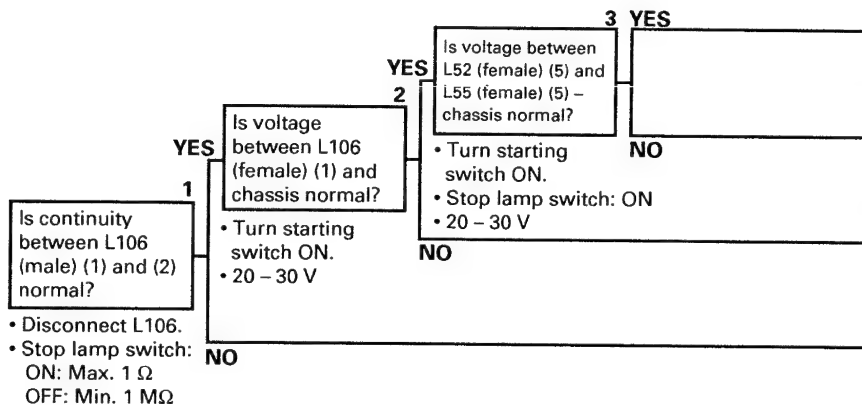
★ When the stop lamp does not light up on either the left or right (when the stop lamp bulb is normal).

★ Check that bottom fuse III-7 is not blown.

(If the fuse is blown, check for a short circuit with the chassis ground between fuse – M20 (10) – LM05 (1) – L70 (9) – L106 (1) – stop lamp switch – L106 (2) – L70 (10) – LM03 (14) – M60 (2), (3) – LM04 (11) – L52 (5) or L55 (5).)

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

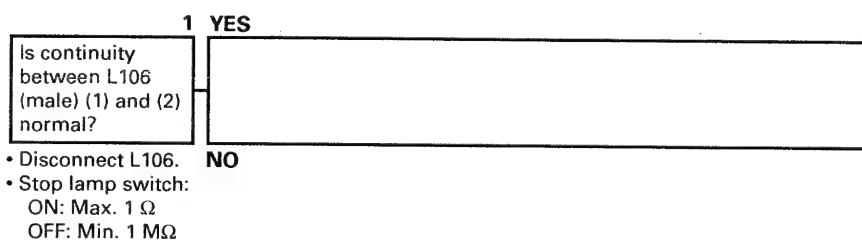


Cause	Remedy
Defective contact or disconnection in wiring harness between L52 (female) (6) or L55 (female) (6) – chassis	Repair or replace
Defective contact or disconnection in wiring harness between L106 (female) (2) – L70 (10) – LM03 (14) – M60 (2), (3) – LM04 (11) – L52 (fe-male) (5) or L55 (female) (5)	Repair or replace
Defective contact or disconnection in wiring harness between bottom fuse III-7 – M20 (10) – LM05 (1) – L70 (9) – L106 (female) (1)	Repair or replace
Defective stop lamp switch	Replace

b) Stop lamp does not go out (short circuit with power source)

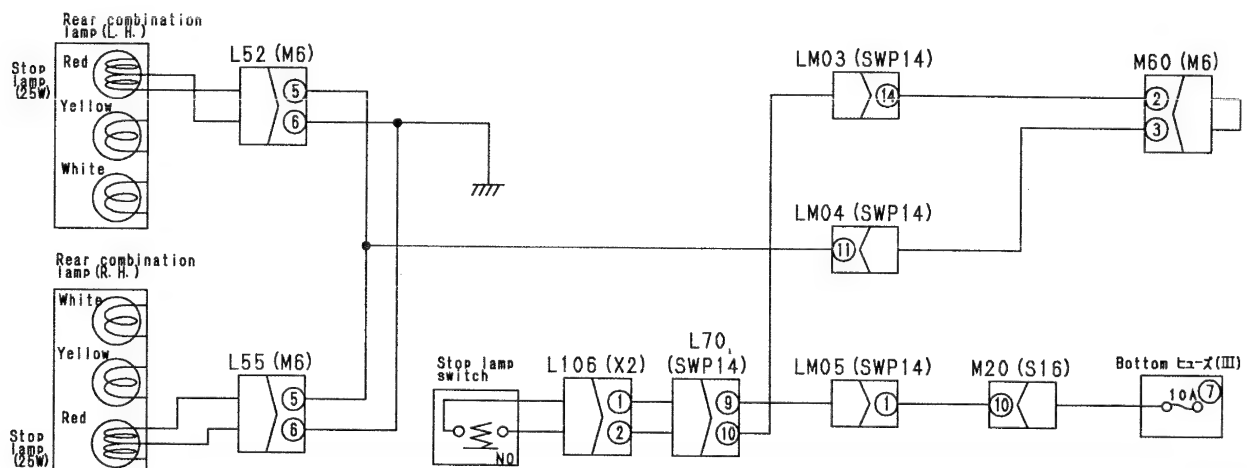
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.



Cause	Remedy
Wiring harness between L106 (female) (2) – L70 (10) – LM03 (14) – M60 (2), (3) – LM04 (11) – L52 (female) (5) – L55 (female) (5) short circuiting with power source	Repair wiring harness or replace
Defective back-up lamp relay	Replace

E-18 Related electric circuit diagram

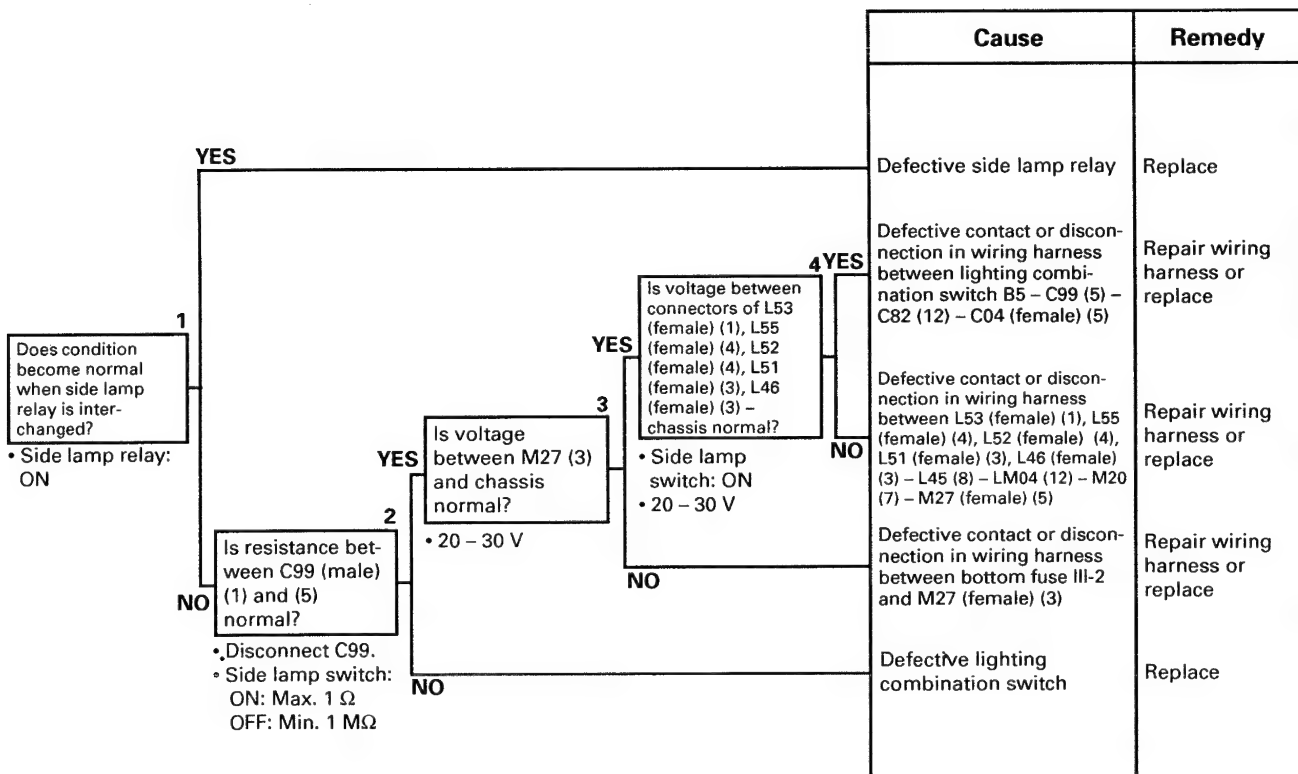


TKL00679

E-19 Side lamp, tail lamp, license lamp do not light up or do not go out

a) Side lamp, tail lamp, license lamp do not light up (disconnection)

- ★ When no error code is displayed.
- ★ When none of 4 side lamps and license plate lamp light up (when each lamp bulb is normal).
- ★ When head lamp Lo beam is normal.
- ★ When turn signal lamp flashes.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that top fuse 17 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between top fuse 17 – C20 (3) – C82 (9) – C99 (1) – lighting switch combination B1, and between lighting switch combination B5 – C99 (5) – C82 (9) – C04 (5).)
- ★ Check that bottom fuse III-2 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between bottom fuse III-2 – M27 (3), and between M27 (5) – M20 (7) – LM04 (12) – L45 (8) – L46 (3) or L51 (3).)

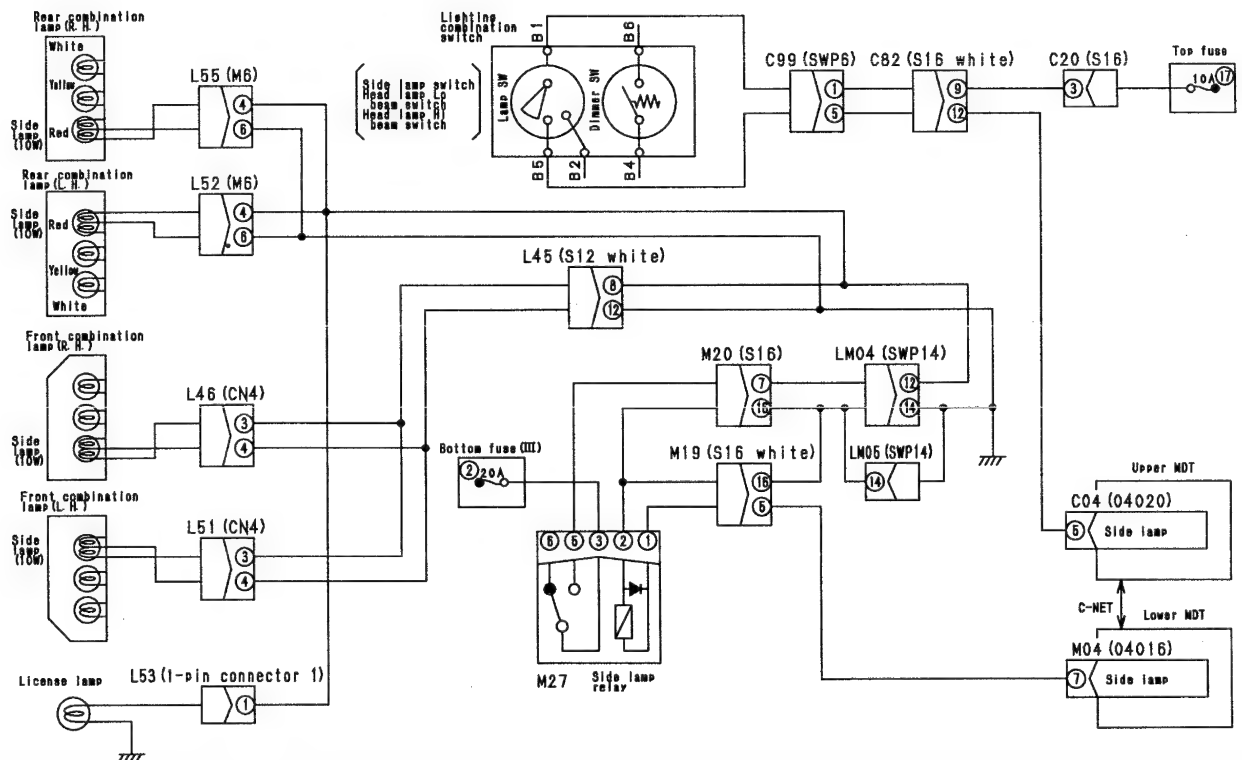


023S02

b) Side lamp, tail lamp, license lamp do not go out (short circuit with power source)

- ★ When no error code is displayed.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<p>1</p> <p>Does condition become normal when side lamp relay is inter-changed?</p> <p>• Side lamp relay: ON</p> <p>YES</p> <p>3</p> <p>Is voltage between C04 (5) and chassis normal?</p> <p>YES</p> <p>2</p> <p>Is resistance between C99 (male) (1) and (5) normal?</p> <p>• Disconnect C99.</p> <p>• Side lamp switch: ON: Max. 1 Ω OFF: Min. 1 MΩ</p> <p>NO</p> <p>• Side lamp switch: OFF</p> <p>NO</p>	<p>Defective side lamp relay</p> <p>Wiring harness between L53 (female) (1), L55(female) (4), L52(female) (4), L51(female) (3), L46 (female) (3) – L45 (8) – LM04 (12) – M20 (7) – M27 (female) (5) short circuiting with power source</p> <p>Wiring harness between lighting combination switch B5 – C99 (5) – C82 (12) – C04 (female) (5) short circuiting with power source</p> <p>Defective side lamp switch</p>	<p>Replace</p> <p>Repair wiring harness or replace</p> <p>Repair wiring harness or replace</p> <p>Replace</p>

E-19 Related electric circuit diagram


TKL00680

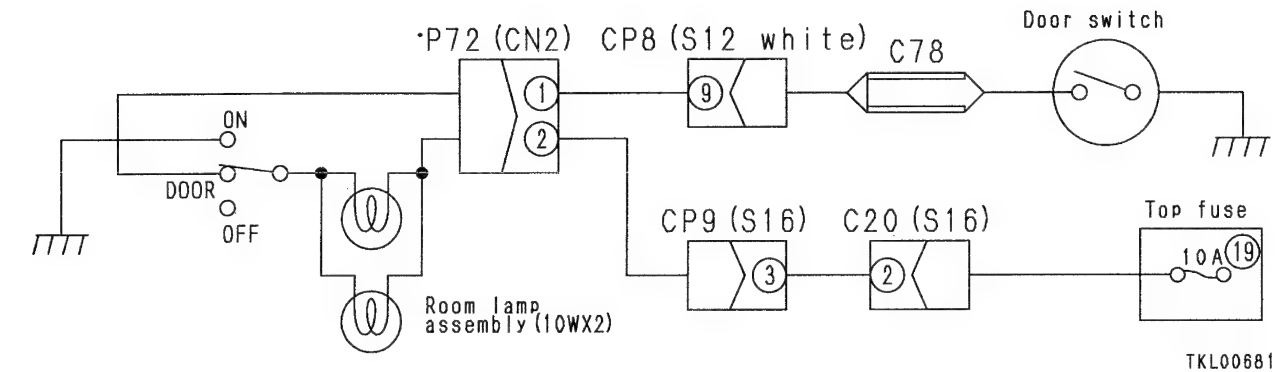
E-20 Room lamp does not light up

- ★ When the room lamp switch is at the central (door) position.
- ★ Check that top fuse 19 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between fuse – C20 (2) – CP9 (3) – C72 (2) – room lamp switch.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
<div>Is room lamp normal?</div> <div>• Check visually</div> <div>1</div> <div>YES</div> <div>Is resistance between room lamp switch terminals normal?</div> <div>• Disconnect P72</div> <div>• Room lamp switch: ON: Max. 1 Ω DOOR: Max. 1 Ω OFF: Min. 1 MΩ</div> <div>2</div> <div>YES</div> <div>Is resistance between door switch terminals normal?</div> <div>• Room lamp switch: OFF</div> <div>• Door switch: ON: Max. 1 Ω OFF: Min. 1 MΩ</div> <div>3</div> <div>YES</div> <div>Is resistance between P72 (female) (1) and chassis normal?</div> <div>• Disconnect P72.</div> <div>• Door switch ON: Max. 1 Ω</div> <div>4</div> <div>YES</div>	<div>Defective contact or disconnection in wiring harness between top fuse 9 – C20 (2) – CP9 (3) – P72 (female) (2)</div> <div>Defective contact or disconnection in wiring harness between P72 (female) (1) – CP8 (9) – C78 – door switch – chassis</div> <div>Defective door switch</div> <div>Defective room lamp switch</div> <div>Defective room lamp</div>	Repair wiring harness or replace	
		Repair wiring harness or replace	
		Replace	
		Replace	

023S02

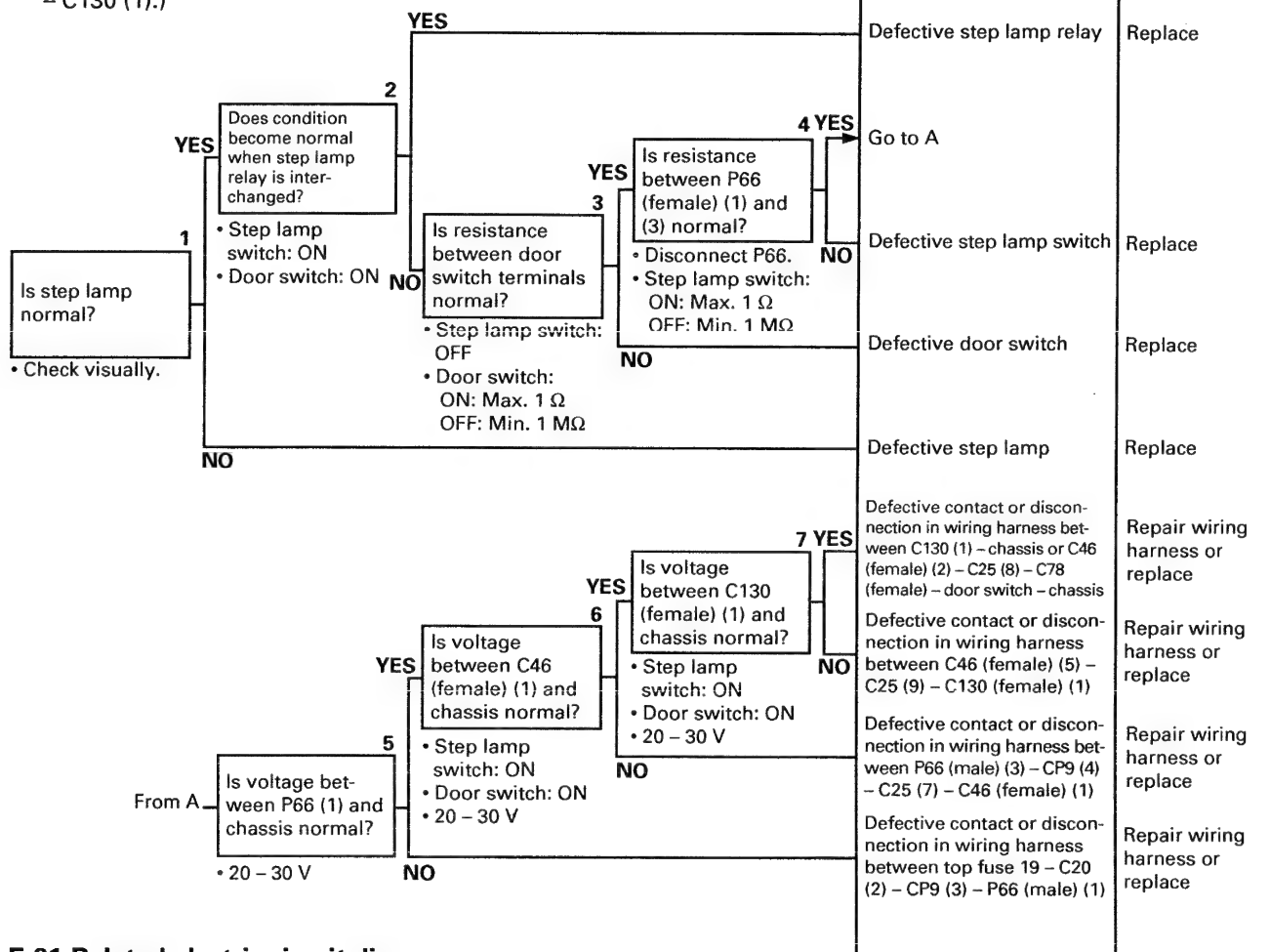
E-20 Related electric circuit diagram



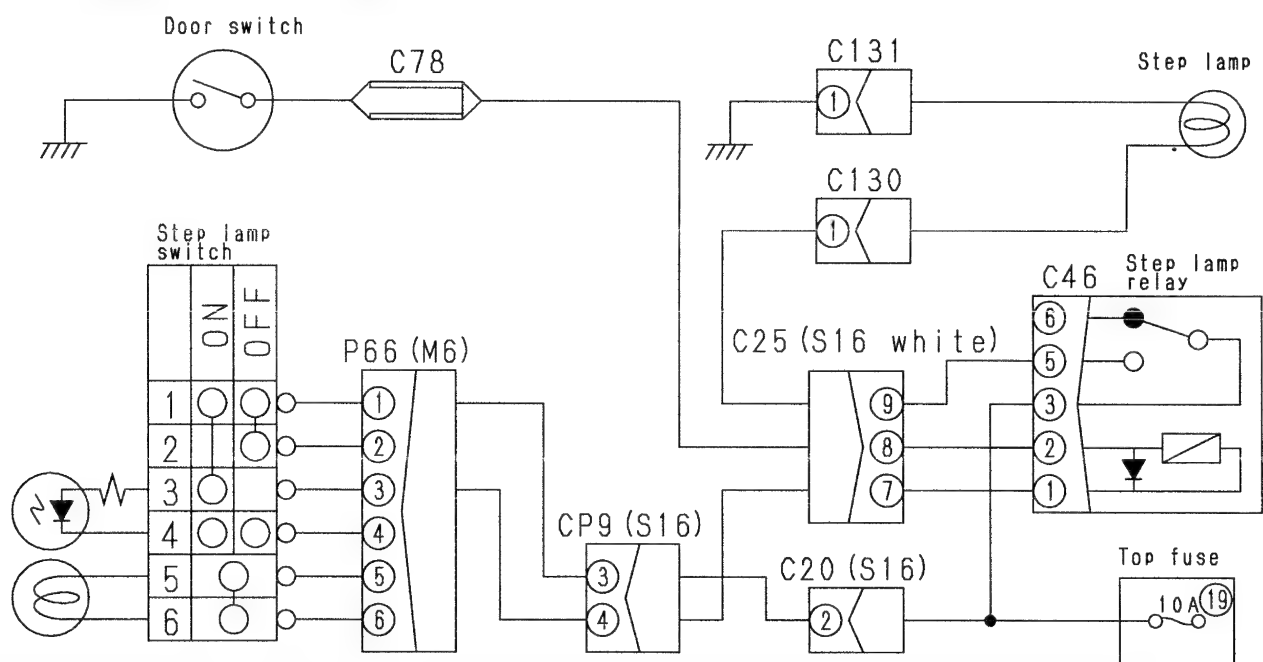
E-21 Step lamp does not light up

★ Check that top fuse 19 is not blown.

(If the fuse is blown, check for a short circuit with the chassis ground between fuse – C20 (2) – CP9 (3) - P66 (1), between P66 (3) – CP9 (4) – C25 (7) – C46 (1), between fuse – C46 (3), and between C46 (5) – C25 (9) – C130 (1).)



E-21 Related electric circuit diagram



TKL00682

E-22 Abnormality in tachograph system

- ★ Check that bottom fuse IV-2 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between fuse – M21 (9) – LM10 (16) – L07 (2) – tachograph.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

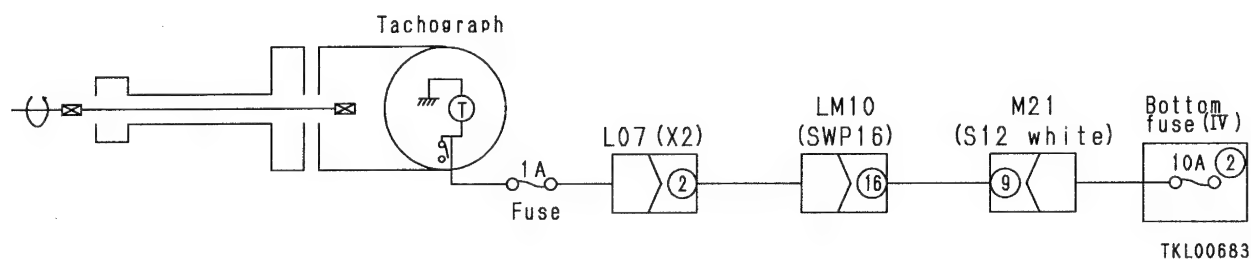
a) Tachograph does not work (speed indicator does not move)

		Cause	Remedy
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> 1 YES Is flexible cable entering tachometer rotating? </div> <div style="border: 1px solid black; flex-grow: 1; min-height: 40px;"></div> </div>		Defective tachograph	Replace
	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> NO • Start engine. • Jack up machine with outriggers and raise tires from ground. • Set gear shift lever to any position other than N, and rotate wheels. </div> <div style="border: 1px solid black; flex-grow: 1; min-height: 40px;"></div> </div>	Defective flexible cable	Replace

b) Cannot be printed out on tachograph print sheet

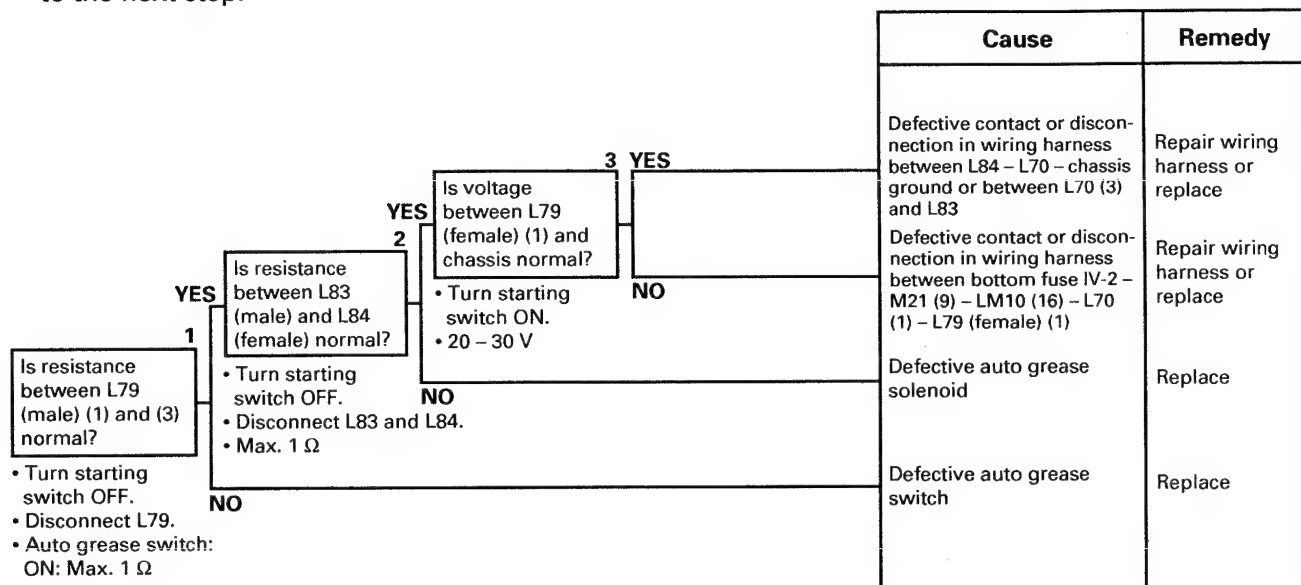
		Cause	Remedy
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> 1 YES Is resistance between tachograph power source terminal and L07 (male) (2) normal? </div> <div style="border: 1px solid black; flex-grow: 1; min-height: 40px;"></div> </div>	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> 2 YES Is resistance between M02 (female) (6), L10 (female) (3) and chassis normal? </div> <div style="border: 1px solid black; flex-grow: 1; min-height: 40px;"></div> </div>	Defective contact or disconnection in wiring harness between bottom fuse IV-2 – M21 (9) – LM10 (16) – L07 (2)	Repair wiring harness or replace
	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> NO • Turn starting switch ON. • 20 – 30 V </div> <div style="border: 1px solid black; flex-grow: 1; min-height: 40px;"></div> </div>	Defective tachograph	Replace
	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> NO • Turn starting switch OFF. • Disconnect L07. • Max. 1 Ω </div> <div style="border: 1px solid black; flex-grow: 1; min-height: 40px;"></div> </div>	Defective tachograph fuse (1A)	Replace

E-20 Related electric circuit diagram



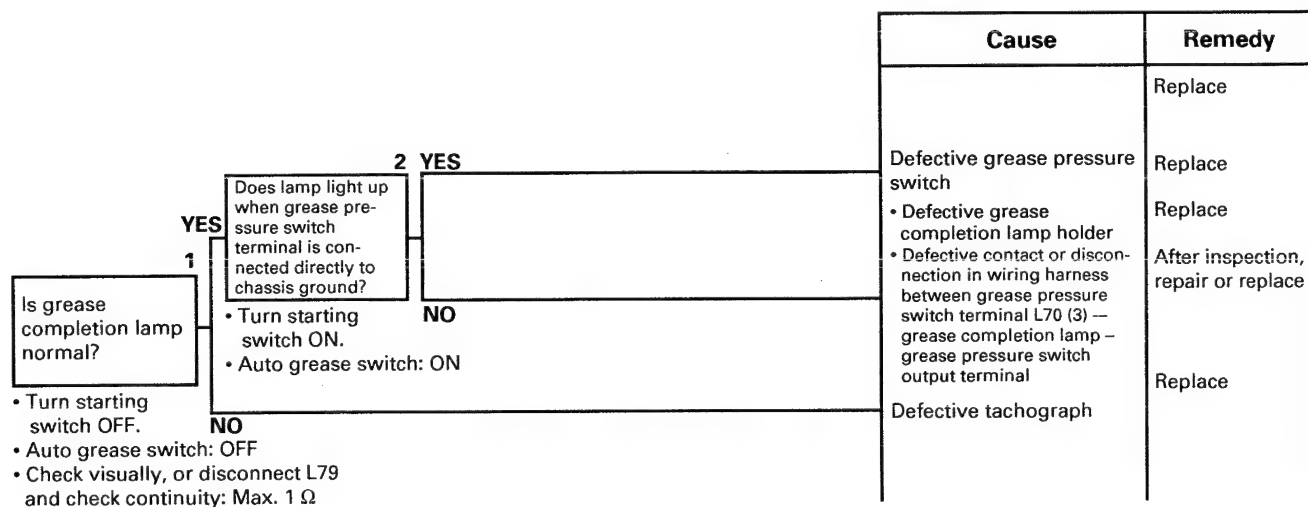
E-23 Centralized greasing cannot be carried out

- ★ Check that bottom fuse IV-2 is not blown.
(If the fuse is blown, check for a short circuit with the chassis ground between fuse - M21 (9) - LM10 (16) - L07 (1) - auto-grease switch - L70 (3) - L83 - auto-grease solenoid.)
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

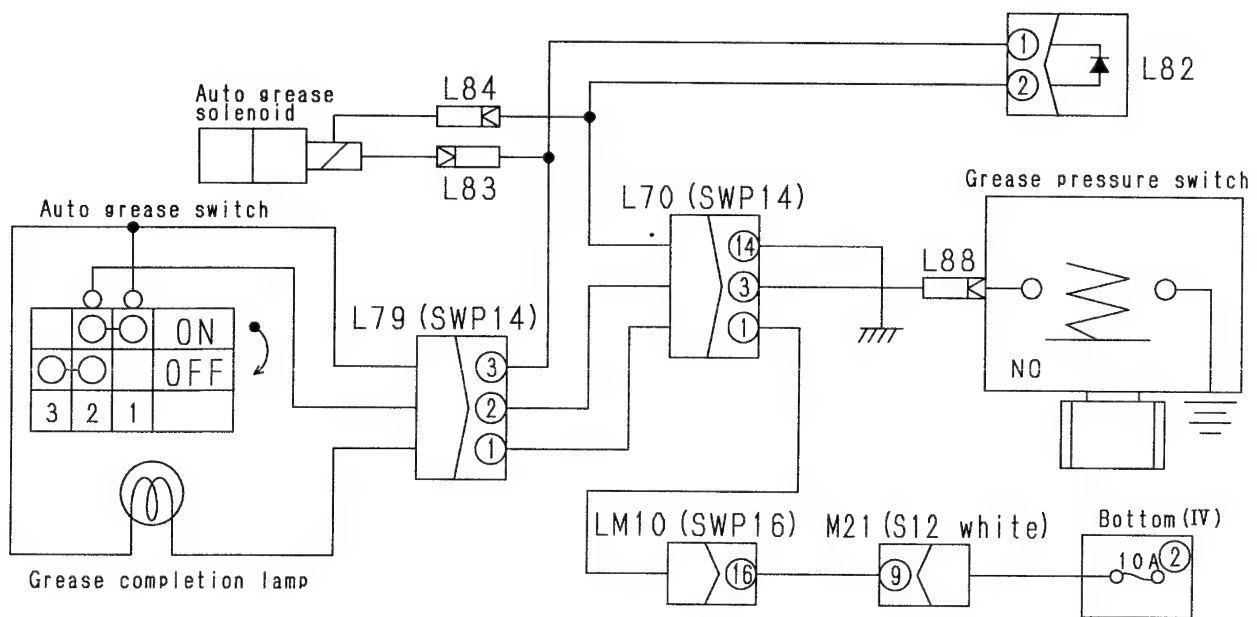


E-24 Greasing completion lamp does not light up

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



E-23, 24 Related electric circuit diagram



TKL00684

023S02

E-25 Front wiper, front window washer do not work

- ★ Check that top fuse 8 is not blown.

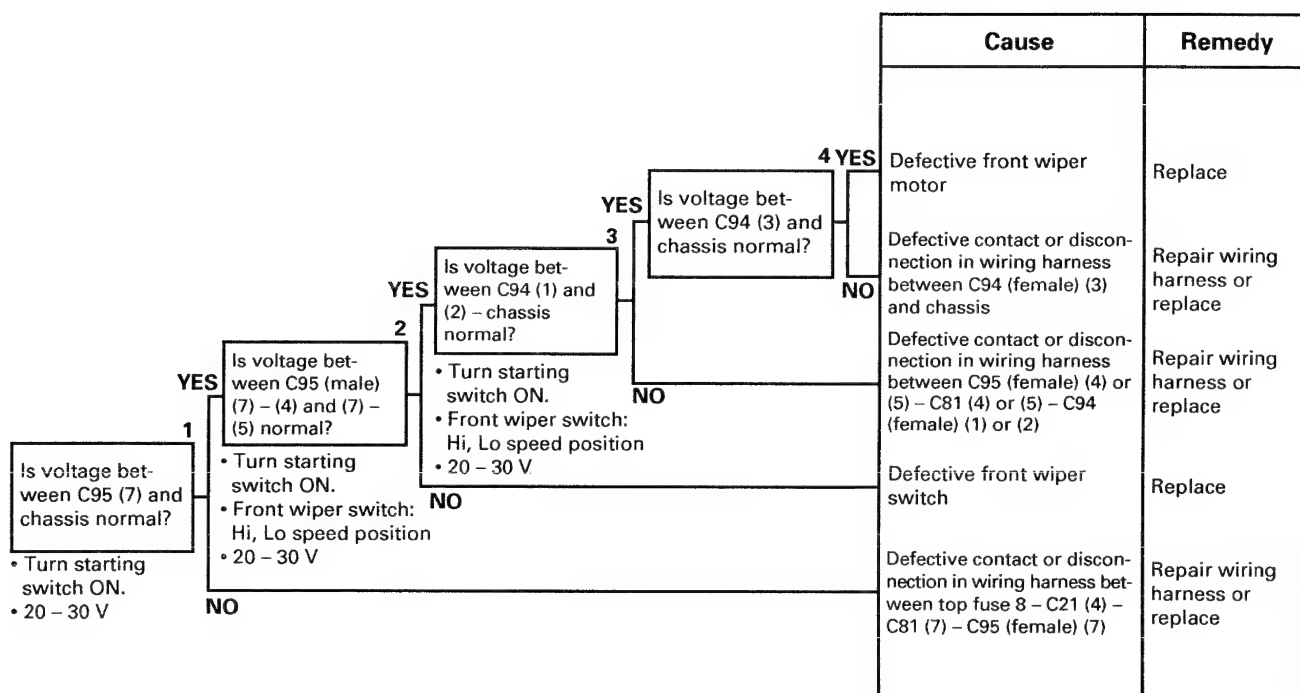
(If the fuse is blown, check for a short circuit with the chassis ground between top fuse 8 - C21 (4) - C81 (7) - C95 (7), between C95 (1) - C81 (1) - C139 (4), between C95 (2) - C81 (2), C95 (6) - C81 (6) - C138 (2), between C81 (6) - CR4 (14) - R20 (1), between C95 (8) - C139 (5), between C95 (9) - C81 (9) - C132 (5) - C133 (2), between C95 (10) - C81 (10) - CR4 (14) - R22 (1), and between C133 (1) - C132 (3) - C139 (6).)

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

- ★ Always connect any disconnected connectors before going on to the next step.

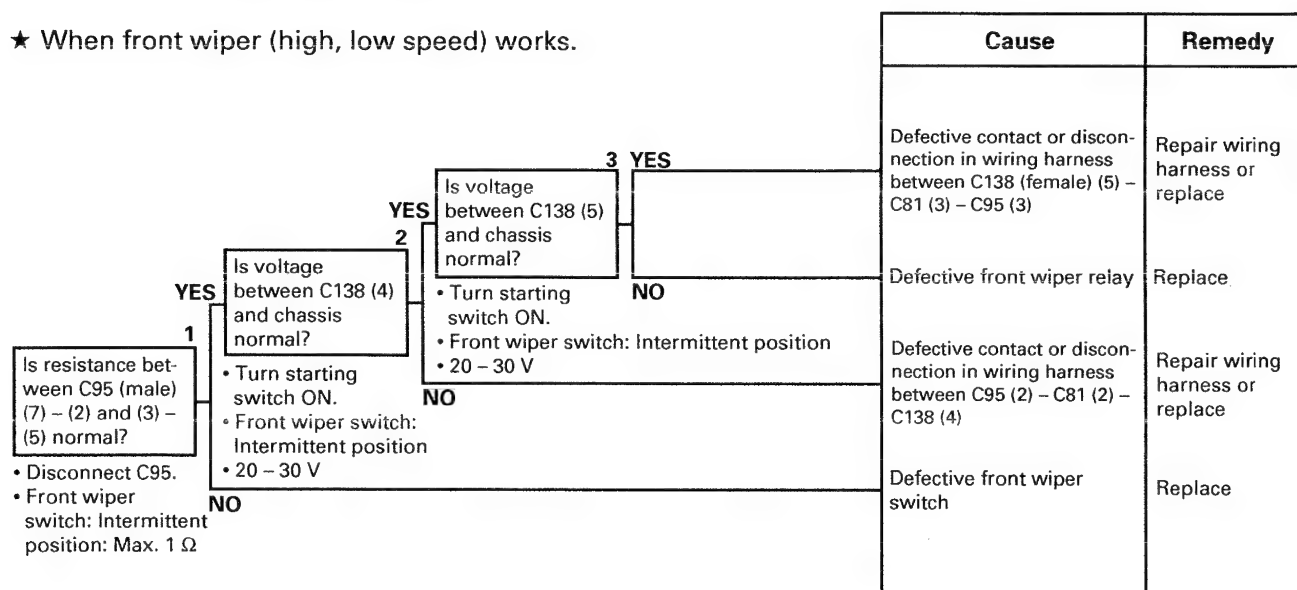
a) Front wiper (Hi, Lo speed) does not work

023S02



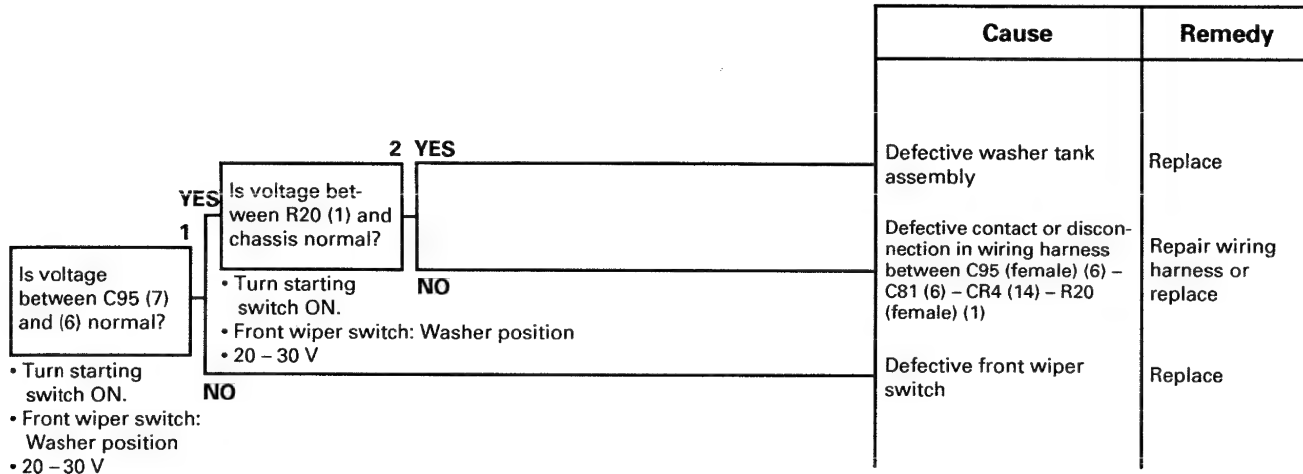
b) Front wiper (intermittent) does not work

- ★ When front wiper (high, low speed) works.

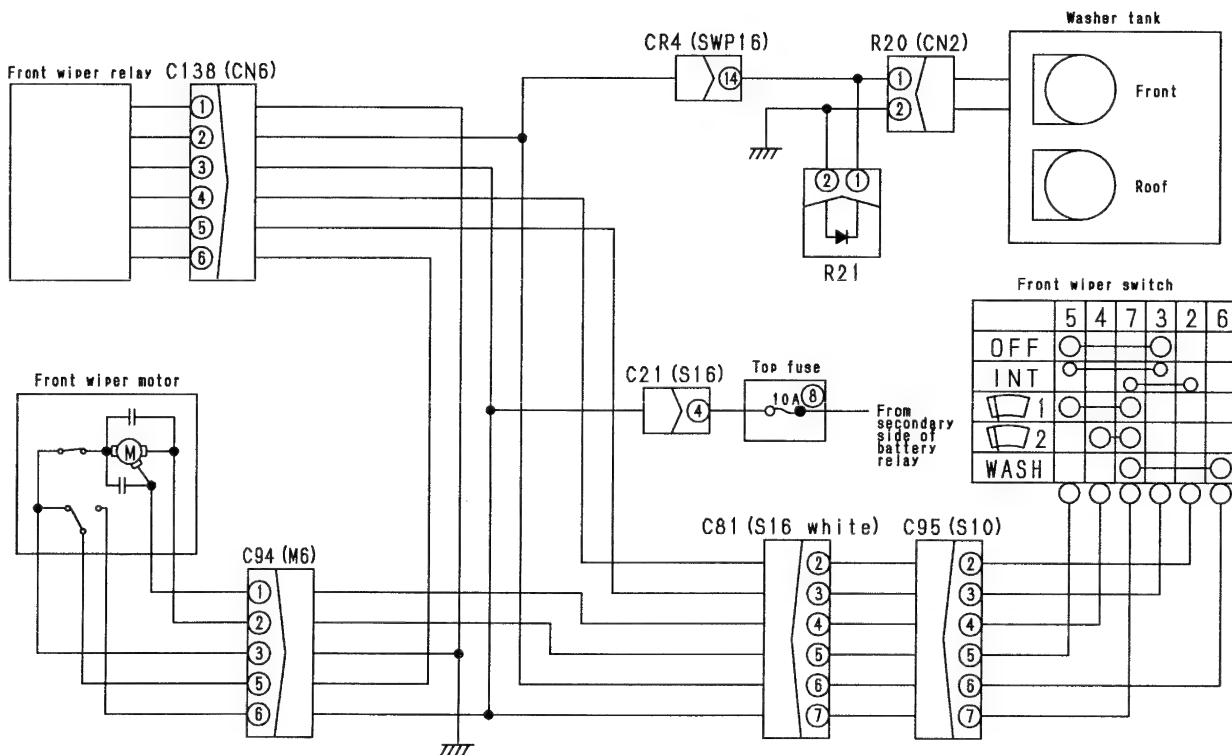


c) Front window washer does not work

★ When front wiper works.



E-25 Related electric circuit diagram

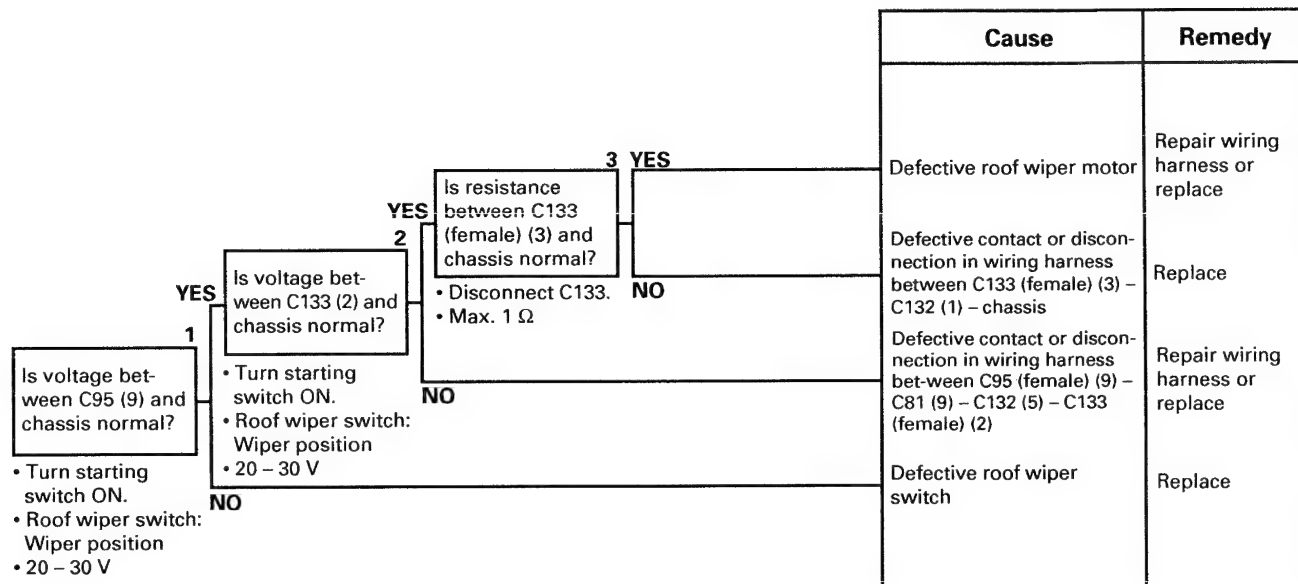


TKL00685

E-26 Roof wiper, roof window washer do not work

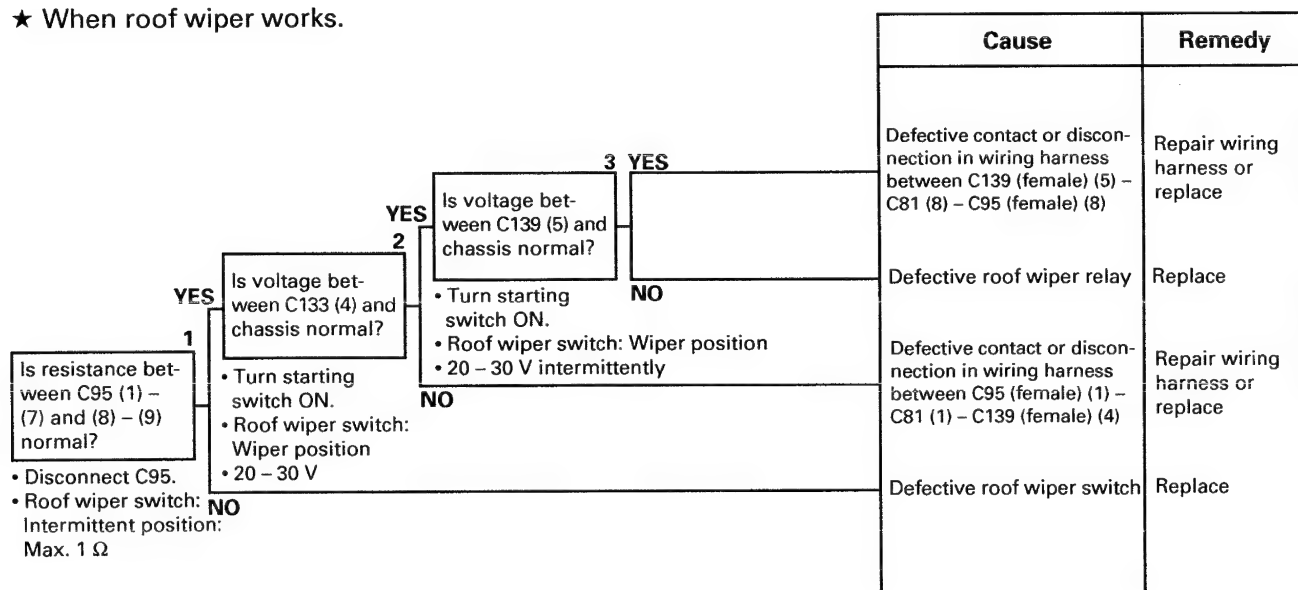
- ★ When the front wiper works.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

a) Roof wiper does not work



b) Roof wiper (intermittent) does not work

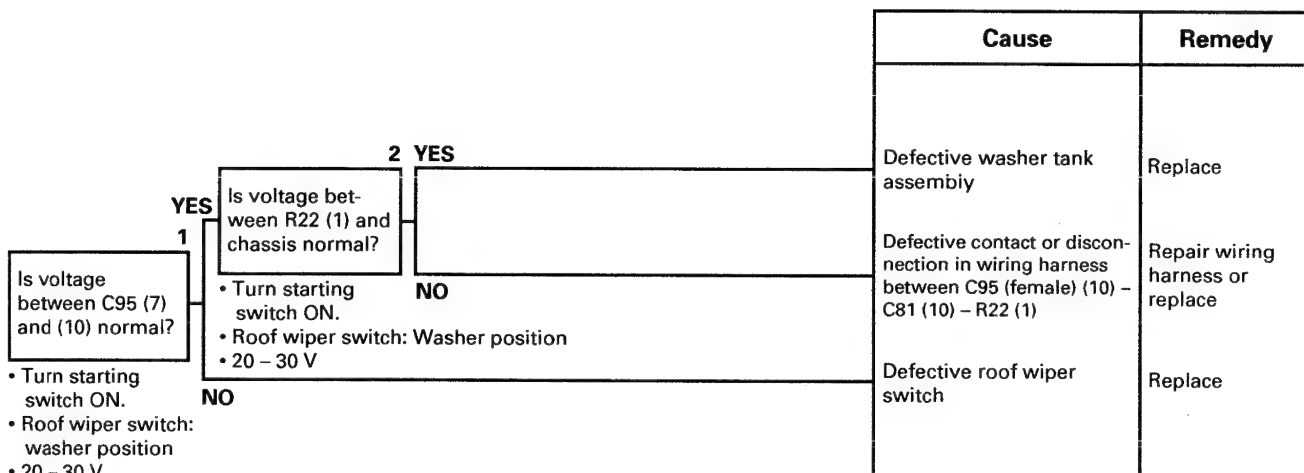
- ★ When roof wiper works.



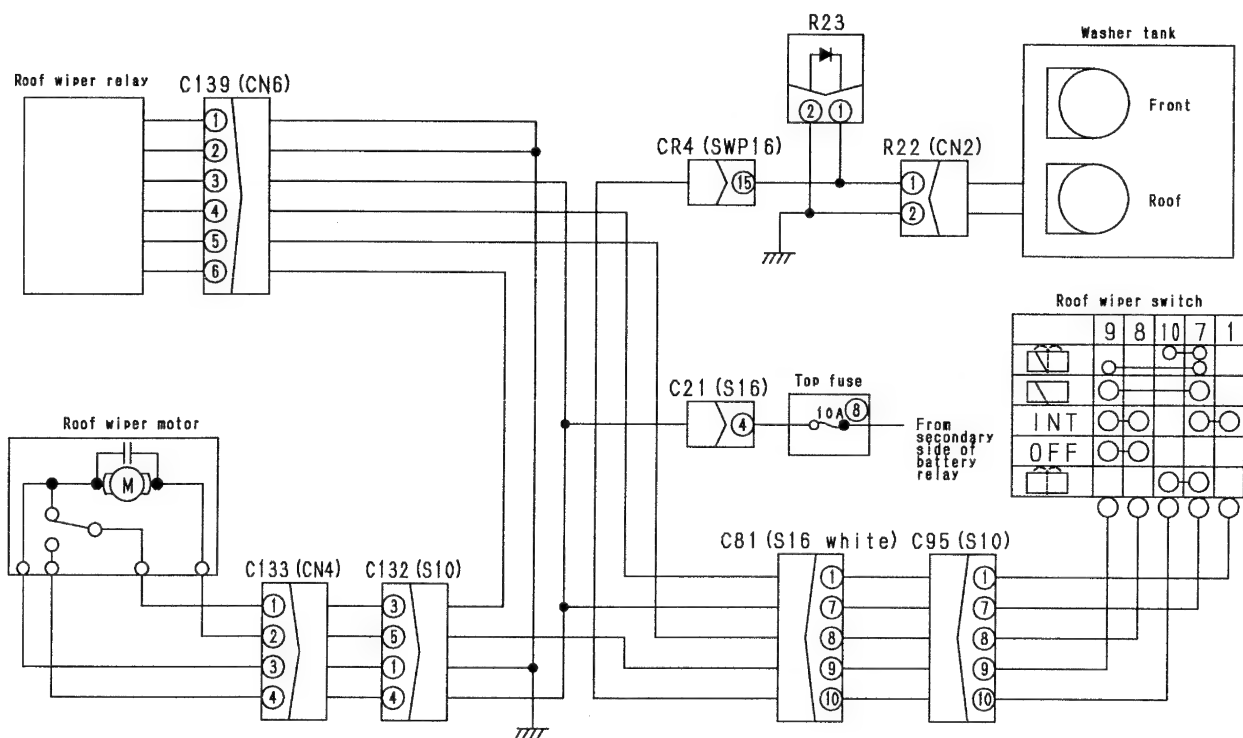
023S02

c) Roof window washer does not work

★ When front wiper works.



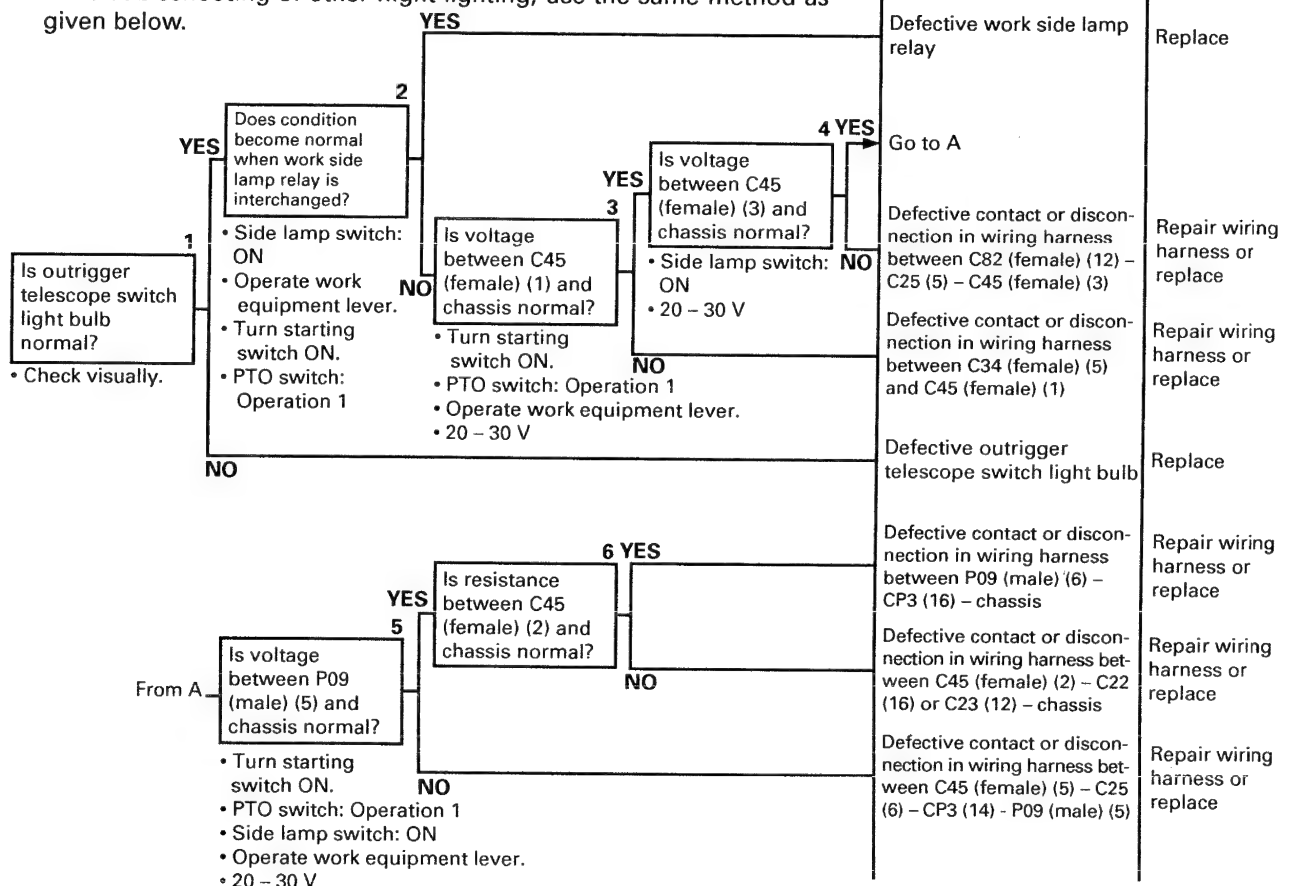
E-26 Related electric circuit diagram



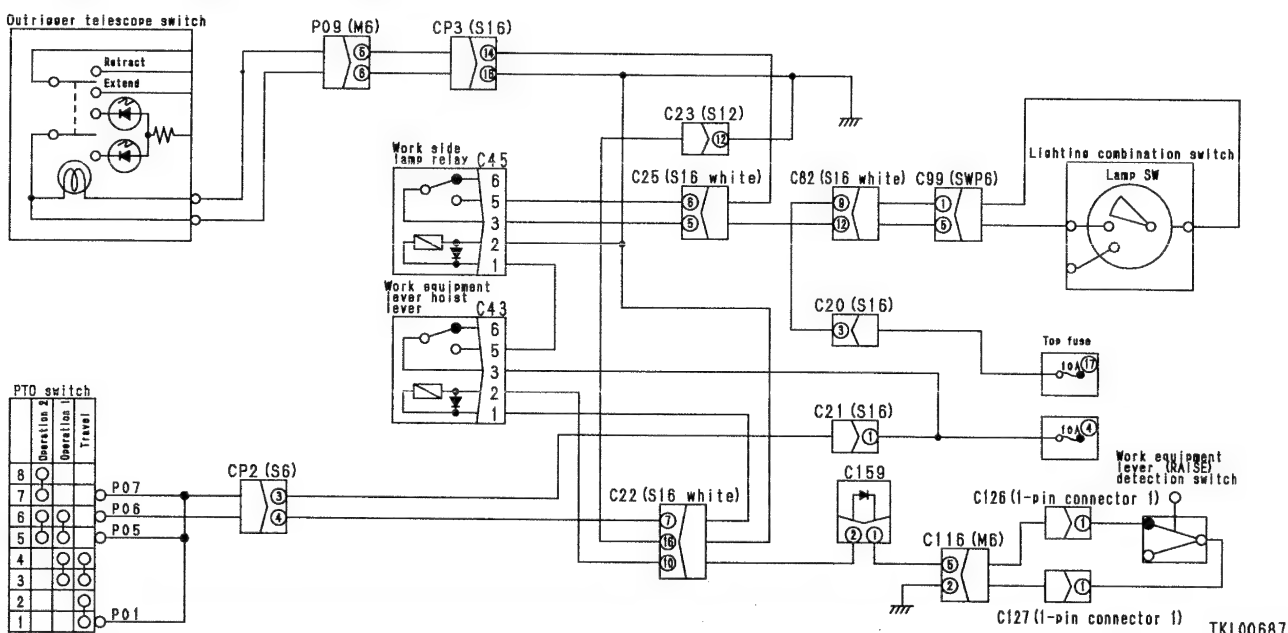
TKL00686

E-27 Night lighting does not light up (outrigger telescope switch light- ing does not light up)

- ★ When side lamp lights up.
- ★ When work equipment works normally.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ For troubleshooting of other night lighting, use the same method as given below.



E-27 Related electric circuit diagram



E-51 DEFECTIVE AIR CONDITIONER**Troubleshooting chart for air conditioner system**

Trouble-shooting number	Problem	Trouble-shooting section number	Specific problem
E-51 a)	Air conditioner does not work at all	a)-(1)	Does not work at all, control panel LEDs do not light up
		a)-(2)	Troubleshooting of cooling circuit
		a)-(3)	Impossible to adjust air temperature
		a)-(4)	Compressor clutch does not come ON
E-51 b)	Defective cooling	b)-(1)	Condenser fan motor does not turn
		b)-(2)	Troubleshooting of hot water circuit
E-51 c)	Defective heating		Impossible to adjust air temperature
E-51 d)	No breeze comes from vent		Blower motor does not turn
E-51 e)	Impossible to adjust wind force		Wind force does not switch
E-51 f)	Impossible to adjust air temperature		Impossible to adjust air temperature
E-51 g)	Impossible to switch vents		Impossible to switch vents
E-51 h)	Impossible to switch FRESH/RECIRC		Impossible to switch FRESH/RECIRC
E-51 i)	Abnormal noise		Abnormal noise troubleshooting table
E-51 j)	Water leaks from air conditioner unit		Water leakage from air conditioner unit troubleshooting table

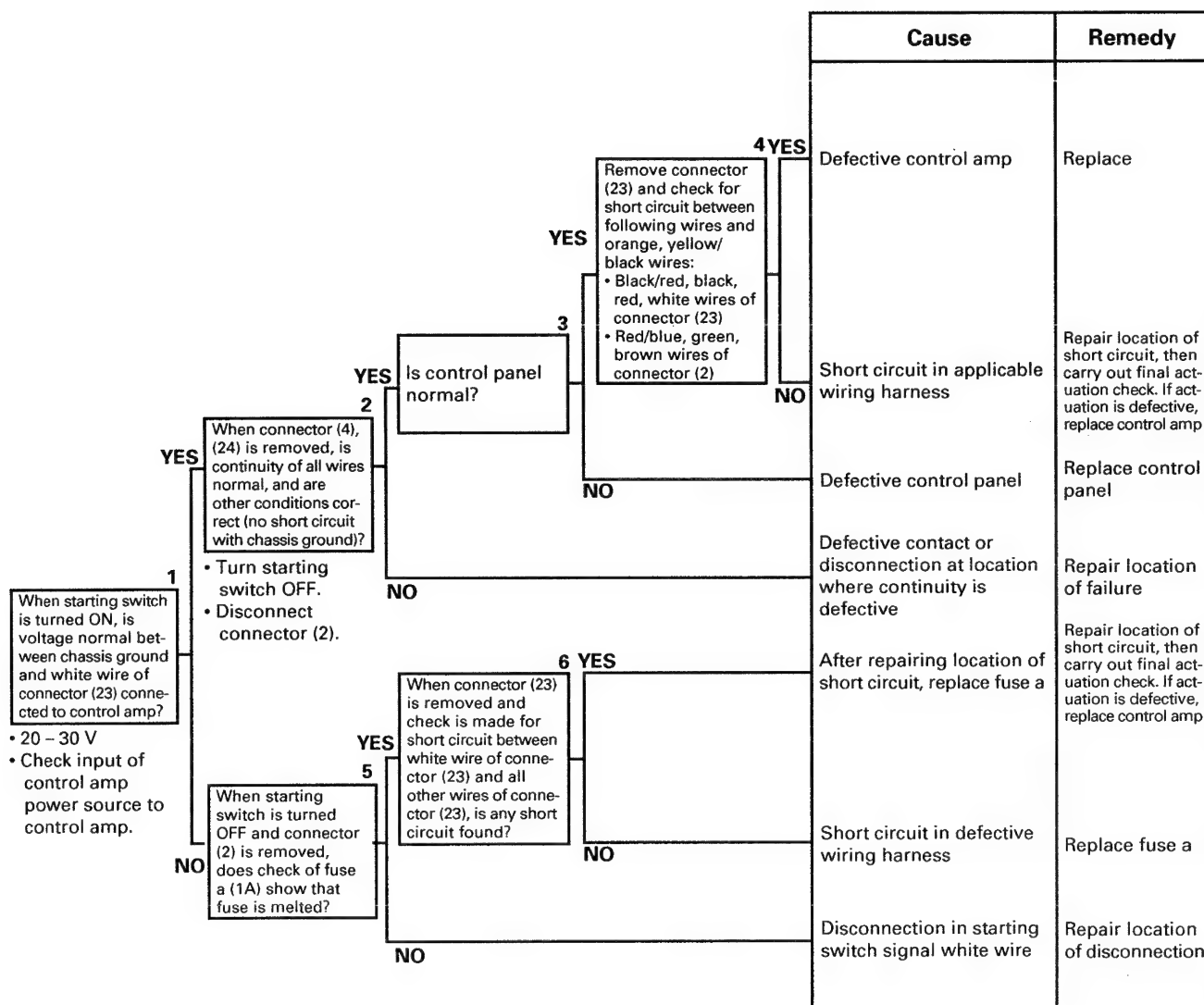
023S02

E-51 a) Air conditioner does not work at all

E-51 a)-(1) Does not work at all, control panel LEDs do not light up

Note: If any connectors are removed for inspection, connect them securely after completing repairs.

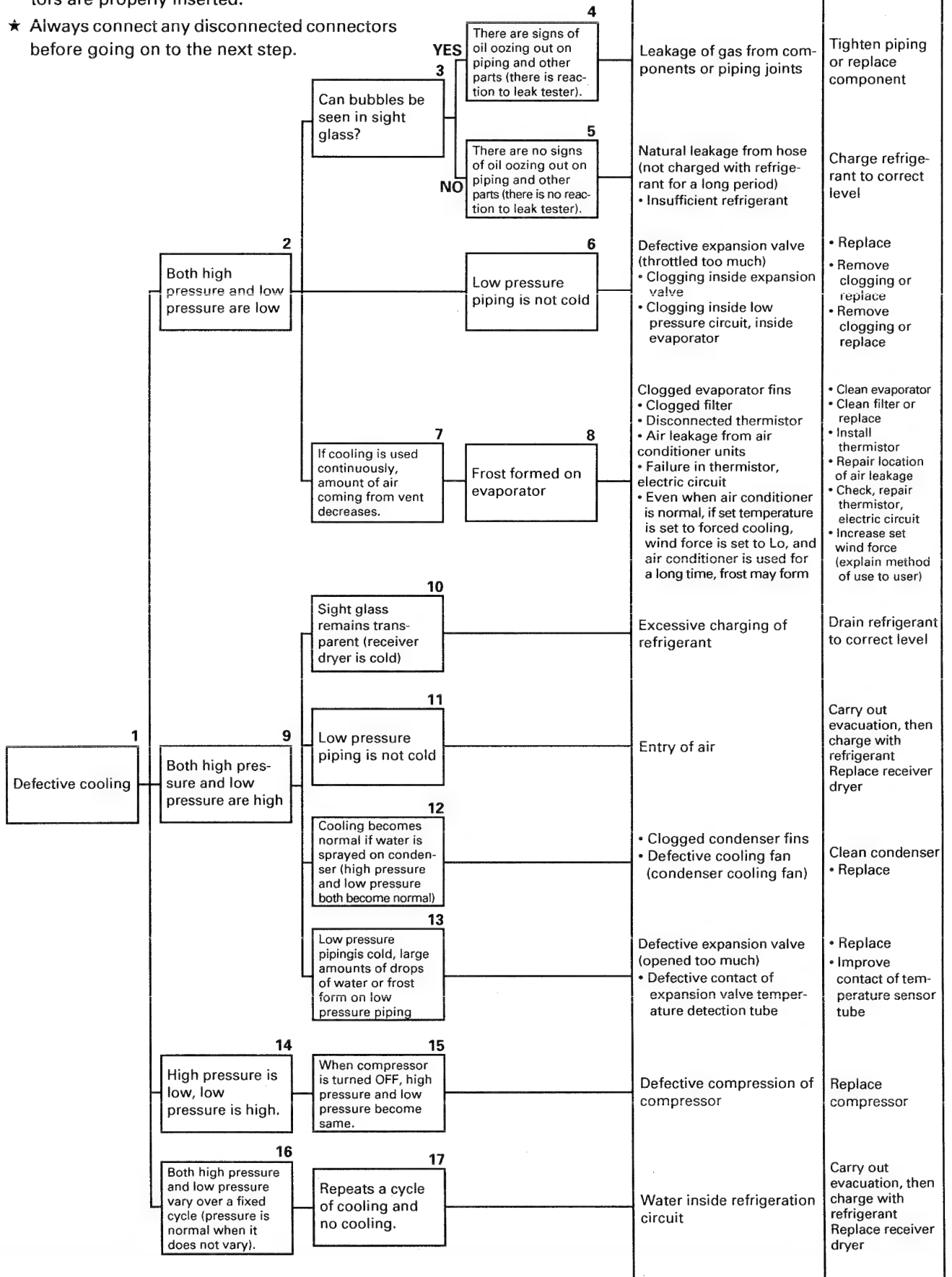
- ★ Check that top fuses 7, 17, and 20 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

E-51 a)-(2) Troubleshooting of cooling circuit

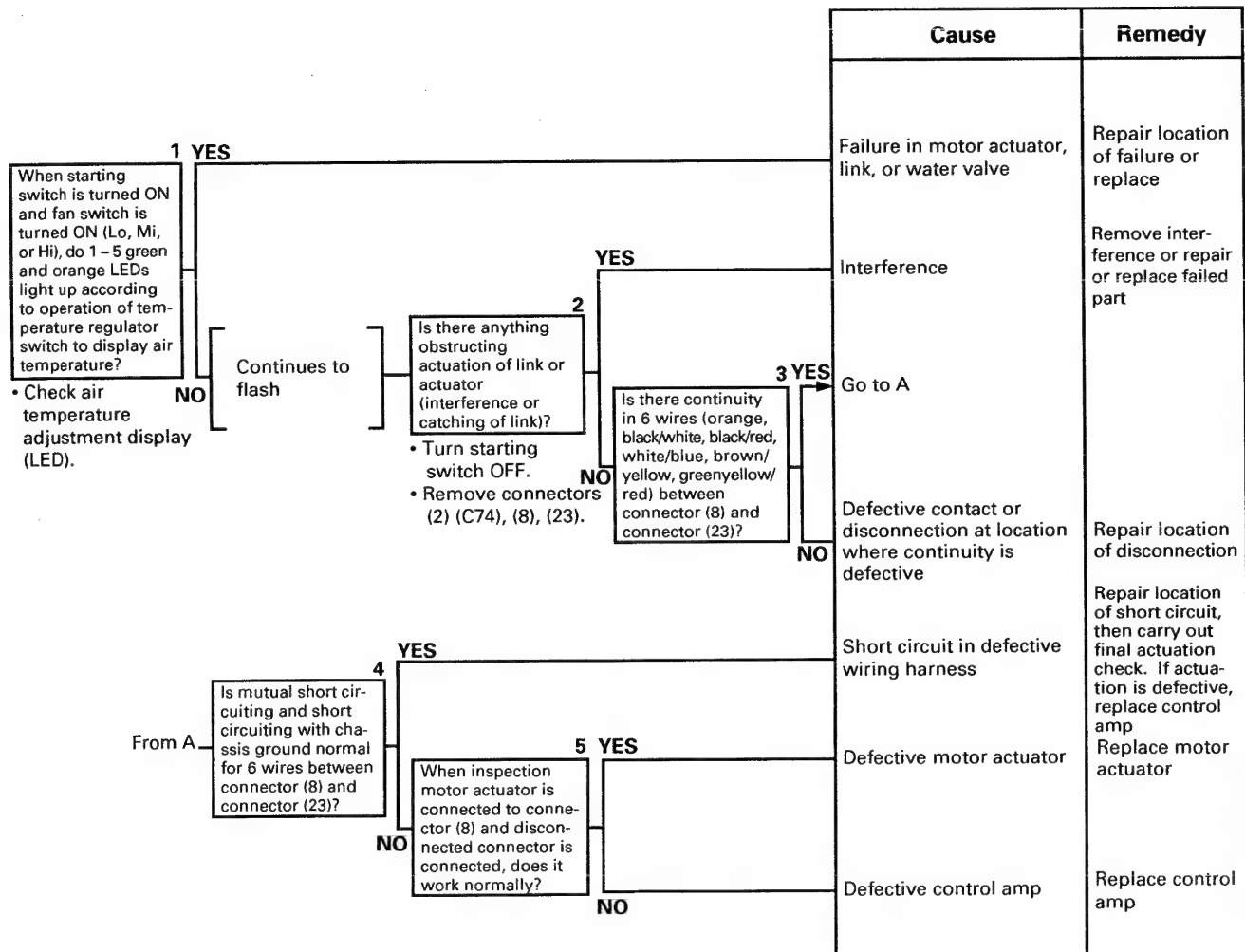
- ★ Check that top fuses 7, 17, and 20 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



E-51 a)-(3) Impossible to adjust air temperature

Note: If any connectors are removed for inspection, connect them securely after completing repairs.

- ★ Check that top fuses 7, 17, and 20 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

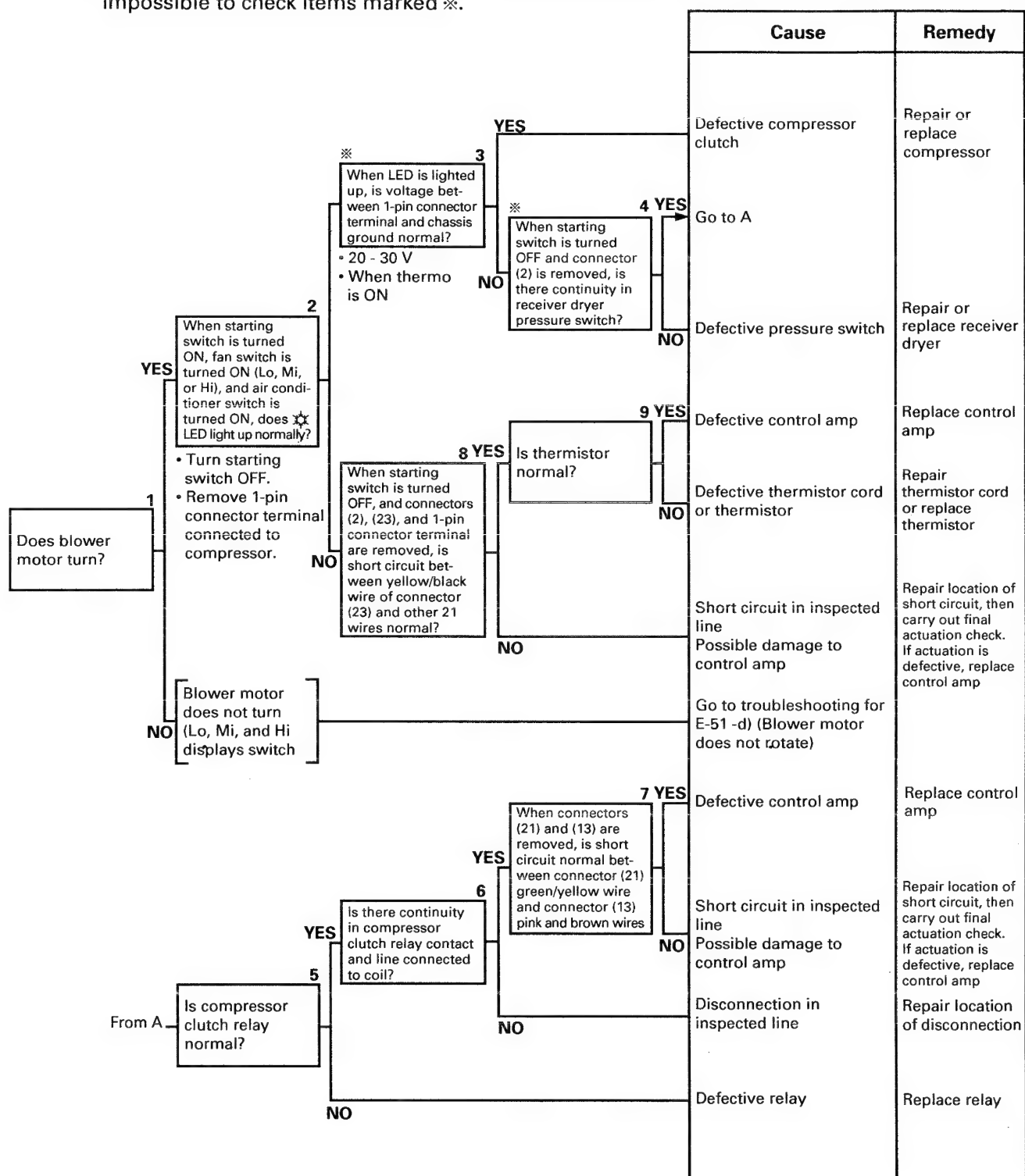


023S02

E-51 a)-(4) Compressor clutch does not come ON

- ★ Check that top fuses 7, 17, and 20 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

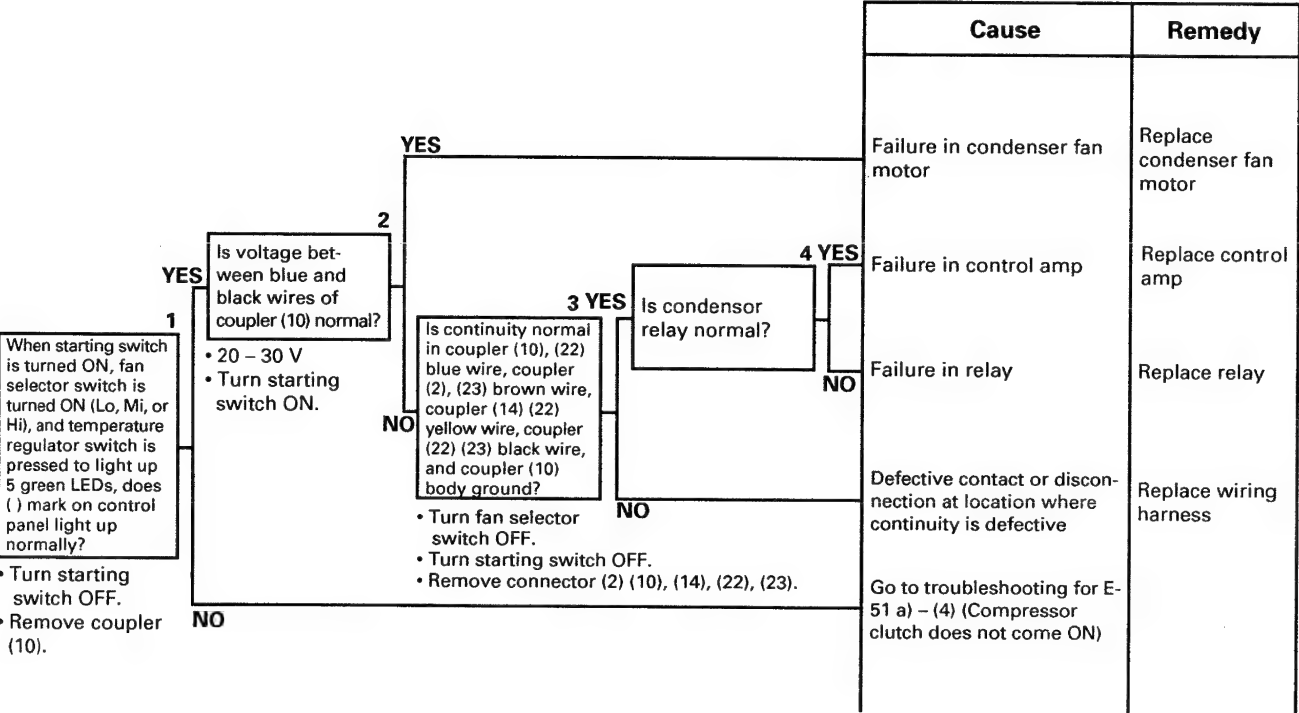
Note 1. If any connectors are removed for inspection, connect them securely after completing repairs.
2. If the system is not charged with refrigerant and the ambient temperature is not above 0°C, it is impossible to check items marked ✱.



E-51 b) Defective cooling

E-51 b)-(1) Condenser fan motor does not turn

- Note: If any connectors are removed for inspection, connect them securely after completing repairs.
- ★ Check that top fuses 7, 17, and 20 are normal.
 - ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.



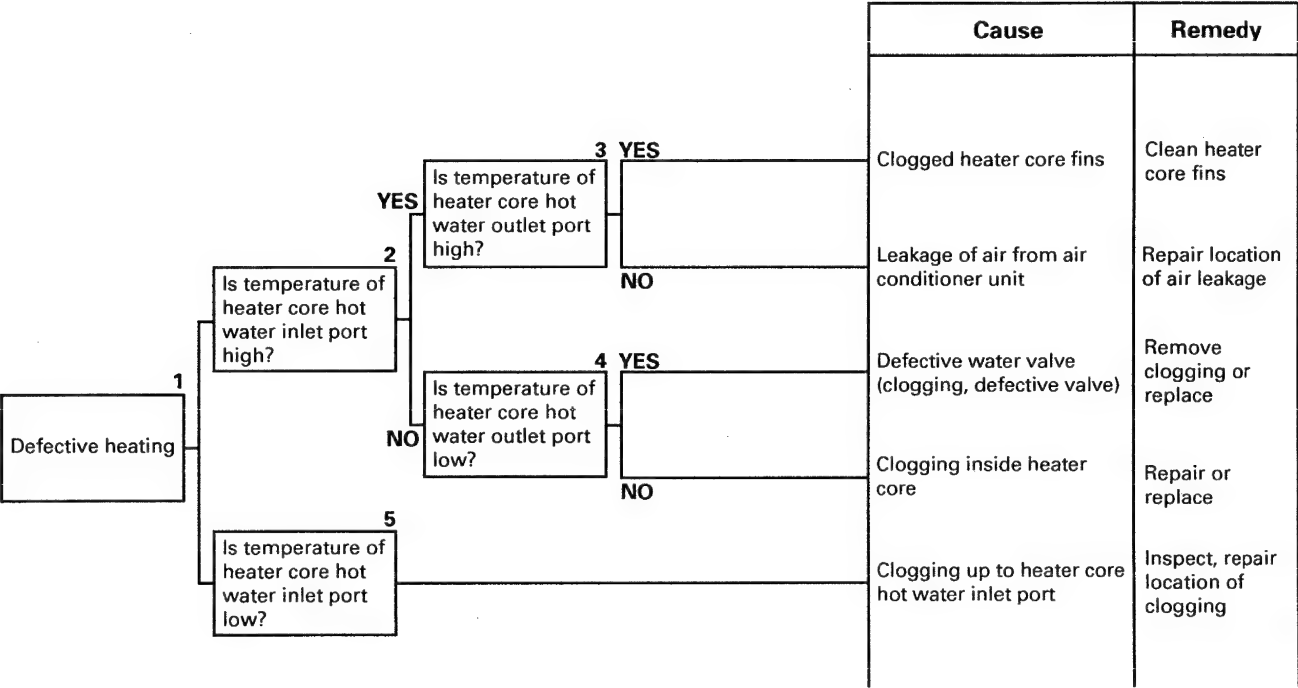
023S02

E-51 b)-(2) Troubleshooting of hot water circuit

- ★ Check that top fuses 7, 17, and 20 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

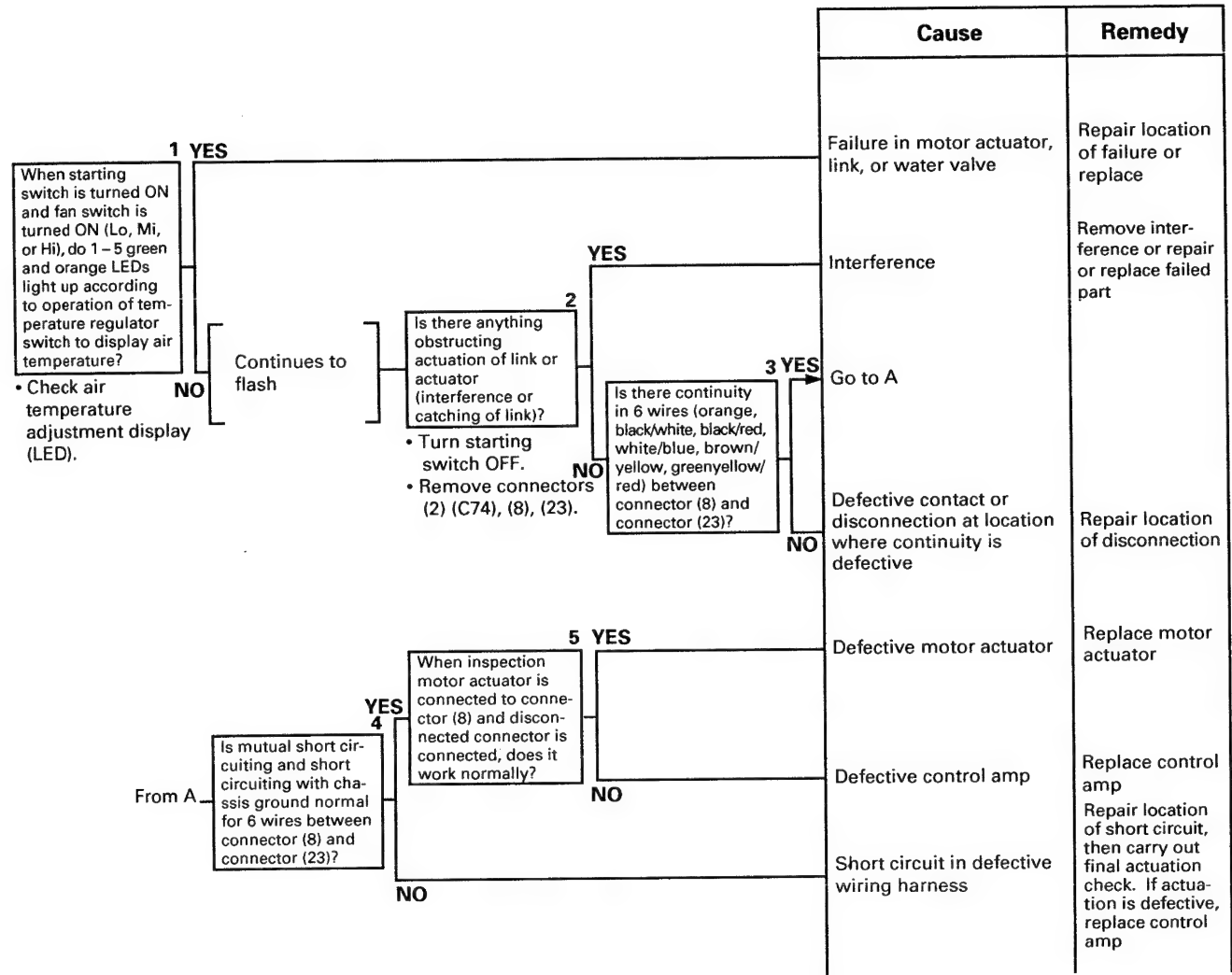
Note 1. Check that there is no leakage of water from the air conditioner unit hot water circuit.

2. Check that air is coming out from the vent.



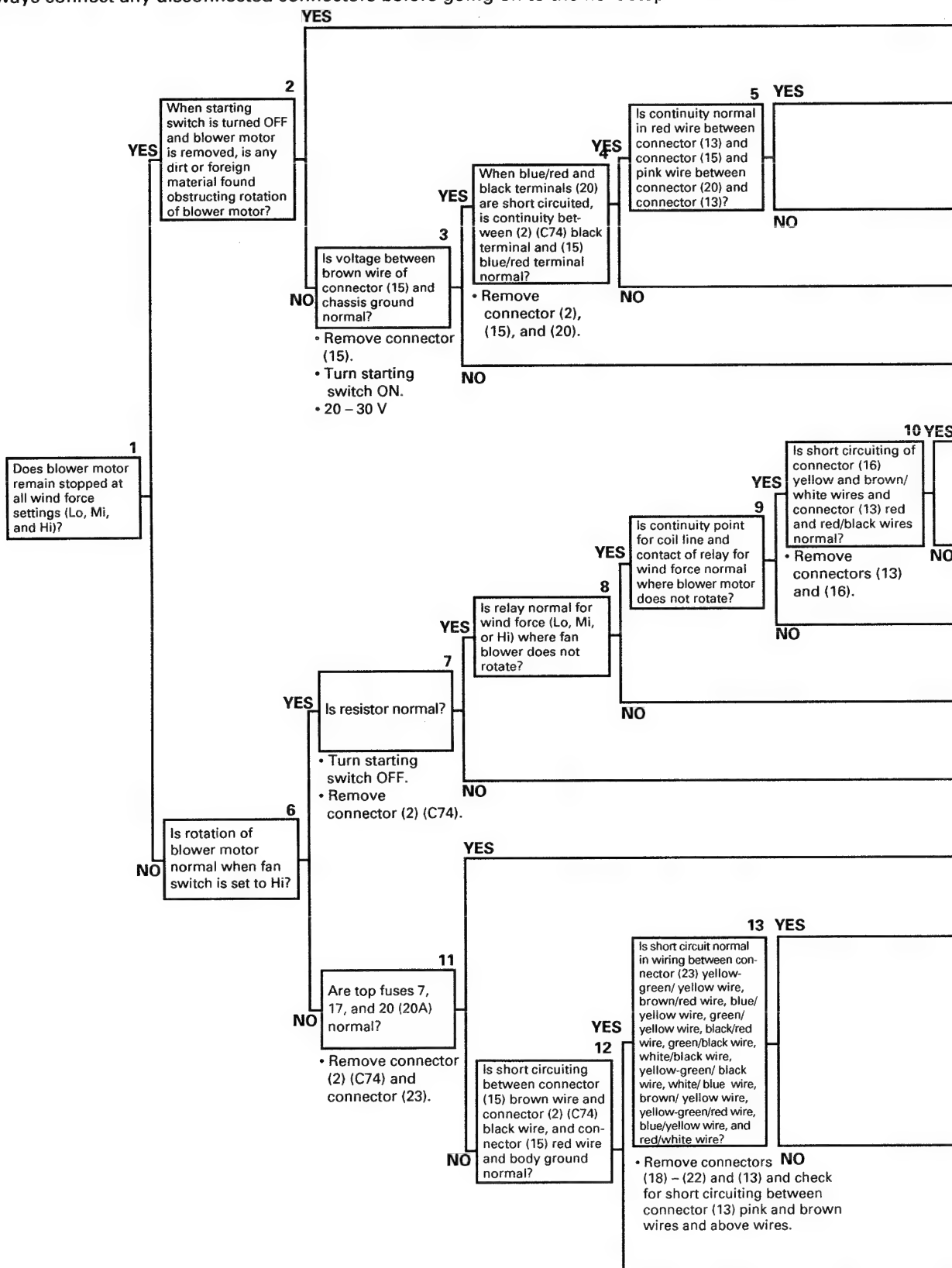
E-51 c) Defective heating (impossible to adjust air temperature)

Note: If any connectors are removed for inspection, connect them securely after completing repairs.
 ★ Check that top fuses 7, 17, and 20 are normal.
 ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 ★ Always connect any disconnected connectors before going on to the next step.



E-51 d) No breeze comes from vent {blower motor does not rotate (Lo, Mi, and Hi displays switch)}

- ★ Check that top fuses 7, 17, and 20 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

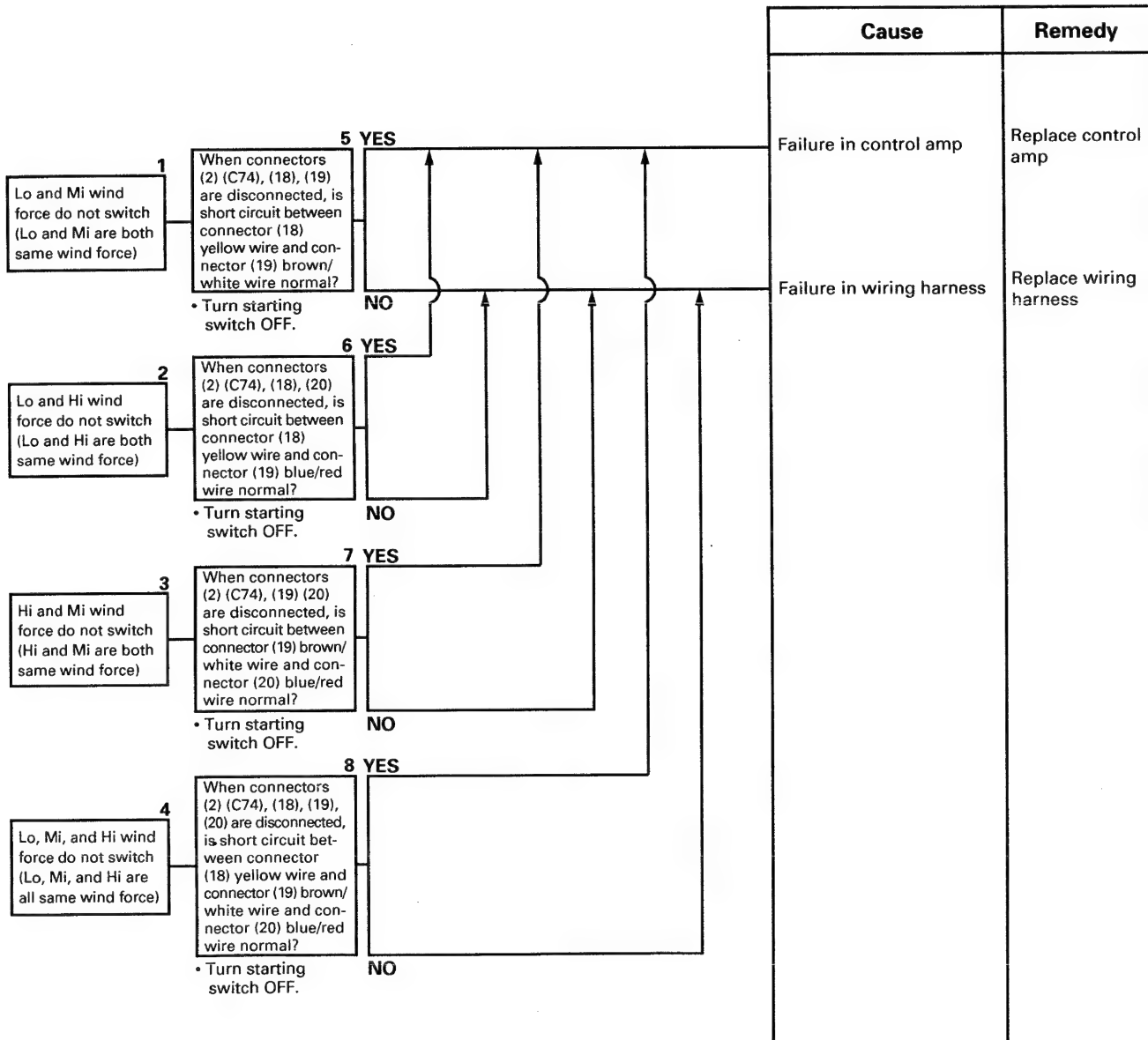
Cause	Remedy
Defective boom telescope counterbalance valve	Remove foreign material
Defective wire inside boom	Repair disconnection location
Defective boom telescope cylinder	Remove foreign material
Defective order selector valve	Replace resistor Note: Do not try to repair
Defective boom telescope PPC valve	After repairing location of short circuit, replace resistor Note: Do not try to repair
Air sucked into suction circuit	Repair disconnection location
Defective adjustment of main relief valve at boom circuit end	Replace relay
Defective boom control valve flow control	Repair disconnection location
Drop in boom pump performance or defective swivel joint	Replace blower motor; if chassis top fuse (20A) is melted, replace fuse
Defective main unload valve	Repair location of short circuit, then replace chassis top fuse (20A) (if melted) If final actuation check shows that actuation is defective, replace control amp or diode A
Defective adjustment of PPC circuit main relief valve	Repair location of short circuit, then replace chassis top fuse (20A)

023S02

E-51 e) Impossible to adjust wind force (wind force does not switch. However, Lo, Mi, and Hi displays switch)

Note: If any connectors are removed for inspection, connect them securely after completing repairs.

- ★ Check that top fuses 7, 17, and 20 are normal.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.



023S02

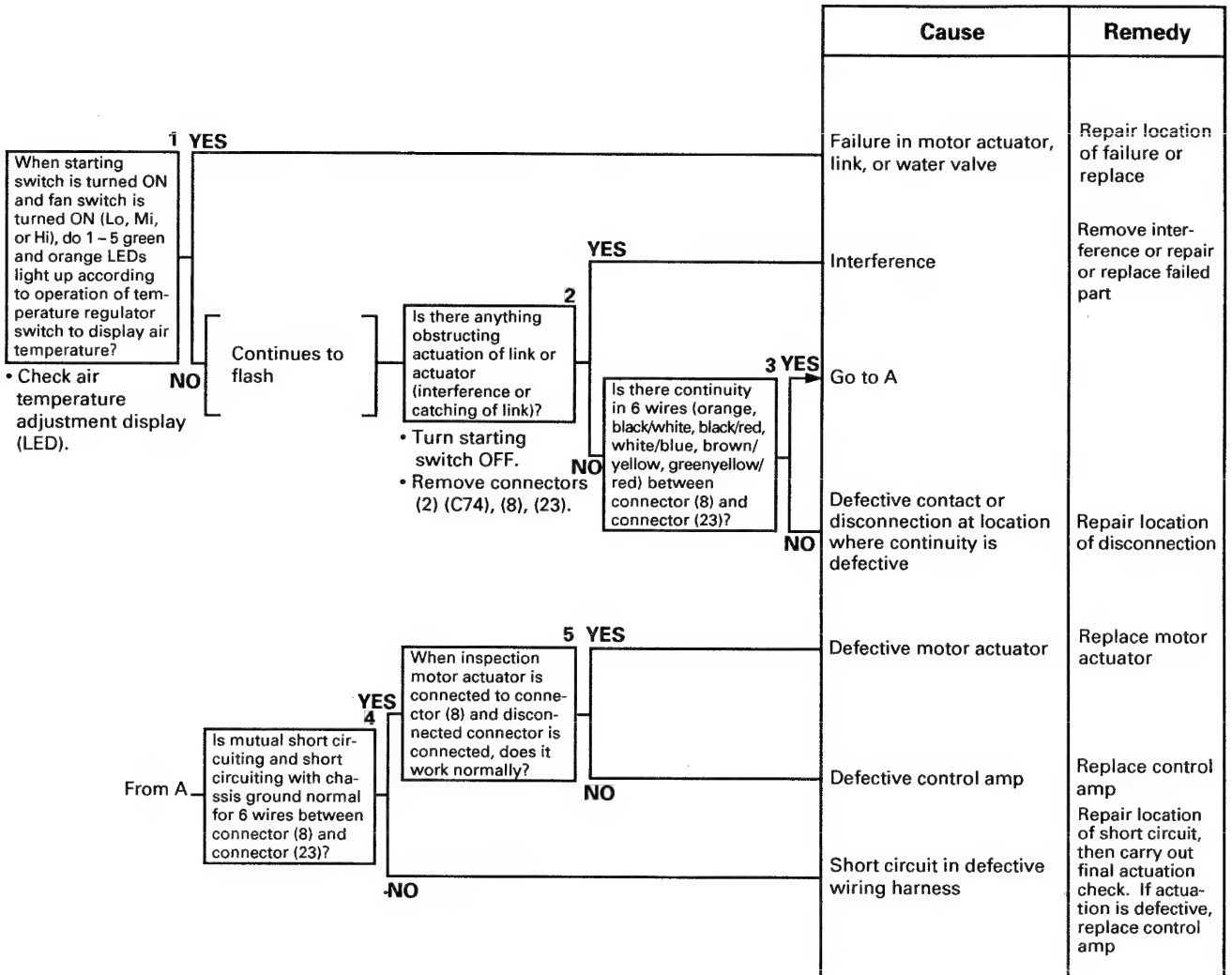
E-51 f) Impossible to adjust air temperature

Note: If any connectors are removed for inspection, connect them securely after completing repairs.

★ Check that top fuses 7, 17, and 20 are normal.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.



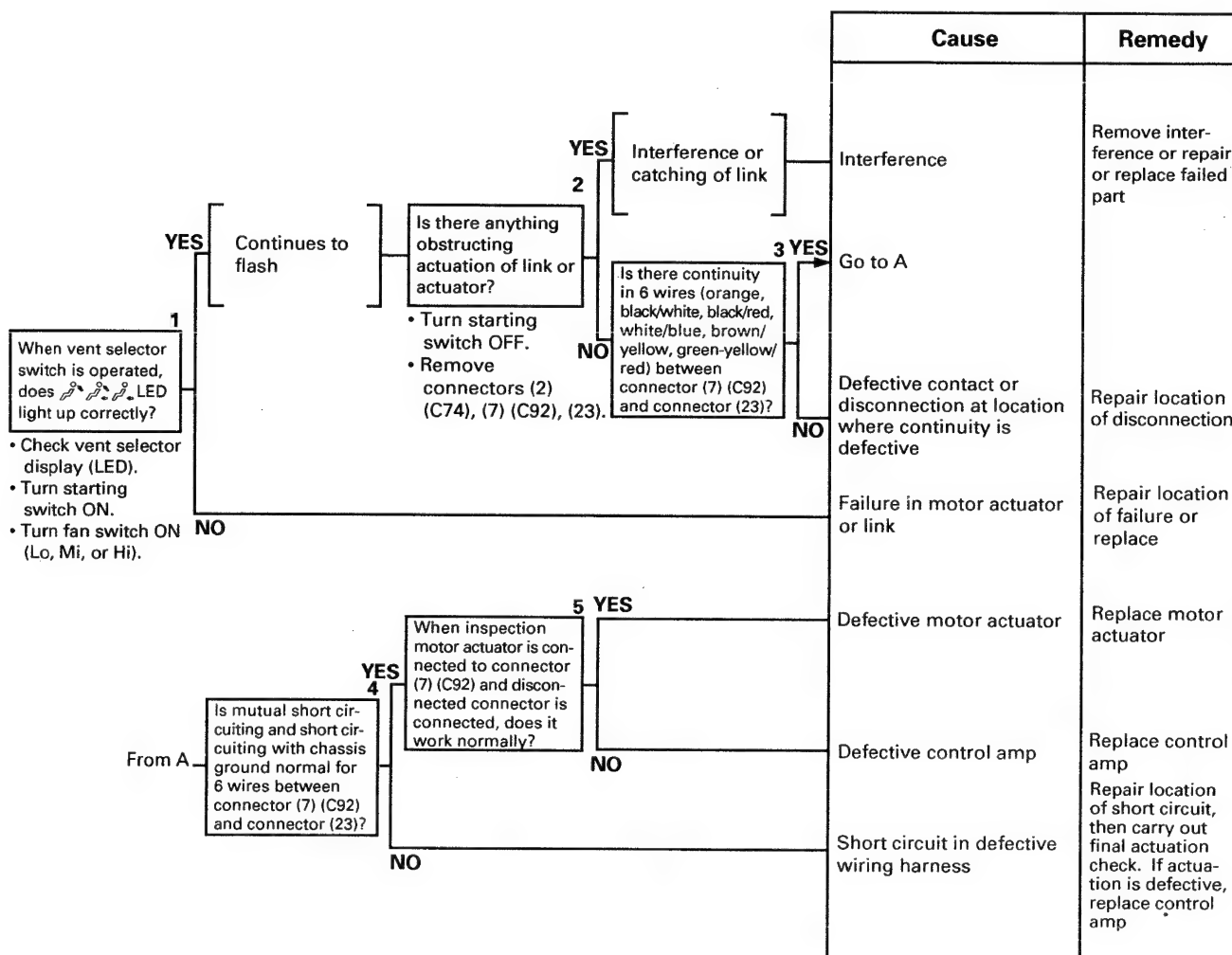
E-51 g) Impossible to switch vents

Note: If any connectors are removed for inspection, connect them securely after completing repairs.

★ Check that top fuses 7, 17, and 20 are normal.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.



023S02

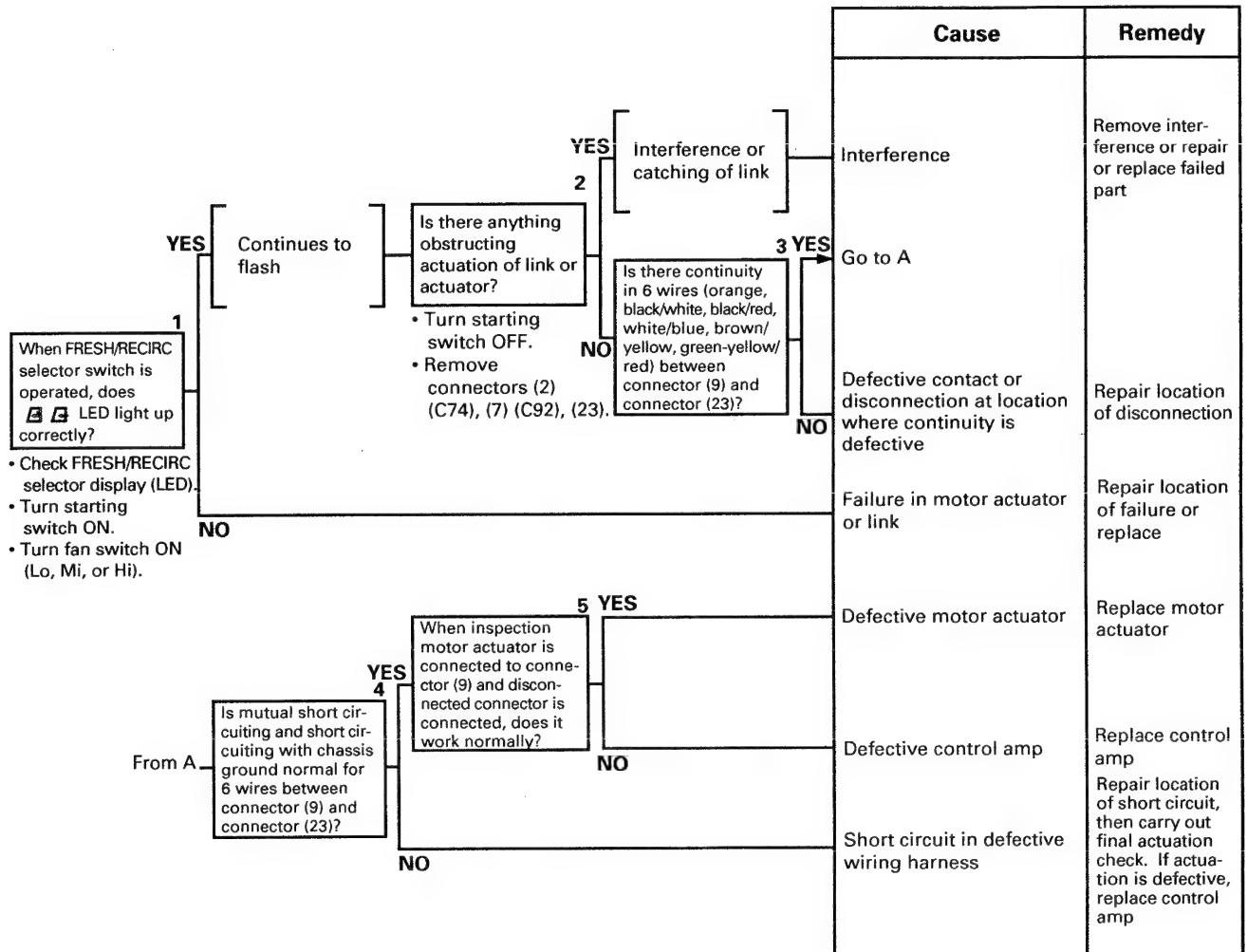
E-51 h) Impossible to switch FRESH/RECIRC

Note: If any connectors are removed for inspection, connect them securely after completing repairs.

★ Check that top fuses 7, 17, and 20 are normal.

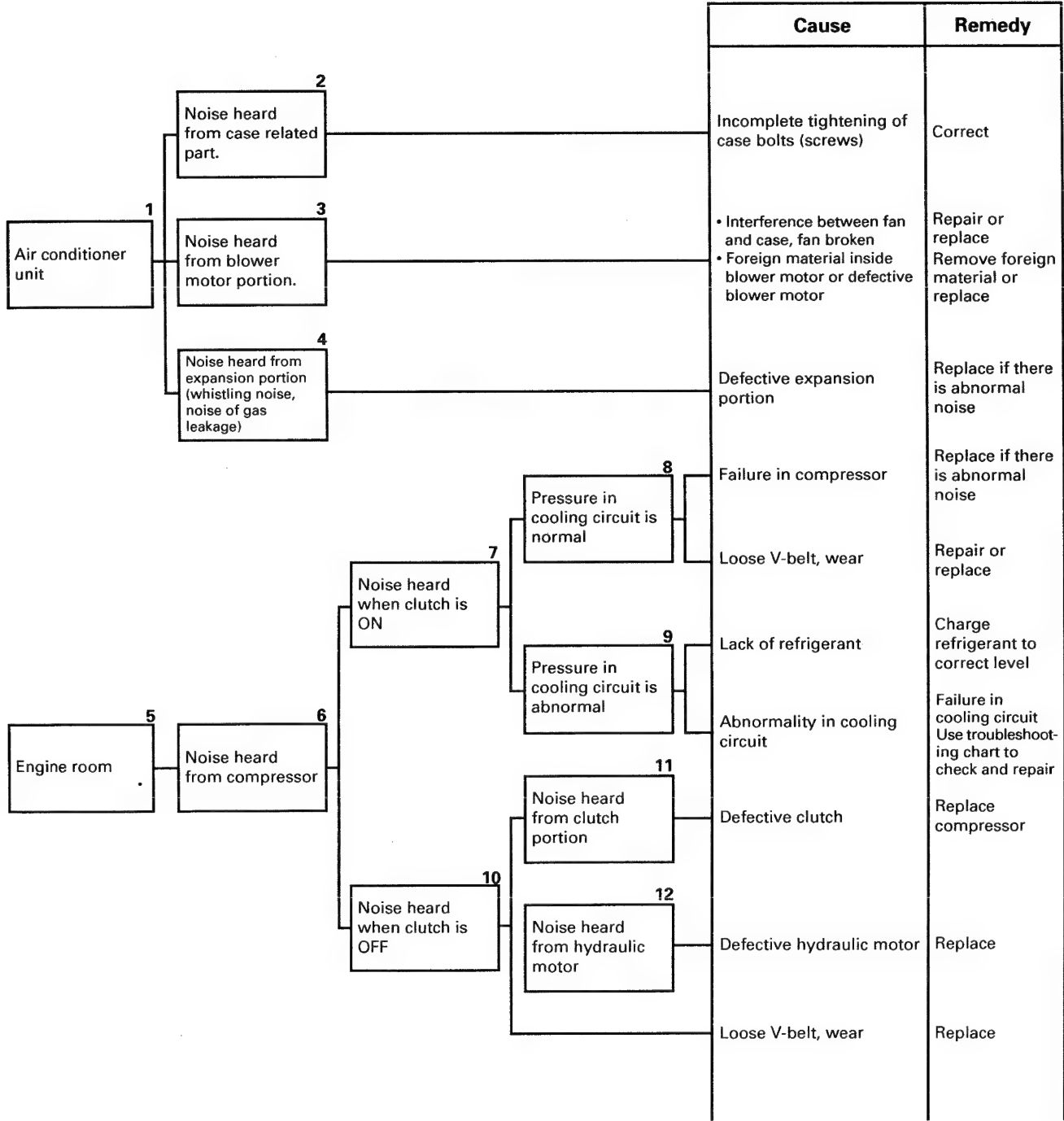
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.



E-51 i) Abnormal noise (troubleshooting table for abnormal noise)

Note: If any connectors are removed for inspection, connect them securely after completing repairs.
★ Check that top fuses 7, 17, and 20 are normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on to the next step.



023S02

E-51 j) Water leaks from air conditioner unit (troubleshooting table for water leakage from air conditioner unit)

Note: If any connectors are removed for inspection, connect them securely after completing repairs.

★ Check that top fuses 7, 17, and 20 are normal.

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on to the next step.

		Cause	Remedy
Leakage of water when cooling (when heating and dehumidifying)	1		
	2	Clogged water drain port of air conditioner unit	Remove foreign material
		Clogged drain hose, bent, incomplete mounting, hole	Remove foreign material, install correctly, replace
Air conditioner unit	3	Cracked case	Replace
		Incomplete tightening of air conditioner case mounting bolts (screws)	Correct
	4		
	5	Incomplete tightening of hot water circuit piping connection	Tighten connection fully
	6	Defective heater core	Replace
Water spraying out from vent when cooling (when heating and dehumidifying)	7	Defective water valve	Replace
	8	Failure in drain hose discharge valve	Replace drain hose

023S02

Additional information for troubleshooting of air conditioner

1) Normal pressure in refrigerating circuit

[Conditions]

Engine warming-up operation	Radiator water temperature stable
Engine speed	High idling
Air conditioner display switch	ON
Wind force regulator switch	Hi (wind force: strong)
Temperature regulator switch	Strong cooling
FRESH/RECIRC selector switch	RECIRC
Door	Fully open
Intake air temperature	Approx. 30°C

[Normal pressure]

Low pressure	Approx. 0.1 – 0.2 MPa {1.0 – 2.0 kg/cm ² }
High pressure	Approx. 1.6 – 1.8 MPa {16 – 18 kg/cm ² }

※ If the above conditions change, the pressure also changes.

2) Thermistor resistance value

Temperature (C°)	0	5	10	15	20	25	30
Thermistor resistance (kΩ)	7.2	5.6	4.4	3.5	2.8	2.2	1.8

3) Specified pressure of pressure switch (supplied with receiver dryer)

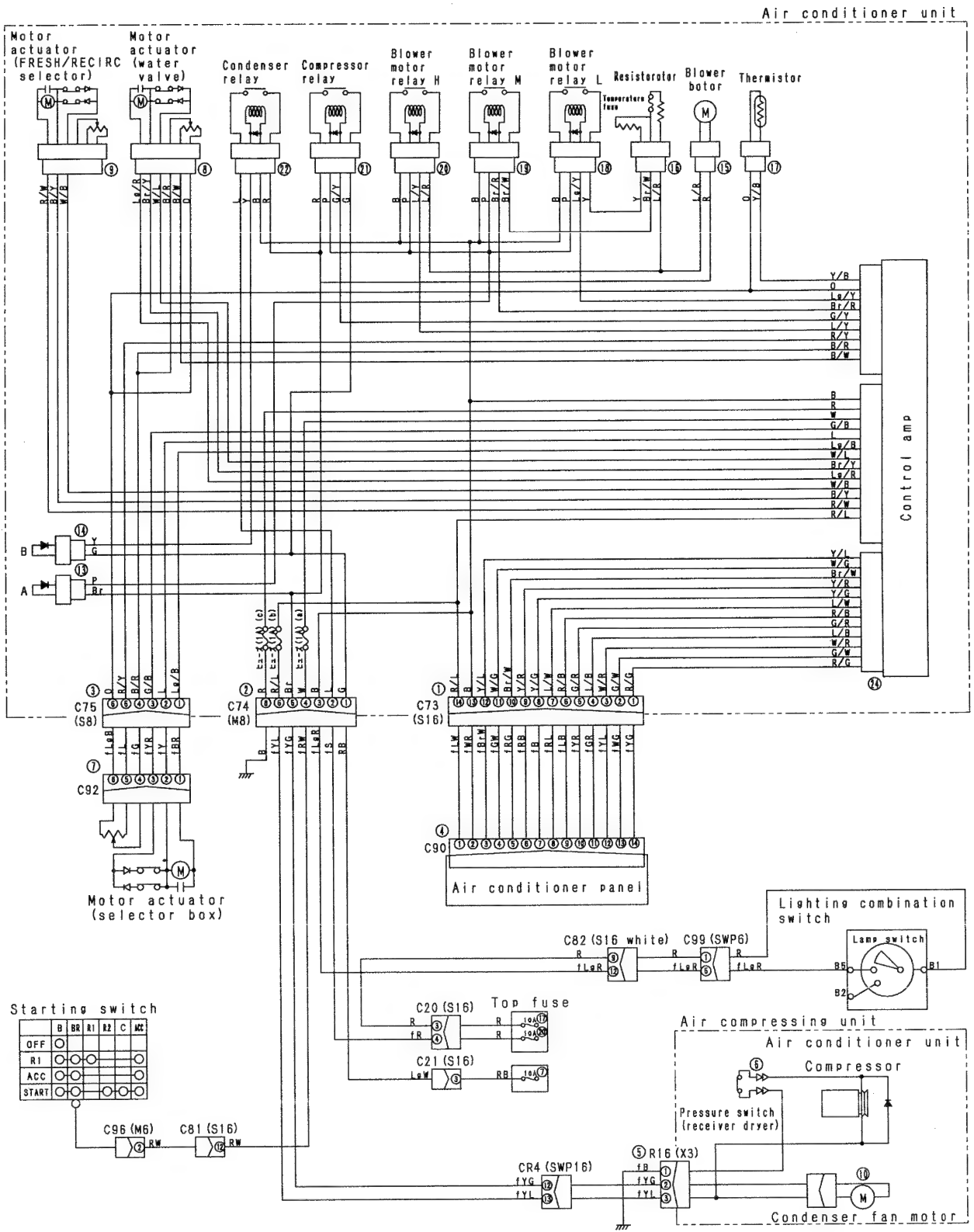
Low pressure side OFF pressure	Approx. 0.196 ± 0.02 MPa {2.0 ± 0.2 kg/cm ² }
Low pressure side RESET pressure	Approx. OFF pressure ± 0.03 MPa {0.3 kg/cm ² }
High pressure side OFF pressure	3.14 ± 0.2 MPa {32 ± 2 kg/cm ² }
High pressure side RESET pressure	Approx. OFF pressure ± 0.6 ± 0.2 MPa {6 ± 2 kg/cm ² }

4) Correct amount of refrigerant for charging refrigerating circuit

LW250-5 900 ± 50g

E-51 Related electrical circuit for air conditioner

023S02



TKL00688

30 DISASSEMBLY AND ASSEMBLY

023S02

METHOD OF USING MANUAL	30- 5	PTO SET CYLINDER	
PRECAUTIONS WHEN CARRYING OUT		Removal and installation	30- 49
OPERATION.....	30- 6	Disassembly and assembly	30- 50
SPECIAL TOOL LIST	30- 8	ACCELERATOR CONTROL CYLINDER	
SKETCHES OF SPECIAL TOOLS	30-13	Removal and installation	30- 51
STARTING MOTOR		Disassembly.....	30- 52
Removal and installation	30-16	Assembly	30- 53
ALTERNATOR		FUEL TANK	
Removal and installation	30-17	Removal and installation	30- 54
ENGINE OIL COOLER		DAMPER	
Removal and installation	30-18	Removal	30- 55
FUEL INJECTION PUMP		Installation	30- 57
Removal	30-19	DAMPER COVER	
Installation	30-20	Disassembly.....	30- 58
WATER PUMP		Assembly	30- 59
Removal and installation	30-21	TRANSMISSION	
THERMOSTAT		Removal	30- 61
Removal and installation	30-22	Installation	30- 64
MUFFLER		TRANSMISSION	
Removal and installation	30-23	Disassembly.....	30- 65
EXHAUST BRAKE		Assembly	30- 85
Removal and installation	30-24	TORQUE CONVERTER	
TURBOCHARGER		Disassembly.....	30-111
Removal and installation	30-25	Assembly	30-115
NOZZLE HOLDER		TRANSMISSION CONTROL VALVE	
Removal and installation	30-26	Removal and installation	30-120
ENGINE FRONT SEAL		Disassembly.....	30-122
Removal and installation	30-27	Assembly	30-126
ENGINE REAR SEAL		HI/LO, 2WD/4WD SELECTOR SOLENOID	
Removal	30-29	VALVE	
Installation	30-30	Removal and installation	30-130
CYLINDER HEAD		FRONT AXLE	
Removal	30-33	Removal	30-131
Installation	30-37	Installation	30-133
AIR COMPRESSOR		REAR AXLE	
Removal	30-40	Removal	30-134
Installation	30-42	Installation	30-136
ENGINE		AXLE	
Removal	30-44	Disassembly.....	30-137
Installation	30-47	Assembly	30-143
RADIATOR, POWER TRAIN OIL COOLER,		DIFFERENTIAL	
HYDRAULIC COOLER		Disassembly.....	30-152
Removal and installation	30-48	Assembly	30-156

PARKING BRAKE SHOE	
Removal	30-163
Installation	30-164
WHEEL ASSEMBLY	
Removal and installation	30-165
WHEEL BRAKE DISC PLATE	
Removal	30-166
Installation	30-168
REAR STEERING LOCK CYLINDER	
Removal and installation	30-170
SUSPENSION LOCK CYLINDER	
Removal and installation	30-171
SUSPENSION LIFT VALVE	
Removal and installation	30-172
SWING CIRCLE	
Removal and installation	30-173
AIR GOVERNOR	
Removal and installation	30-174
AIR REGULATOR VALVE	
Removal and installation	30-175
WHEEL BRAKE VALVE	
Removal and installation	30-176
WHEEL BRAKE AIR MASTER	
Removal and installation	30-177
Disassembly	30-178
Assembly	30-180
PARKING BRAKE SOLENOID VALVE	
Removal and installation	30-183
AUXILIARY BRAKE SOLENOID VALVE	
Removal and installation	30-183
EXHAUST BRAKE SOLENOID VALVE	
Removal and installation	30-184
WHEEL BRAKE CALIPER	
Removal and installation	30-185
Disassembly and assembly	30-186
PARKING BRAKE CHAMBER	
Removal and installation	30-187
Disassembly and assembly	30-188
HYDRAULIC TANK ASSEMBLY	
Removal and installation	30-189
WINCH, BOOM, PPC PUMP	
Removal and installation	30-190
TRANSMISSION, STEERING (OUTRI-GGER), SWING PUMP	
Removal and installation	30-191
MAXIMUM FLOW CONTROL VALVE	
Removal and installation	30-192
Disassembly and assembly	30-193
CENTER SWIVEL JOINT	
Removal	30-194
Installation	30-196
Disassembly	30-198
Assembly	30-200
STEERING PRIORITY VALVE	
Removal and installation	30-202
Disassembly and assembly	30-203

STEERING VALVE	
Removal and installation	30-204
Disassembly	30-205
Assembly	30-208
EMERGENCY STEERING PUMP	
Removal and installation	30-212
EMERGENCY STEERING PUMP, MOTOR	
Removal and installation	30-213
STEERING MODE SOLENOID VALVE	
Removal and installation	30-214
STEERING CYLINDER	
Removal and installation	30-215
OUTRIGGER CONTROL VALVE	
Removal and installation	30-216
OUTRIGGER JACK CYLINDER CHECK VALVE	
Removal and installation	30-217
Disassembly and assembly	30-218
OUTRIGGER INDIVIDUAL SOLENOID VALVE	
Removal and installation	30-219
OUTRIGGER SLIDE CYLINDER (X-SHAPED)	
Removal and installation	30-220
OUTRIGGER JACK CYLINDER (X-SHAPED)	
Removal and installation	30-221
Disassembly	30-222
Assembly	30-224
OUTRIGGER SLIDE PILOT CHECK VALVE	
Removal and installation	30-227
OUTRIGGER SLIDE PILOT CHECK VALVE	
Disassembly and assembly	30-228
PPC RELIEF VALVE	
Removal and installation	30-229
Disassembly and assembly	30-230
BOOM HOIST, MAIN WINCH, AUXILIARY WINCH PPC VALVE	
Removal and installation	30-231
JIB POWER TILT, SWING PPC VALVE	
Removal	30-232
Installation	30-233
BOOM TELESCOPE PPC VALVE	
Removal and installation	30-234
LEVER CONTROL PPC VALVE	
Disassembly	30-235
Assembly	30-237
PEDAL CONTROL PPC VALVE	
Removal and installation	30-239
Disassembly	30-240
Assembly	30-241
WINCH BRAKE MASTER CYLINDER	
Removal and installation	30-242
WINCH BRAKE MASTER CYLINDER	
Disassembly	30-243
Assembly	30-244
BOOM, WINCH CONTROL VALVE	
Removal	30-245
Installation	30-246
Disassembly	30-247
Assembly	30-252

SWING CONTROL VALVE		
Removal and installation	30-258	
SWING CONTROL VALVE		
Disassembly	30-259	
Assembly	30-261	
SWING PPC SHUTTLE VALVE		
Removal and installation	30-263	
SWING BRAKE SOLENOID VALVE		
Removal and installation	30-264	
SWING MOTOR, SWING MACHINERY		
Removal and installation	30-265	
SWING FREE SOLENOID VALVE		
Removal and installation	30-266	
SWING, OUTRIGGER MERGE VALVE		
Removal and installation	30-267	
SWING, OUTRIGGER MERGE SELECTOR		
SOLENOID VALVE		
Removal and installation	30-268	
ACCUMULATOR		
Removal and installation	30-269	
ACCUMULATOR		
Disassembly	30-270	
Assembly	30-272	
ACCUMULATOR CHARGE VALVE		
Removal and installation	30-275	
Disassembly	30-276	
Assembly	30-277	
WINCH CLUTCH VALVE		
Removal and installation	30-278	
Disassembly	30-280	
Assembly	30-281	
MAIN, AUXILIARY WINCH MOTOR		
Removal and installation	30-282	
BOOM HOIST CYLINDER		
Removal and installation	30-283	
BOOM HOIST CYLINDER		
Disassembly	30-284	
Assembly	30-287	
BOOM TELESCOPE ORDER SELECTOR		
SOLENOID VALVE		
Removal and installation	30-290	
PEDAL CONTROL SELECTOR VALVE		
Removal and installation	30-291	
WINCH BRAKE CALIPER		
Removal and installation	30-292	
PPC UNLOAD SOLENOID VALVE		
Removal and installation	30-293	
MAIN UNLOAD SOLENOID VALVE		
Removal and installation	30-294	
JIB ROTATION CYLINDER		
Removal and installation	30-295	
JIB POWER TILT CYLINDER		
Removal and installation	30-296	
Disassembly	30-297	
Assembly	30-300	
JIB LOCK CYLINDER		
Removal and installation	30-303	
HYDRAULIC CYLINDER		
Disassembly	30-304	
Assembly	30-306	
JIB EXTEND/STOW SOLENOID VALVE		
Removal and installation	30-309	
PTO CLUTCH, SUSPENSION LOCK PILOT		
SELECTOR VALVE		
Removal and installation	30-310	
AIR CONDITIONER COMPRESSOR MOTOR		
Removal and installation	30-311	
AIR CONDITIONER COMPRESSOR MOTOR		
CHECK VALVE		
Removal and installation	30-312	
AIR CONDITIONER MOTOR CHECK VALVE		
Disassembly and assembly	30-313	
Removal and installation	30-314	
ACCELERATOR CONTROL VALVE		
Disassembly and assembly	30-315	
MAIN WINCH, AUXILIARY WINCH		
Removal	30-316	
Installation	30-317	
MAIN WINCH, AUXILIARY WINCH		
Disassembly	30-318	
Assembly	30-323	
BOOM		
Removal	30-329	
Installation	30-332	
Disassembly	30-332-1	
Assembly	30-332-9	
BOOM TELESCOPE CYLINDER		
Disassembly	30-333	
Assembly	30-336	
JIB		
Removal	30-339	
Installation	30-341	
OUTRIGGER (X-SHAPED)		
Removal	30-344	
Installation	30-345	
OPERATOR'S CAB		
Removal	30-346	
Installation	30-349	
REVOLVING FRAME		
Removal	30-350	
Installation	30-352	
HOOD		
Removal and installation	30-353	
AIR CONDITIONER COMPRESSOR		
Removal and installation	30-354	
Removal and installation	30-355	
UPPER MDT CONTROLLER		
Removal and installation	30-356	
MOMENT LIMITER CONTROLLER		
Removal and installation	30-357	
LOWER MDT CONTROLLER		
Removal and installation	30-358	
TRANSMISSION CONTROLLER		
Removal and installation	30-359	

JIB TRANSMISSION MODULE	
Removal and installation	30-360
SLIP RING	
Removal and installation	30-361
JIB TILT CORD REEL	
Removal and installation	30-362
JIB EXTEND CORD REEL	
Removal and installation	30-363
OUTRIGGER LENGTH SENSOR	
Removal and installation	30-364
BOOM LENGTH SENSOR	
Removal and installation	30-365
FRONT HOSE REEL	
Removal and installation	30-366

METHOD OF USING MANUAL

1. When removing or installing unit assemblies

- ① When removing or installing a unit assembly, the order of work and techniques used are given for the removal operation; the order of work for the installation operation is not given.
- ② Any special techniques applying only to the installation procedure are marked ※ 1, and the same mark is placed after the relevant step in the removal procedure to indicate which step in the installation procedure it applies to.

(Example)

REMOVAL OF TMMMM ASSEMBLY Title of operation

 Precautions related to safety when carrying out the operation

1. xxx (1) Step in operation

★ Technique or important point to remember when removing xxx (1).

2. △△△ (2) ※ 1 Indicates that a technique is listed for use during installation

3. □□□ assembly (3)

 See Lubricant and Coolant Table

INSTALLATION OF TMMMM ASSEMBLY.. Title of operation


• Carry out installation in the reverse order to removal.

※ 1 Technique used during installation

★ Technique or important point to remember when installing (2).

• Adding water, oil Step in operation

★ Point to remember when adding water or oil

 Quantity when filling with oil and water

2. General precautions when carrying out installation or removal (disassembly or assembly) of units are given together as PRECAUTIONS WHEN CARRYING OUT OPERATION, so be sure to follow these precautions when carrying out the operation.

3. Listing of special tools

- ① For details of the description, part number, and quantity of any tools (A1, etc.) that appear in the operation procedure, see the SPECIAL TOOLS LIST given in this manual.

023S02

PRECAUTIONS WHEN CARRYING OUT OPERATION

[When carrying out removal or installation (disassembly or assembly) of units, be sure to follow the general precautions given below when carrying out the operation.]

1. Precautions when carrying out removal work

- If the coolant contains antifreeze, dispose of it correctly.
- After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors. Do not pull the wires.
- Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- Check the number and thickness of the shims, and keep in a safe place.
- When raising components, be sure to use lifting equipment of ample strength.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

★ Precautions when handling piping during disassembly

Fit the following blind plugs into the piping after disconnecting it during disassembly operations.

1) Hoses and tubes using sleeve nuts

Nominal number	Plug	Sleeve nut (elbow end)	Use the two items below as a set
02	07376-50210	07221-20210(Nut),	07222-00210(Plug)
03	07376-50315	07221-20315(Nut),	07222-00312(Plug)
04	07376-50422	07221-20422(Nut),	07222-00414(Plug)
05	07376-50522	07221-20522(Nut),	07222-00515(Plug)
06	07376-50628	07221-20628(Nut),	07222-00616(Plug)
10	07376-51034	07221-21034(Nut),	07222-01018(Plug)
12	07376-51234	07221-21234(Nut),	07222-01219(Plug)

2) Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

3) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions (mm)		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34

2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
 - Install the hoses without twisting or interference.
 - Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
 - Bend the cotter pin or lock plate securely.
 - When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2 – 3 drops of adhesive.
 - When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
 - Clean all parts, and correct any damage, dents, burrs, or rust.
 - Coat rotating parts and sliding parts with engine oil.
 - When press fitting parts, coat the surface with anti-friction compound (LM-P).
 - After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
 - When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
 - When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
 - When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
- ★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:
1. Start the engine and run at low idling.
 2. Operate the work equipment control lever to operate the hydraulic cylinder 4 – 5 times, stopping 100 mm from the end of its stroke.
 3. Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.
 4. After doing this, run the engine at normal speed.
- ★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operation

- If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.
- If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- If the hydraulic equipment has been removed for repair, always bleed the air from the system after reassembling the parts. For details, see TESTING AND ADJUSTING, Bleeding air.
- Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.

SPECIAL TOOL LIST

★ Tools with part number 79OT-000-0000 cannot be supplied (they are items to be locally manufactured).

★ New/remodel: N : Tools with new part numbers, newly developed for this model
 R : Tools with upgraded part numbers, remodeled from items already available for other models

Blank : Tools already available for other models, used without any modification

★ Tools marked O in the Sketch column are tools introduced in special sketches (See SKETCHES OF SPECIAL TOOLS).

Component	Symbol	Part No.	Part Name	Q'ty	New/ remodel	Sketch	Nature of work, remarks
Engine assembly	A	1	790-331-1110	Angle tightening wrench	1		Installation of cylinder head
		2	790-101-5401	Push tool kit	1		Installation of front seal (for repair)
			• 790-101-5421	• Grip	1		
			• 790-101-5431	• Plate	1		
			• 01010-51240	• Bolt	1		
		3	795-931-1100	Puller	1		Removal of rear seal (for repair)
		4	795-931-1210	Sleeve	1		Installation of rear seal (for repair)
			01050-31645	Bolt	3		
			01050-31625	Bolt	3		
			795-931-1220	Sleeve	1		
			01050-31645	Bolt	3		
			01050-31625	Bolt	3		
Torque converter assembly	C	790-332-1010	Wrench	1			Removal of stator shaft round nut
Transmission assembly	D	1	797T-423-1140	Push tool	1		Press fitting of output shaft bearing
		2	799-301-1600	Oil leak tester	1		Actuation check of piston
		3	795-630-1803	Torque wrench	1		Measurement of rotating torque
		4	790-201-2740	Spacer	1		Press fitting of 3rd, REVERSE clutch bearing
			797T-423-1130	Push tool	1	N O	
Axle assembly		1	790-425-1451	Shaft	1	N	Centering of housing and knuckle
Differential assembly	H	2	790-501-5000	Repair stand	1		Disassembly, assembly of differential assembly
			790-901-4110	Bracket	1		
			797-423-1110	Plate	1		
		3	796-465-1120	Spacer	1		Press fitting of pinion bearing
		4	796-795-1110	Push tool	1		Press fitting of bevel gear case bearing
		5	797T-423-1150	Push tool	1	N O	Press fitting of pinion oil seal
		6	797-423-1120	Plate	1		Adjusting backlash of bevel gear and pinion

023S02

Component	Symbol	Part No.	Part Name	Q'ty	New/ remodel	Sketch	Nature of work, remarks	
Final drive	J	797T-423-1190	Push tool	1	N	O	Disassembly, assembly	Press fitting of wheel hub seal
Center swivel joint assembly	T	790-101-2501	Puller	1			Disassembly, assembly	Disconnection of shaft and rotor
		• 790-101-2510	• Plate	1				
		• 790-101-2620	• Leg	2				
		• 790-101-2570	• Plate	4				
		• 790-101-2560	• Nut	2				
		• 790-101-2660	• Adapter	2				
		797T-423-1180	Plate	1	N	O		
		01050-51035	Bolt	3				
		790-201-2640	Plate	1				
		790-201-2750	Push tool	1				
Suspension lock cylinder assembly Steering cylinder assembly Outrigger slide assembly Jib rotation cylinder assembly Jib lock cylinder assembly	U	790-502-1003	Cylinder repair stand	1			Disassembly, assembly	Disassembly, assembly of hydraulic cylinder
		790-101-1102	Pump	1				
		790-302-1280	Socket (width across flats: 55)	1				Suspension lock cylinder
		790-302-1480	Socket (width across flats: 41)	1	N			Steering cylinder
		792-535-2340	Socket (width across flats: 36)	1				Outrigger slide cylinder Jib rotation cylinder
		790-201-1702	Push tool kit	1				Press fitting of coil bushing
		• 790-101-5021	• Grip	1				
		• 01010-50816	• Bolt	1				
		• 790-201-1761	• Push tool	1				
		• 790-201-1751	• Push tool	1				
		• 790-201-1731	• Push tool	1				
		• 790-201-1711	• Push tool	1				
		790-201-1500	• Push tool kit	1				Press fitting of dust seal
		• 790-101-5021	• Grip	1				
		• 01010-50816	• Bolt	1				
		• 790-201-1570	• Plate	1				
		• 790-201-1560	• Plate	1				
		• 790-201-1540	• Plate	1				
		• 790-201-1520	• Plate	1				

023S02

Component	Symbol	Part No.	Part Name	Q'ty	New/ remodel	Sketch	Nature of work, remarks		
Suspension lock cylinder assembly Steering cylinder assembly Outrigger slide cylinder assembly Jib rotation cylinder assembly Jib lock cylinder assembly	U	5	790-720-1000	Expander	1		Disassembly, assembly	All cylinders	Removal, installation of piston ring
		6	796-720-1660	Ring	1			Suspension lock cylinder	
			07281-01159	Clamp	1			Steering cylinder	
			796-720-1640	Ring	1				
			07281-00909	Clamp	1			Outrigger slide cylinder (X, H-shaped)	
			796-720-1630	Ring	1				
			07281-00709	Clamp	1			Jib lock cylinder	
			796-720-1620	Ring	1				
			07281-00609	Clamp	1			Jib rotation cylinder	
			796-720-1740	Ring	1				
			07281-00809	Clamp	1				
7	790-102-3802	Wrench	1			Removal, installation of cylinder head			
Outrigger jack cylinder assembly	8	790-502-1003	Cylinder repair stand	1			Disassembly, assembly of cylinder assembly		
		790-101-1102	Pump	1					
	9	790-102-3902	Wrench	1			Removal, installation of piston		
	10	790-201-1702	Push tool kit	1			Disassembly, assembly	Press fitting of coil bushing	
		• 790-101-5021	• Grip	1					
		• 01010-50816	• Bolt	1					
		• 790-201-1950	• Push tool	1	N				Outrigger jack cylinder (X-shaped)
		• 790-201-1861	• Push tool	1					Outrigger jack cylinder (H-shaped)
	11	790-201-1500	Push tool kit	1			Disassembly, assembly	Press fitting of dust seal	
		• 790-101-5021	• Grip	1					
		• 01010-50816	• Bolt	1					
		• 790-201-1670	• Plate	1					Outrigger jack cylinder (H-shaped)
		790-445-4230	Push tool	1					Outrigger jack cylinder (X-shaped)
		790-101-5421	Grip	1					
		01010-51225	Bolt	1					
	12	790-720-1000	Expander	1			All cylinders	Removal, installation of piston ring	
	13	796-720-1690	Ring	1			Outrigger jack cylinder (X-shaped)		
		07281-01919	Clamp	1					
		796-720-1670	Ring	1					Outrigger jack cylinder (H-shaped)
		07281-01279	Clamp	1					
	14	790-102-3802	Wrench	1			Removal, installation of cylinder head		
Boom telescope cylinder assembly	15	790-502-1003	Cylinder repair stand	1			Disassembly, assembly of cylinder assembly		
		790-101-1102	Pump	1					
	16	790-102-4200	Socket assembly	1	N		Removal, installation of piston		
		• 790-102-4210	• Frame	1	N				

023S02

Component	Symbol	Part No.	Part Name	Q'ty	New/ remodel	Sketch	Nature of work, remarks				
Boom telescope cylinder assembly	U	16	• 790-102-4220	• Block	2	N	Disassembly, assembly	Removal, installation of piston			
			• 790-102-4130	• Screw	2						
			• 790-102-4140	• Plate	2						
			• 01010-80612	• Bolt	4						
			• 04230-11018	• Eyebolt	2						
			790-102-3140	Frame	1						
			790-102-3151	Frame	1						
			01010-81650	Bolt	8						
			01643-31645	Washer	8						
			01580-11613	Nut	4						
		17	797-463-1310	Push tool	1	N			No. 1 telescope cylinder	Press fitt- ing of coil bushing	
			797-463-1320	Push tool	1	N			No. 2 telescope cylinder		
		18	1	790-720-1000	Expander	1				All telescope cylinder	Install- ation of piston ring
				796-720-1670	Rubber band	1				No. 1 telescope cylinder	
			2	07281-01279	Clamp	1				No. 2 telescope cylinder	
				796-720-1680	Rubber band	1					
				07281-01589	Clamp	1					
		19	797-463-1250	Retainer	1	N			No. 1 telescope cylinder	Press fitt- ing of dust seal	
			797-463-1750	Retainer	1	N			No. 2 telescope cylinder		
		20		797-463-1340	Guide	1		N		No. 1 telescope cylinder	Install- ation of piston rod assembly
				797-463-1350	Guide	1		N		No. 2 telescope cylinder	
			21	790-102-3802	Wrench	1				Removal, installation of cylinder head	
		Boom hoist cylinder assembly		22	790-502-1003	Cylinder repair stand		1			Disassembly, assembly of cylinder head
790-101-1102	Pump				1						
23	790-102-3902			Wrench	1			Removal, installation of piston			
24	797-463-1110			Push tool	1	N		Press fitting of coil bushing			
25	1			790-720-1000	Expander	1			Installation of piston ring		
				796-720-1710	Rubber band	1					
	2			07281-02909	Clamp	1					Press fitting of dust seal
26				797-463-1150	Retainer	1	N		Installation of piston, rod assembly		
27	797-463-1360			Guide	1	N		Removal, installation of cylinder head			
Jib power tilt cylinder assembly				29	790-502-1003	Cylinder repair stand	1			Disassembly, assembly of cylinder assembly	
		790-101-1102	Pump		1						
		30	790-102-4200	Socket assembly	1	N		Removal, installation of piston			
			• 790-102-4210	• Frame	1	N					
			• 790-120-4220	• Block	2	N					

023S02

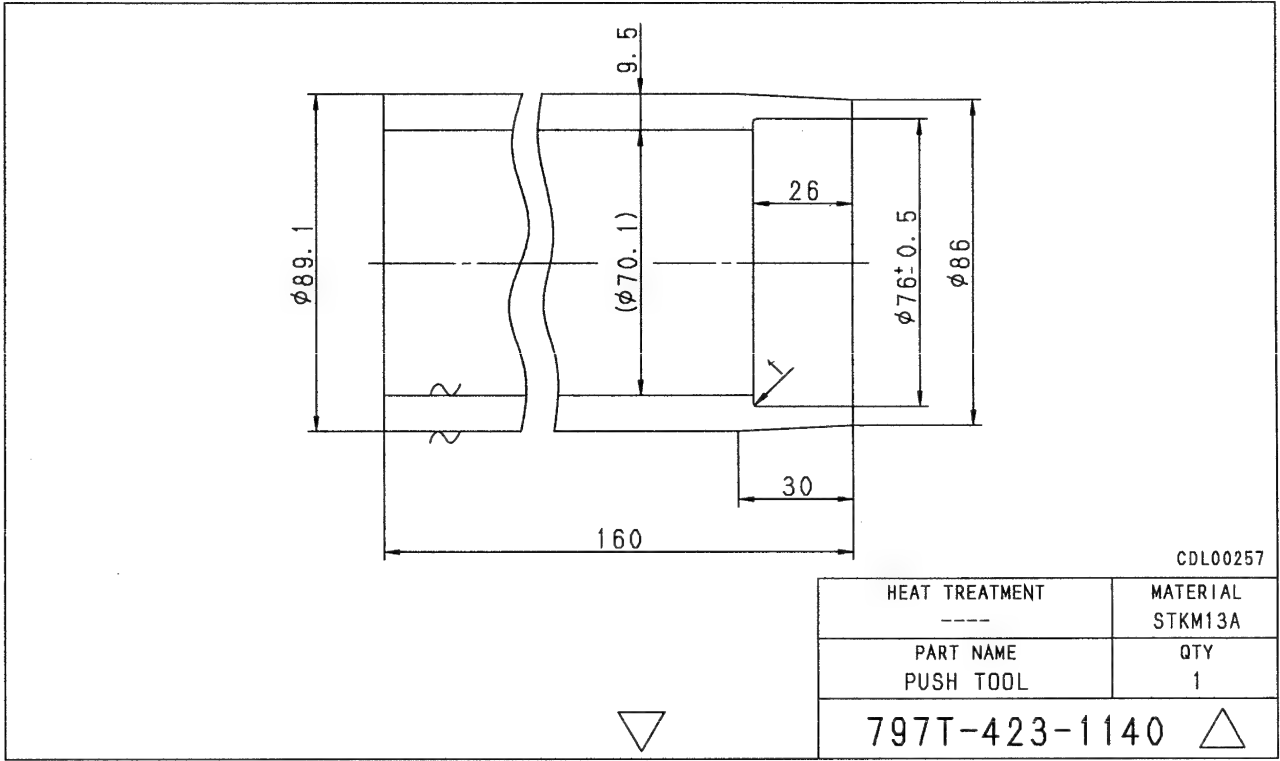
Component	Symbol	Part No.	Part Name	Q'ty	New/ remodel	Sketch	Nature of work, remarks
Jib power tilt cylinder assembly	U	30	• 790-102-4130 • Screw	2			Removal, installation of piston
			• 790-102-4140 • Plate	2			
			• 01010-80612 • Bolt	4			
			• 04530-11018 • Eyebolt	2			
			790-102-3140 Frame	1			
			790-102-3151 Frame	1			
			01010-81650 Bolt	8			
			01643-31645 Washer	8			
			01580-11613 Nut	4			
		31	797-463-1330 Push tool	1	N		Press fitting of coil bushing
		32	1 790-720-1000 Expander	1			Installation of piston ring
			2 796-720-1670 Rubber band	1			
			07281-01279 Clamp	1			
		33	797-463-1760 Retainer	1	N		Press fitting of dust seal
		34	797-463-1370 Guide	1	N		Installation of piston, rod assembly
		35	790-102-3802 Wrench	1			Removal, installation of cylinder head
Accumulator assembly		36	790-502-1003 Cylinder repair stand	1			Disassembly, assembly of accumulator
			790-101-1102 Pump	1			
		37	790-102-3802 Wrench	1			Removal, installation of round head
		38	790-720-1000 Expander	1			Installation of piston ring
		39	796-720-1660 Ring	1			
			07281-01159 Clamp	1			Releasing, charging with nitrogen gas
		40	792-610-2190 Joint	1			
			792-610-1700 Charge tool	1			Charging with nitrogen gas
		41	792-610-1260 Nipple	1			
Boom assembly	V		792-900-2100 Remover	1			Removal of boom foot pin
			790-101-3800 Puller (50 ton)	1			
			790-101-1102 Pump	1			
Revolving frame assembly	W		797T-446-1110 Plate	1	N	O	Removal, installation of revolving frame
			01010-82470 Bolt	1			
			01643-32460 Washer	3			
			01580-12419 Nut	1			
Winch assembly	X	1	797-475-1100 Lifting tool	1	N		Removal, installation of winch
			• 797-475-1110 • Hanger	1	N		
			• 797-475-1120 • Bolt	3	N		
			• 797-475-1130 • Nut	3	N		
			• 421-461-2740 • Linchpin	3			
			• 04530-11222 • Eyebolt	1			
Air conditioner related	2		799-703-1200 Service tool kit	1			Charging with freon gas
			799-703-1100 Vacuum pump	1			
			799-703-1400 Gas leak detector	1			

023S02

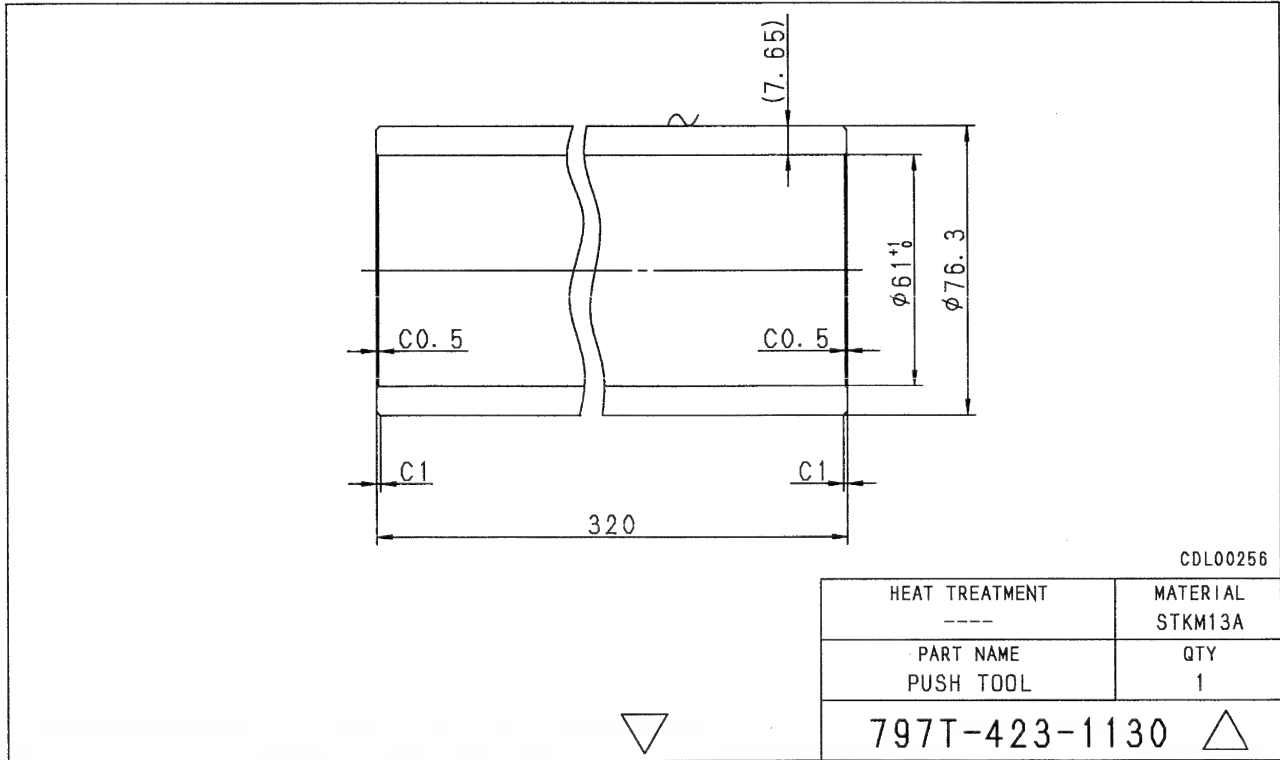
SKETCHES OF SPECIAL TOOLS

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

D1 Push tool



D4 Push tool



023S02

Technical drawing of a push tool (797T-423-1150) showing dimensions and material specifications.

Dimensions:

- Overall length: 124.5 ± 0.2
- Overall diameter: $\phi 135$
- Internal diameter: $\phi 105$
- Top chamfer: $R0.8$
- Top radius: $R1$
- Top hole diameter: $\phi 8.8$ (8.8 DRILL)
- Top hole depth: $C1$
- Top hole position: 7
- Bottom hole diameter: $\phi 6 \pm 0.5$
- Bottom hole depth: $C1$
- Bottom hole position: 11

Material and Heat Treatment:

HEAT TREATMENT ----	MATERIAL SS400P
PART NAME PUSH TOOL	QTY 1

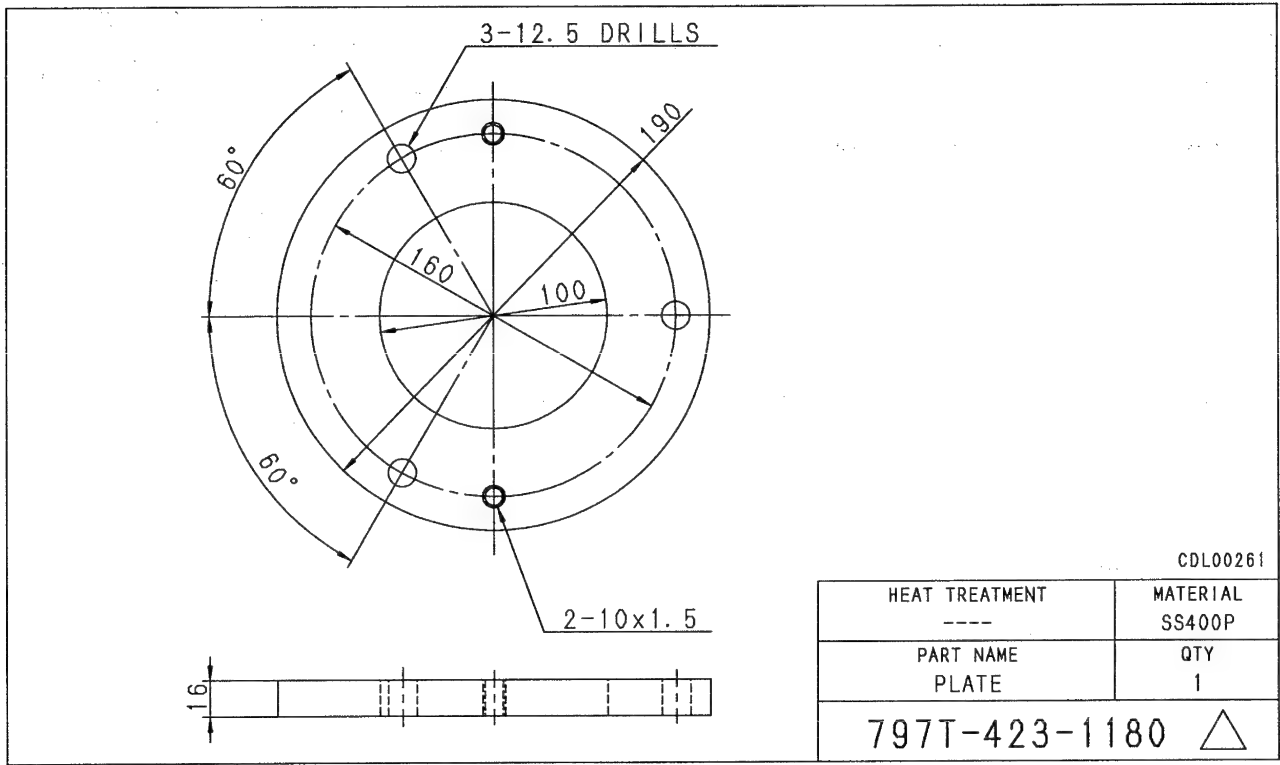
Part Number: 797T-423-1150

Technical drawing of a push tool. The drawing shows a cross-section of the tool with the following dimensions and features:

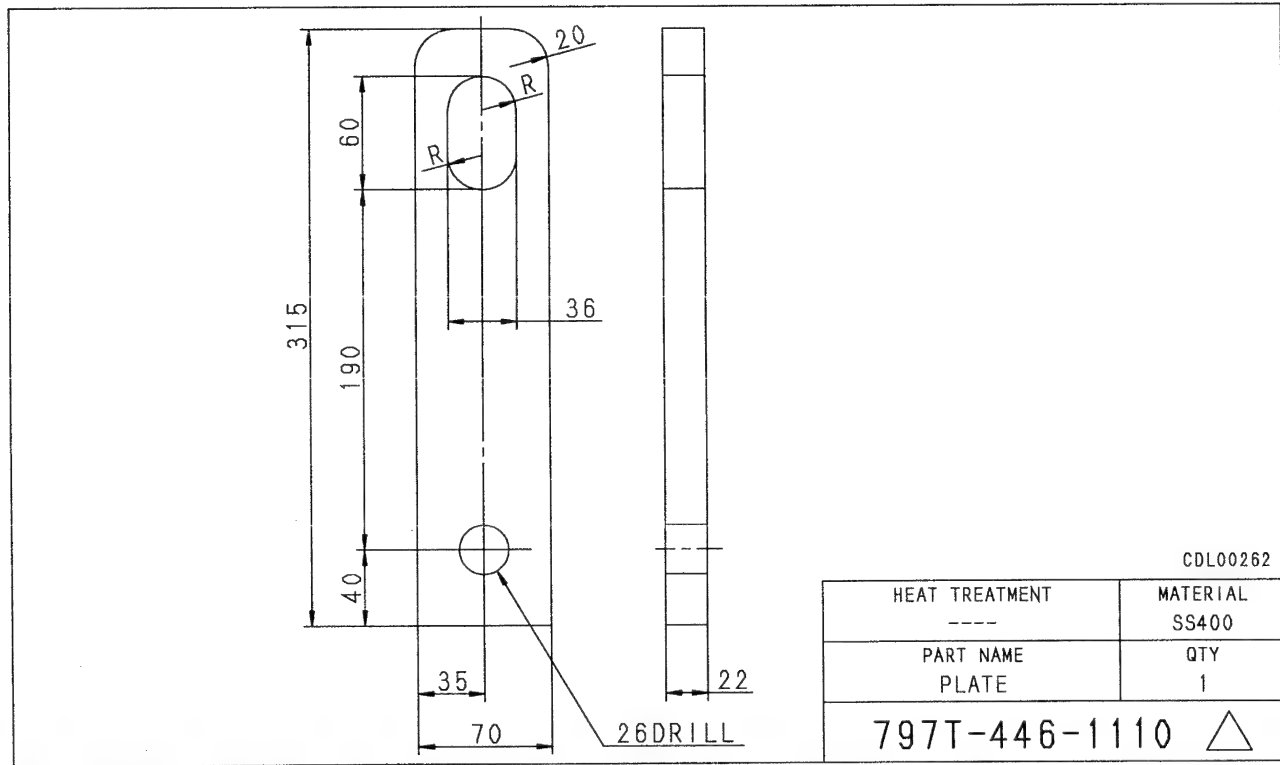
- Overall length: 220 ± 0.3
- Inner diameter: $\phi 180$
- Outer diameter: $\phi 220$
- Top chamfer: $R0.8$
- Bottom chamfer: $R0.8$
- Bottom hole diameter: $\phi 38$
- Bottom hole depth: 28.4 ± 0.2
- Bottom hole offset: $C1$
- Inner hole offset: $C1$
- Inner hole depth: 180
- Inner hole offset: $C1$

HEAT TREATMENT ----	MATERIAL SS400
PART NAME PUSH TOOL	QTY 1
797T-423-1190	

T Plate



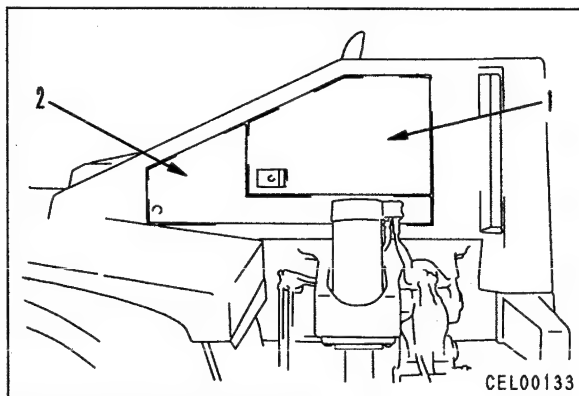
W Plate



REMOVAL OF STARTING MOTOR ASSEMBLY

- ⚠ Set the parking brake switch to PARKING
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove engine left covers (1) and (2).

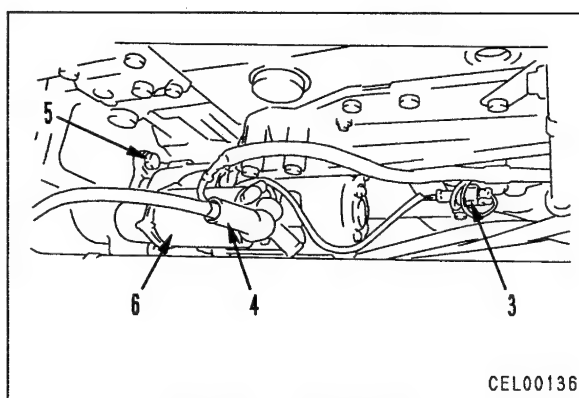


2. Disconnect wiring connector (E11) (3).

3. Remove starting motor wire (4).

4. Loosen mounting bolt (5) of starting motor assembly, then remove starting motor assembly (6).

★ Remove the starting motor from the flywheel so that it turns towards the engine block, then set the pinion gear facing down and remove the starting motor.



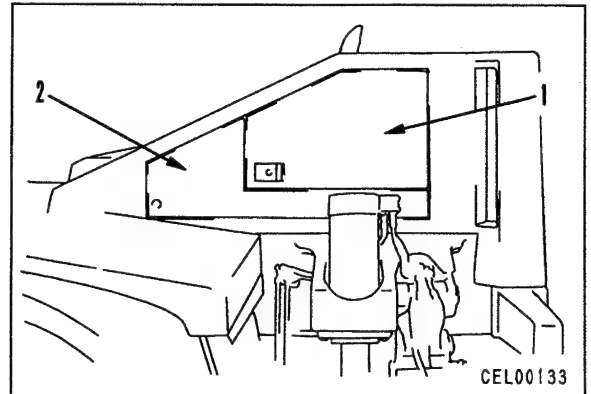
INSTALLATION OF STARTING MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

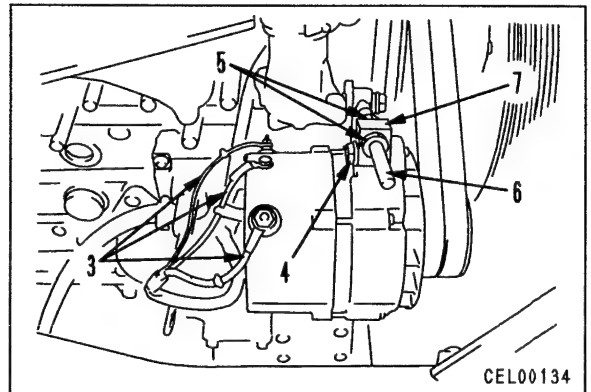
REMOVAL OF ALTERNATOR ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove engine left covers (1) and (2).



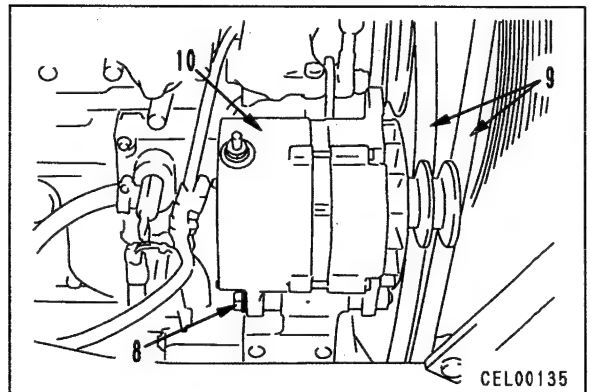
2. Disconnect alternator wires (E06, E14, E15) (3).
3. Loosen lock bolt (6) and locknuts (5) of belt tension adjustment bolt (4), then remove block (7).



4. Loosen mount bolt (8), then move alternator towards engine and remove belt (9) from pulley.

※ 1

5. Remove mount bolt (8), then remove alternator assembly (10).



INSTALLATION OF ALTERNATOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- Adjust the belt tension.
For details, see TESTING AND ADJUSTING, Testing and adjusting fan belt tension.

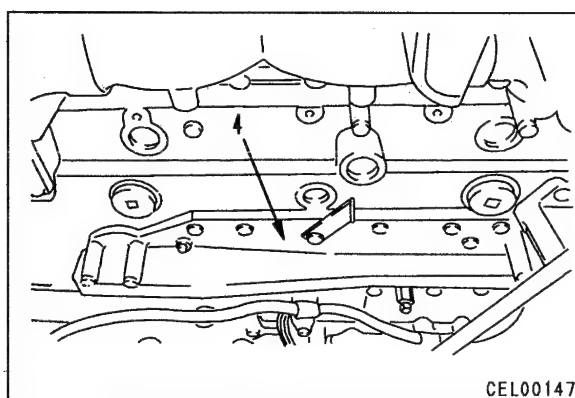
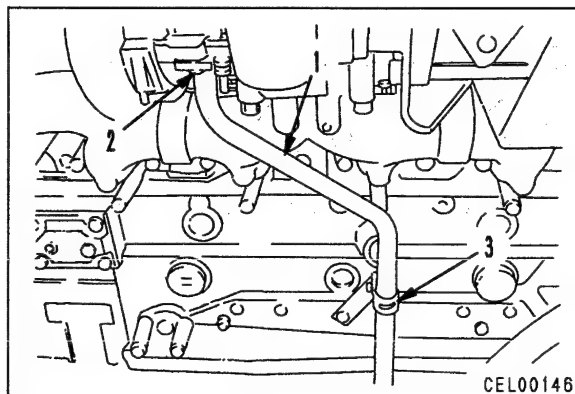
023S02

REMOVAL OF ENGINE OIL COOLER ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Loosen radiator drain valve and oil cooler drain valve, and drain coolant.
2. Remove starting motor assembly.
For details, see REMOVAL OF STARTING MOTOR ASSEMBLY.
3. Disconnect intermediate clamp (3) and mounting bolt (2) at turbocharger end of turbocharger lubrication return tube (1), then move tube to side.
4. Remove 16 mounting bolts, then remove oil cooler assembly (4).
5. Loosen nut (5) from engine oil cooler assembly (4), and remove engine oil cooler core (6).

※ 1



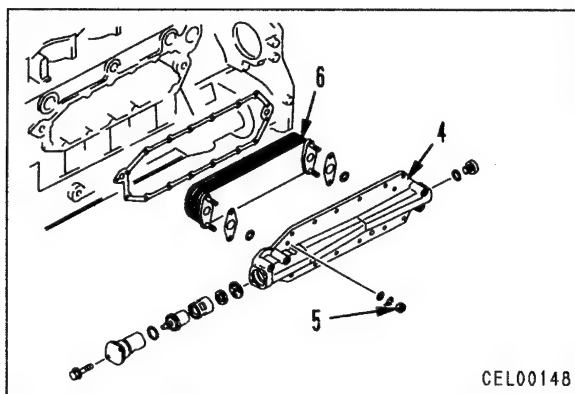
INSTALLATION OF ENGINE OIL COOLER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Oil cooler mounting bolt :
 $43.1 \pm 15.7 \text{ Nm}$ { $4.4 \pm 1.6 \text{ kgm}$ }

- **Refilling with water**
 Add water to the specified level. Run the engine to circulate the water through the system. Then check the water level in the reserve tank again.

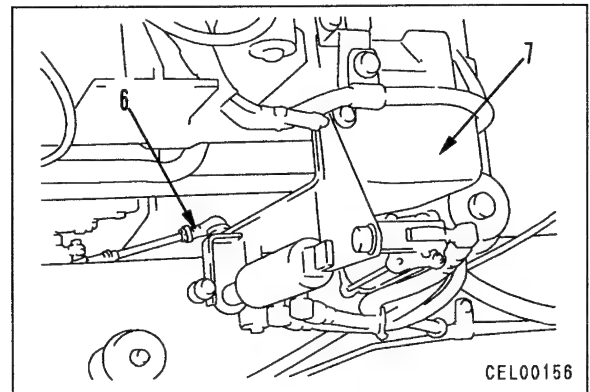
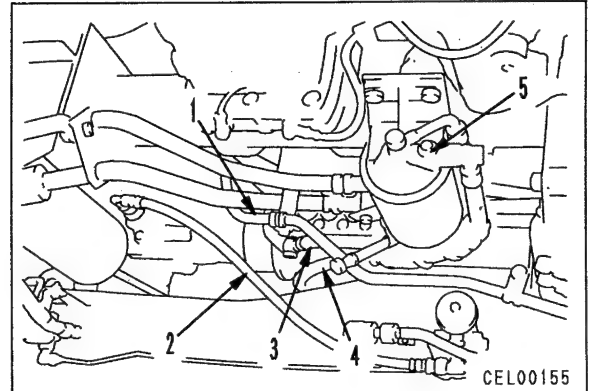


023S02

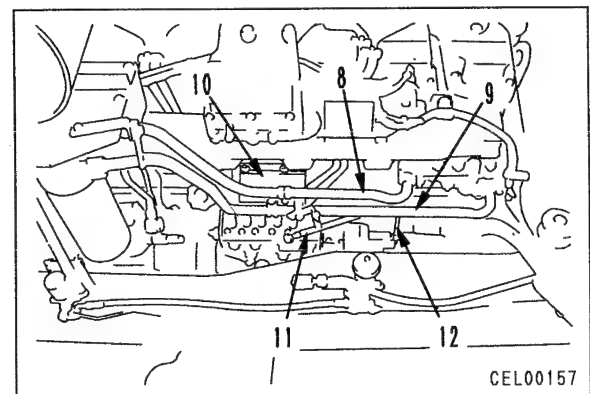
REMOVAL OF FUEL INJECTION PUMP ASSEMBLY

! Disconnect the cable from the negative (-) terminal of the battery.

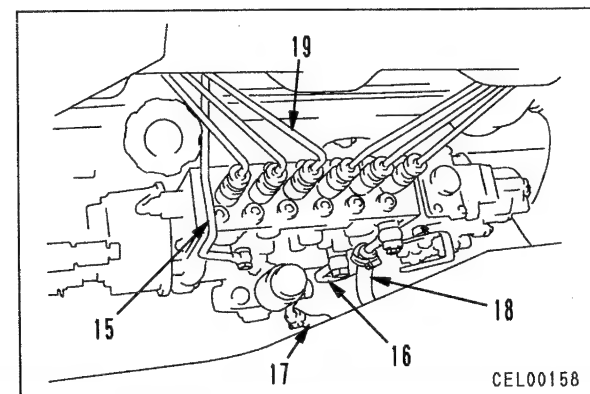
1. Remove hood assembly.
For details, see REMOVAL OF HOOD ASSEMBLY.
2. Remove air compressor tube (1) and hose (2).
3. Disconnect fuel hoses (3) and (4) at injection pump end. ※ 1
- ★ Fit a blind plug to prevent fuel from leaking out.
4. Remove fuel filter assembly (5) together with bracket.
5. Disconnect rod (6), then disconnect accelerator cylinder, PTO set cylinder, and bracket assembly (7) from intake manifold, and move towards outside.



6. Remove engine lubrication oil tubes (8) and (9), then remove bracket (10). ※ 2
7. Remove oil level gauge (11). ※ 3
8. Remove boost compensator tube (12). ※ 4
9. Disconnect engine stop motor cable (13), then remove bracket (14). ※ 5

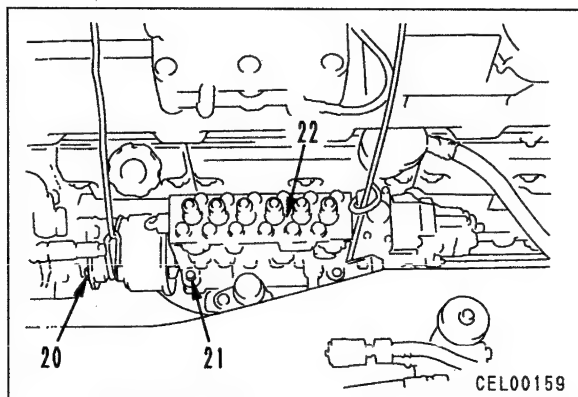


10. Disconnect lubrication tubes (15) and (16).
11. Disconnect fuel hoses (17) and (18).
12. Remove 6 fuel injection tubes (19). ※ 5



13. Remove coupling mounting bolt (20) of fuel injection pump, then loosen 4 fuel injection pump mounting bolts (21), and remove fuel injection pump assembly (22).

※ 6



INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- Fuel hose joint bolt :
 $22.05 \pm 2.45 \text{ Nm}$ { $2.25 \pm 0.25 \text{ kgm}$ }

※ 2

- Lubrication tube joint bolt (15) :
 $17.15 \pm 2.45 \text{ Nm}$ { $1.75 \pm 0.25 \text{ kgm}$ }
- Lubrication tube joint bolt (16) :
 $26.95 \pm 2.45 \text{ Nm}$ { $2.75 \pm 0.25 \text{ kgm}$ }

※ 3

- Boost compensator tube joint bolt :
 $11.25 \pm 1.45 \text{ Nm}$ { $1.15 \pm 0.15 \text{ kgm}$ }

※ 4

Adjust the stop lever.
For details, see TESTING AND ADJUSTING, Adjusting engine stop motor cable.

※ 5

- Injection tube sleeve nut :
 $23.52 \pm 0.98 \text{ Nm}$ { $2.4 \pm 0.1 \text{ kgm}$ }

※ 6

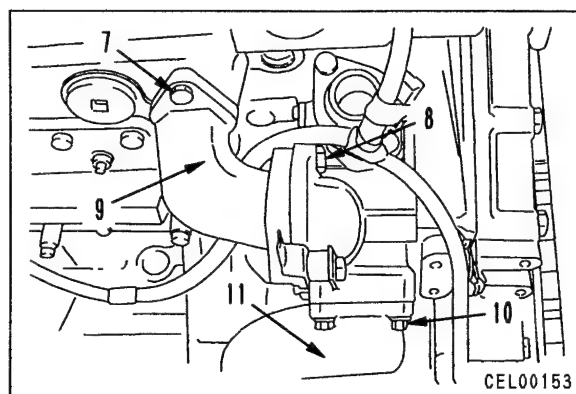
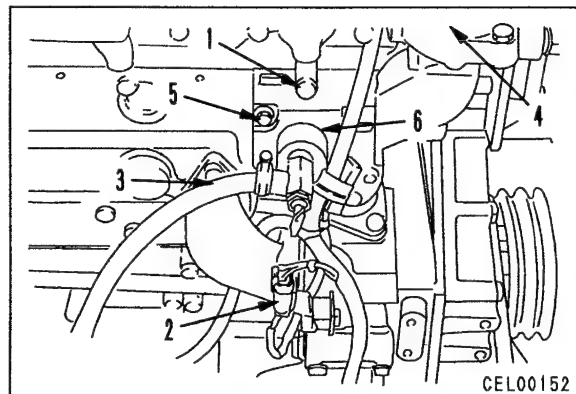
- Coupling mounting bolt :
 $63.2 \pm 1.5 \text{ Nm}$ { $6.45 \pm 0.15 \text{ kgm}$ }
- Pump mounting bolt :
 $22.05 \pm 2.45 \text{ Nm}$ { $2.25 \pm 0.25 \text{ kgm}$ }

- ★ Install the injection pump.
For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.
- ★ Bleed the air from the fuel system.
For details, see TESTING AND ADJUSTING, Bleeding air.

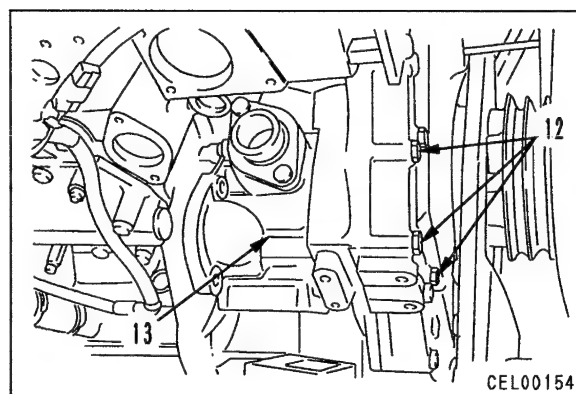
REMOVAL OF WATER PUMP ASSEMBLY

⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Loosen valve at bottom of radiator and drain coolant.
2. Remove hood assembly.
For details, see REMOVAL OF HOOD ASSEMBLY.
3. Remove alternator assembly.
For details, see REMOVAL OF ALTERNATOR ASSEMBLY.
4. Remove exhaust manifold mounting bolt (1).
5. Disconnect wiring connector (E04) (2).
6. Disconnect heater hose (3).
7. Disconnect tube (4), remove bolt (5), then remove thermostat housing (6).
8. Remove bolts (7) and (8), then remove tube (9) between pump and cooler.
9. Remove bolt (10), and disconnect inlet tube (11), then move towards frame.




10. Remove bolts (12), then remove water pump assembly (13).



INSTALLATION OF WATER PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

 **kgm** Water pump mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }

- Refilling with water
Add water to the specified level. Run the engine to circulate the water through the system. Then check the water level in the reserve tank again.

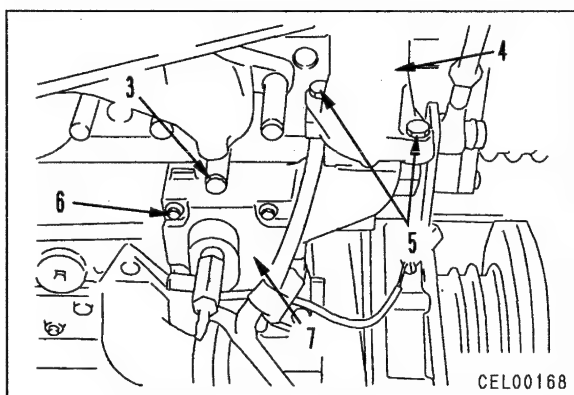
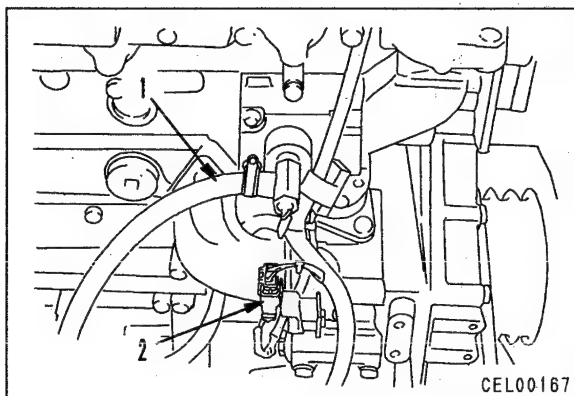
023S02

REMOVAL OF THERMOSTAT

⚠ Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.

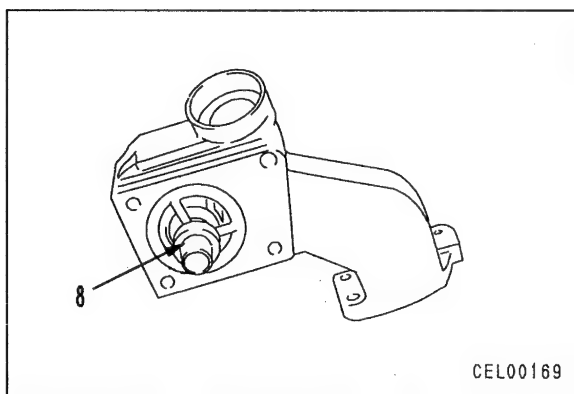
⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove alternator assembly.
For details, see REMOVAL OF ALTERNATOR ASSEMBLY.
2. Loosen band and disconnect heater hose (1).
3. Disconnect wiring connector (E04) (2).
4. Remove exhaust manifold mounting bolt (3).
5. Loosen mounting bolt (5) of tube (4).
6. Remove bolt (6), then remove thermostat assembly (7).
- ★ If the thermostat housing is lifted up and pulled to the front, it can be removed easily.
7. Remove thermostat assembly (8) from housing.




INSTALLATION OF THERMOSTAT

- Carry out installation in the reverse order to removal.



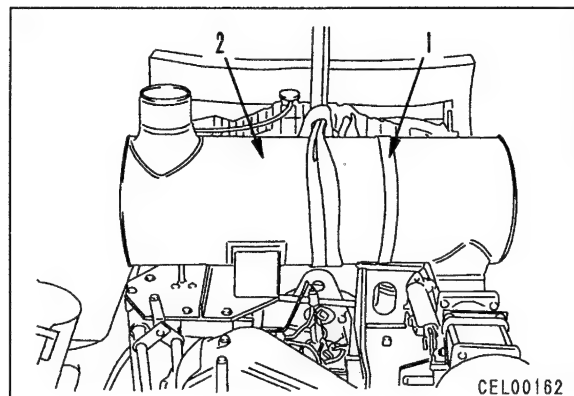
023S02

REMOVAL OF MUFFLER

1. Remove engine hood assembly.
For details, see REMOVAL OF HOOD ASSEMBLY.
2. Remove band (1). 
3. Remove 4 muffler mounting bolts, then raise muffler (2) and remove.
★ When removing the muffler, be careful not to damage the connecting seal ring between the exhaust brake and the muffler drain pipe.



Muffler assembly : 25 kg



INSTALLATION OF MUFFLER

- Carry out installation in the reverse order to removal.



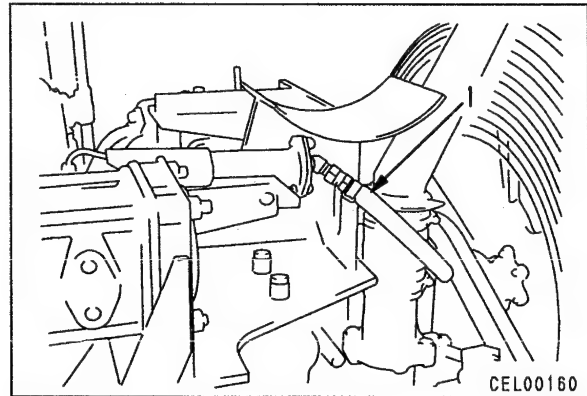
Band mounting bolt :

$9.8 \pm 1.96 \text{ Nm}$ { $1.0 \pm 0.2 \text{ kgm}$ }

REMOVAL OF EXHAUST BRAKE ASSEMBLY

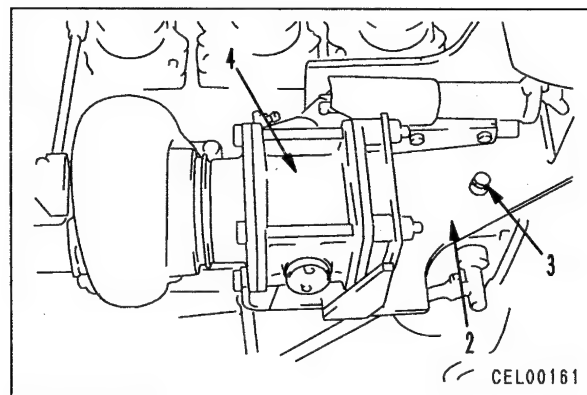
1. Remove muffler.
For details, see REMOVAL OF MUFFLER.

2. Disconnect air hose (1).



3. Remove mounting bolt (3) of bracket (2), then remove together with exhaust brake assembly (4).

4. Remove exhaust brake valve assembly (4) from bracket (2).



INSTALLATION OF EXHAUST BRAKE ASSEMBLY

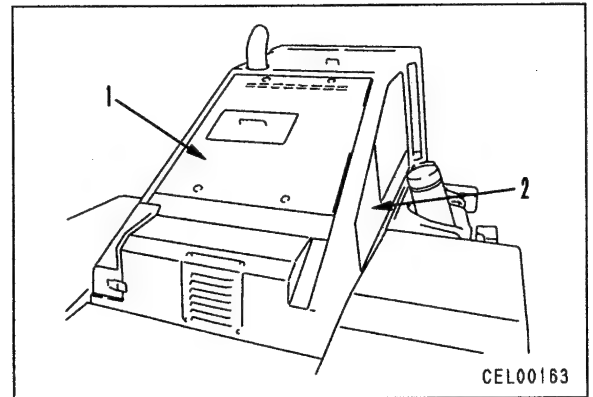
- Carry out installation in the reverse order to removal.

023S02

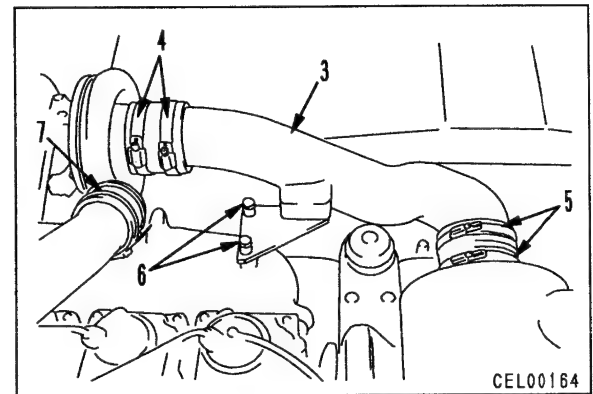
REMOVAL OF TURBOCHARGER ASSEMBLY

⚠ Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.

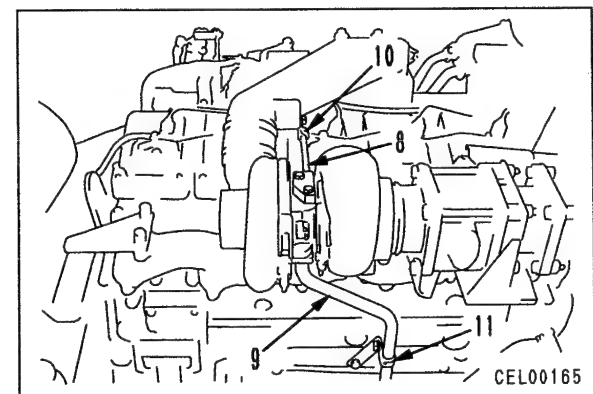
1. Remove engine top cover (1) and left side cover (2).
2. Loosen vibration stopper bolts (6) and connecting hose clamps (4) and (5) of suction tube (3), then remove suction tube (3).



3. Loosen clamp of connecting hose (7) of intake connector and turbocharger, and move towards intake connector.



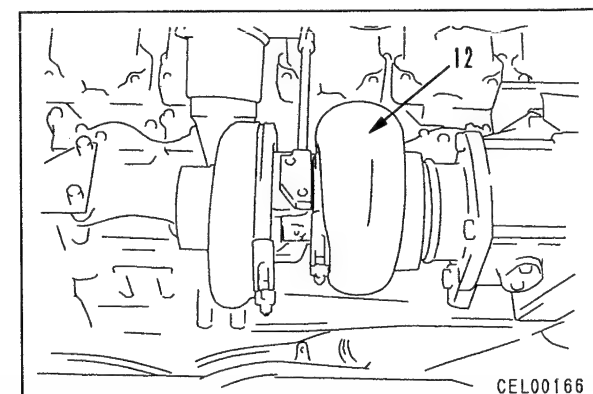
4. Disconnect lubrication inlet tube (8) and lubrication outlet tube (9) at turbocharger end.
★ Loosen clamps (10) and (11) of the lubrication tube.



5. Remove 4 bolts, then remove turbocharger assembly (12).

INSTALLATION OF TURBOCHARGER ASSEMBLY.

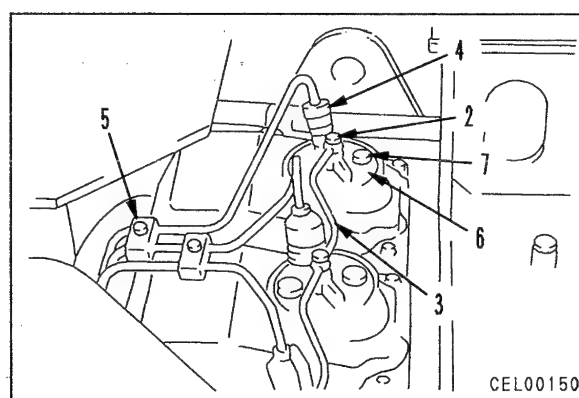
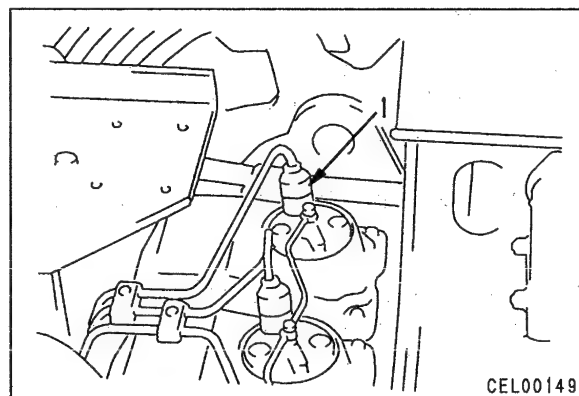
- Carry out installation in the reverse order to removal.



023S02

REMOVAL OF NOZZLE HOLDER ASSEMBLY

1. Remove muffler.
For details, see REMOVAL OF MUFFLER.
(For No. 1 nozzle holder)
 2. Remove engine top cover. (For No. 2, 3, 4, 5, and 6 nozzle holders)
 3. Remove intake connector. (For No. 4 and 5 nozzle holders)
 4. Remove cap (1).
 5. Remove joint bolt (2), then remove spill tube (3). ※ 1
 6. Loosen sleeve nuts (4) at nozzle end and pump end. ※ 2
 7. Loosen holder plate (5) of fuel injection tube.
 8. Remove mounting bolt (7) of nozzle holder assembly (6), then turn nozzle holder assembly to left or right to remove it. ※ 3
- ★ When removing the nozzle holder assembly, clean the area around the nozzle holder first and be careful not to let any dirt or dust get inside the mount.



INSTALLATION OF NOZZLE HOLDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Spill tube eyebolt :
 $11.25 \pm 1.45 \text{ Nm}$ { $1.15 \pm 0.15 \text{ kgm}$ }

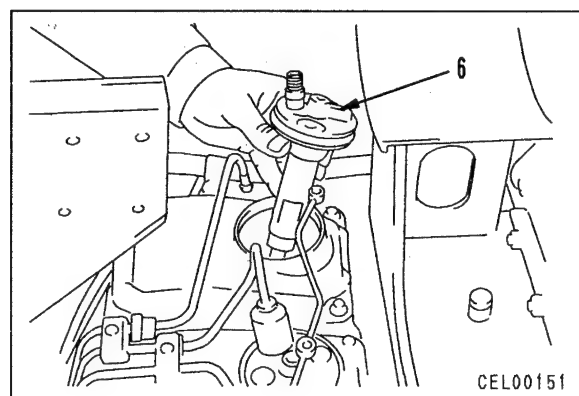
※ 2

kgm Fuel injection tube sleeve nut :
 $23.52 \pm 0.98 \text{ Nm}$ { $2.4 \pm 0.1 \text{ kgm}$ }

※ 3

kgm Nozzle holder mounting bolt :
 $21.55 \pm 2.95 \text{ Nm}$ { $1.85 \pm 0.65 \text{ kgm}$ }

- ★ Tighten the holder mounting bolts in turn uniformly.

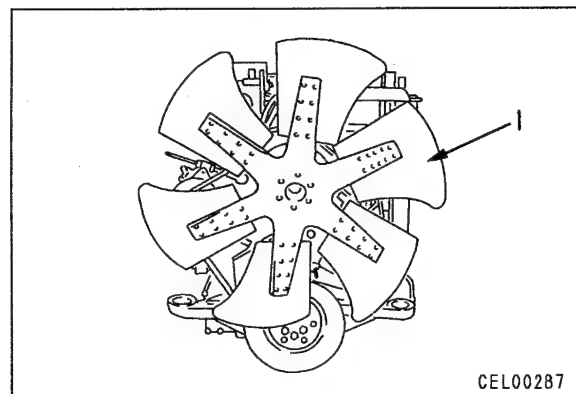


023S02

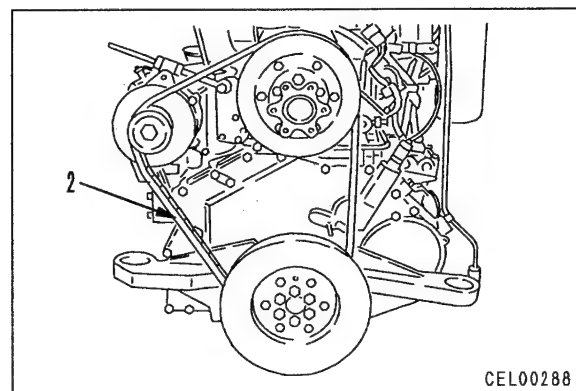
REMOVAL OF ENGINE FRONT SEAL

! Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.

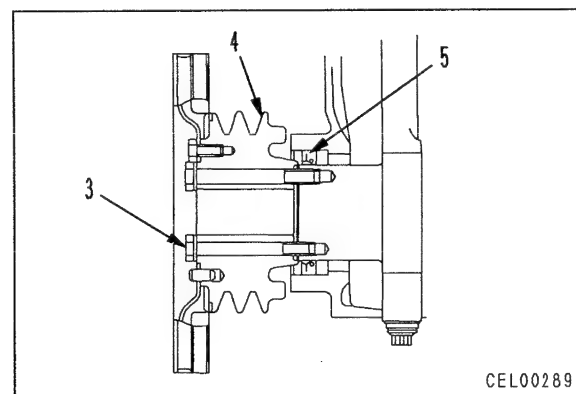
1. Remove radiator, power train oil cooler, and hydraulic cooler assembly.
For details, see REMOVAL OF RADIATOR, POWER TRAIN OIL COOLER, HYDRAULIC COOLER ASSEMBLY.



2. Remove fan (1).
3. Loosen alternator mounting bolts and remove fan belt (2). ※ 1
4. Remove bolts (3), then remove vibration damper and pulley assembly (4). ※ 2
 - ★ The crankshaft pulley mounting bolt (immediately below the dowel pin) is different from the other 5 mounting bolts, so be careful to use the correct tightening torque.



5. Remove engine front seal (5) with offset screwdriver. ※ 3
 - ★ Be extremely careful not to damage the crankshaft.



INSTALLATION OF ENGINE FRONT SEAL



- Carry out installation in the reverse order to removal.

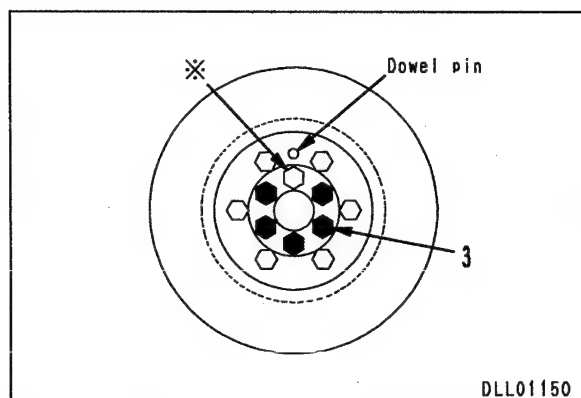
※ 1

Adjust the belt tension.

For details, see TESTING AND ADJUSTING, Testing and adjusting fan belt tension.


※ 2

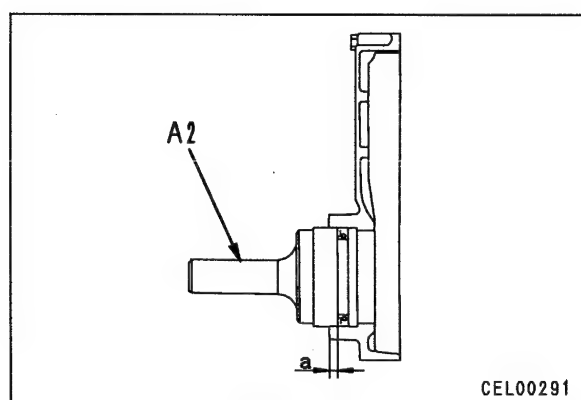
-  Crankshaft pulley mounting bolt (3) :
 $276.85 \pm 31.85 \text{ Nm } \{28.25 \pm 3.25 \text{ kgm}\}$
-  Crankshaft pulley mounting bolt (※) :
 $176.4 \pm 19.6 \text{ Nm } \{18 \pm 2.0 \text{ kgm}\}$



※ 3

- ★ Using tool **A2**, press fit the oil seal.
 Oil seal press-fitting tolerance $a : +1_0 \text{ mm}$

-  Oil seal lip: Fill 50 – 80% of space at lip with heat-resistant long-life grease (G2-LI-S) (Kyodo Grease Martemp ET-130 or equivalent)

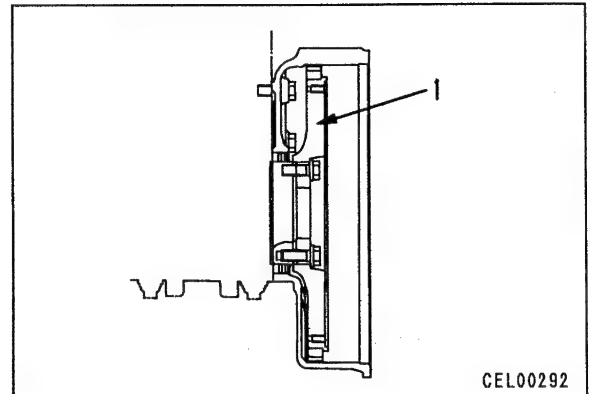


023S02

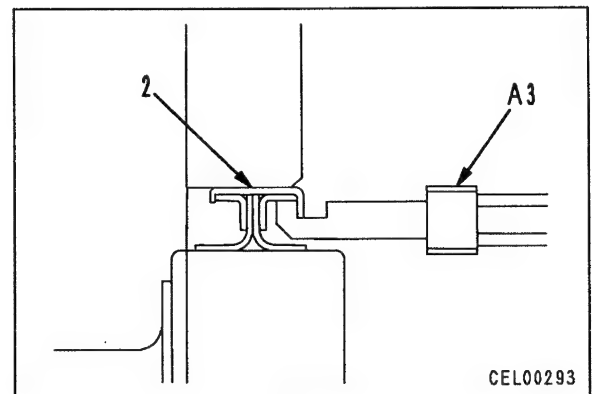
REMOVAL OF ENGINE REAR SEAL

1. Remove damper.
For details, see REMOVAL OF DAMPER.
2. Using eyebolts, sling flywheel (1), then remove mounting bolts, and remove flywheel. ※ 1

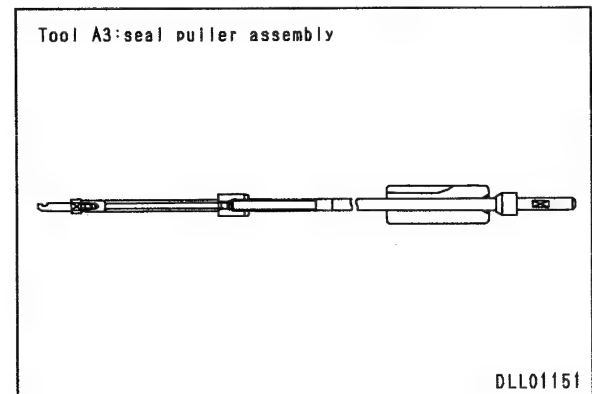
⚠ The flywheel pilot is shallow and it may come off suddenly, so be careful not to get your fingers caught.



3. Hook puller tip of tool **A3** to metal ring of seal (2) and use impact force of a slide hammer to pull out. ※ 2
 - ★ Before pulling out, knock the oil seal in slightly. This separates the seal from the housing and makes it easier to pull out the seal.
 - ★ Be extremely careful not to damage the crankshaft.
 - ★ Do not use a drill. The metal powder will get inside the engine.



Tool A3: seal puller assembly




023S02


INSTALLATION OF ENGINE REAR SEAL

- Carry out installation in the reverse order to removal.

※ 1

- ★ Tighten the flywheel mounting bolts as follows in the order shown in the diagram.

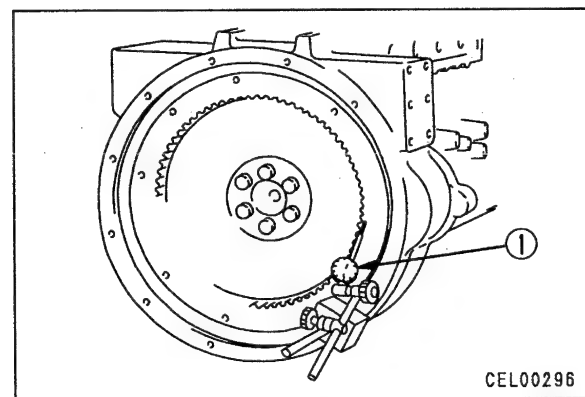
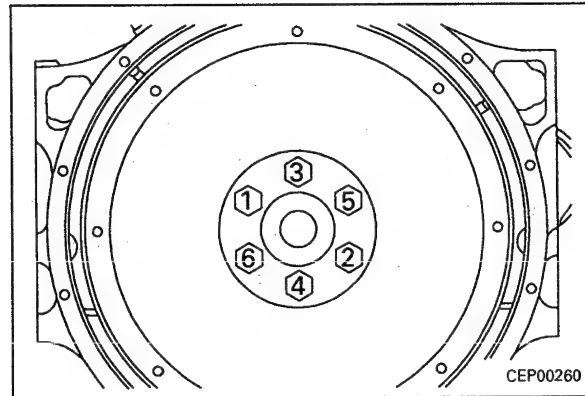
 Flywheel mounting bolt thread:
Lubricating oil (E030)

 Flywheel mounting bolt :

1st step: $147.0 \pm 9.6 \text{ Nm}$ { $15 \pm 2.0 \text{ kgm}$ }

2nd step: $289.1 \pm 19.6 \text{ Nm}$ { $29.5 \pm 2.0 \text{ kgm}$ }

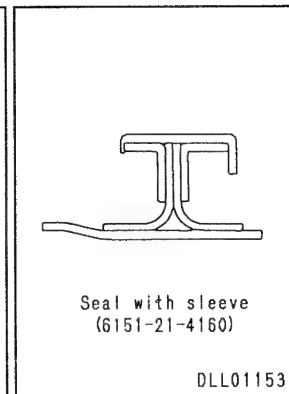
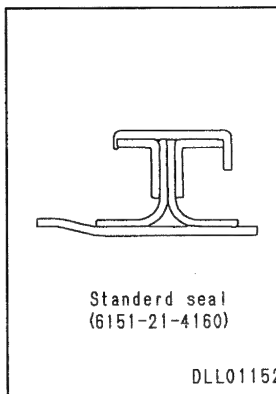
- Using dial gauge (1), measure radial and face runout of flywheel.
Face runout: 0.2 mm
Radial runout: 0.15 mm



※ 2

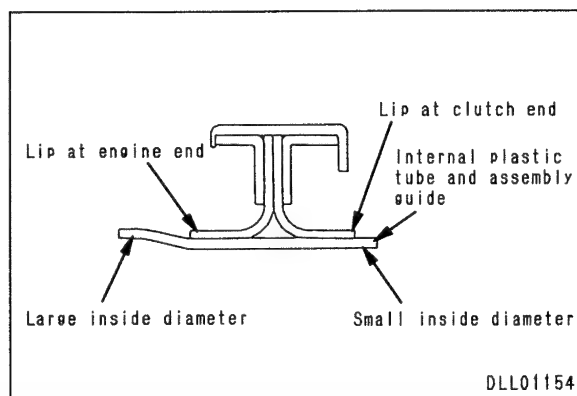
- ★ With the Teflon seal (lay-down lip seal), check the condition of the wear of the crankshaft, then select either a standard seal or a seal with a sleeve, and assemble the seal.

The condition of wear of the crankshaft is judged by the luster (no wear can be felt when touched with the flat of a finger, depth of wear less than $10 \mu\text{m}$). If there are no scratches, assemble a standard seal; in all other cases, assemble a seal with a sleeve.



Procedure for assembling standard seal

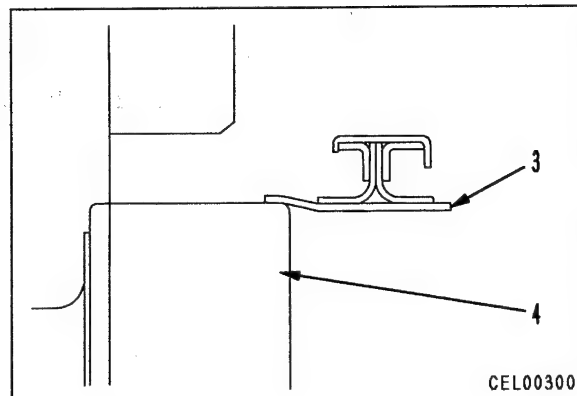
- ★ Before assembling the seal, check that there are no scratches, burrs, flashes, or rust on the housing, lip sliding surface, or at the corner of the end face of the crankshaft.
- ★ When assembling the seal, do not coat the crankshaft and seal lip with oil or grease. Wipe off all the oil from the crankshaft.
- ★ Do not remove the internal plastic tube from the standard seal until the seal is assembled.



023S02

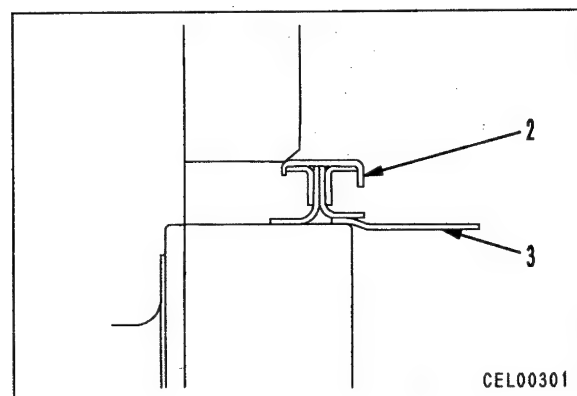
- 1) Put large inside diameter end of internal plastic tube (3) in contact with end of crankshaft (4).

★ Be particularly careful to assemble facing in the correct direction.



- 2) Hold metal ring of seal (2) with both hands and push in uniformly with sudden force.
- 3) After pushing seal in, remove internal plastic tube (3).

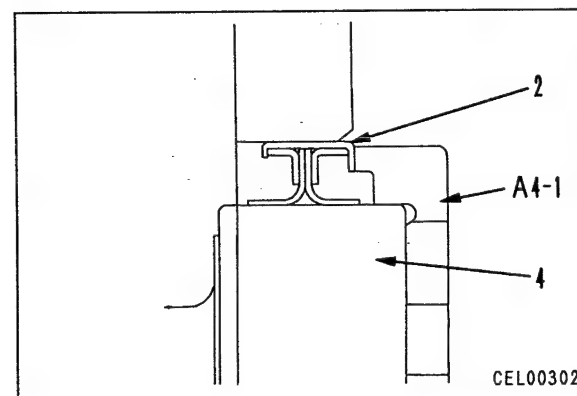
★ When removing the internal plastic tube, be careful not to damage the seal lip.



- 4) Tighten bolts of tool A4-1 uniformly until end face of tool A4-1 contacts end face of crankshaft (4) to press fit seal (2).

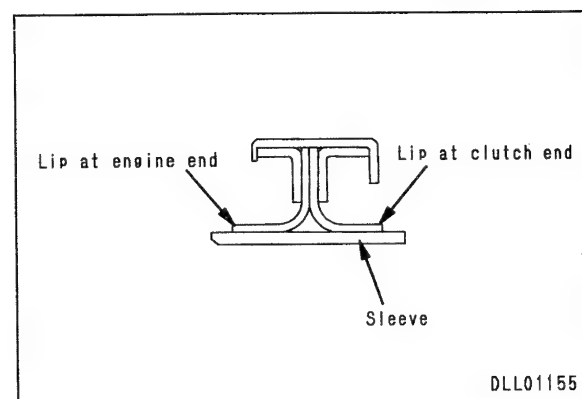
★ When press fitting the seal, be extremely careful not to damage the lip at the clutch end when setting the tool.

★ After press fitting the seal, remove all the remains of the red sealant on the outside circumference.




• Assembly procedure for seal with sleeve

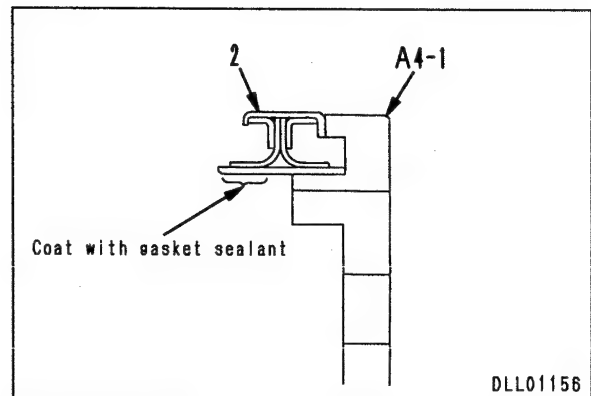
- ★ Before assembling the seal, check that there are no scratches, burrs, flashes, or rust on the housing, lip sliding surface, or at the corner of the end face of the crankshaft.
- ★ When assembling the seal, do not coat the crankshaft and the area between the sleeve and seal lip with oil or grease; wipe off all oil or grease from the crankshaft.
- ★ Always handle the seal and sleeve as a set. Never disassemble it.



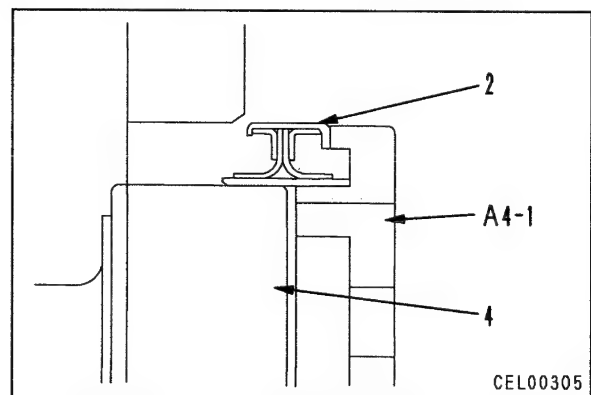
023S02

- 1) Set sleeve and seal (2) to tool **A4-1**.

 Sleeve inside circumference:
Gasket sealant (LG-7)

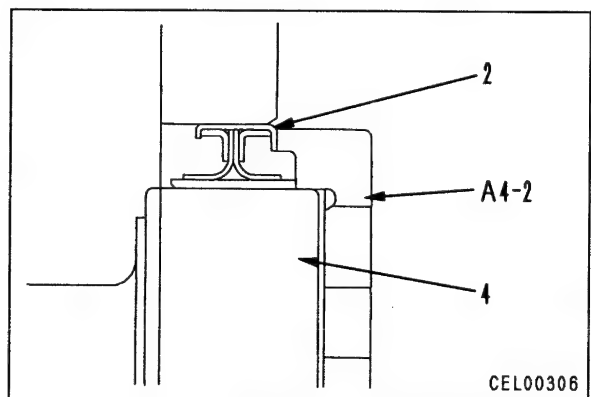


- 2) Put sleeve of seal in contact with end face of crankshaft, then tighten bolts of tool **A4-1** uniformly until end face of tool **A4-1** contacts end face of crankshaft (4) to press fit sleeve assembly (2).



- 3) Remove tool **A4-1**, and install tool **A4-2**.

- 4) Tighten bolts of tool **A4-2** uniformly until end face of tool **A4-2** contacts end face of crankshaft (4) to press fit sleeve/seal (2).
★ After press fitting the seal, remove all the remains of the red sealant on the outside circumference.

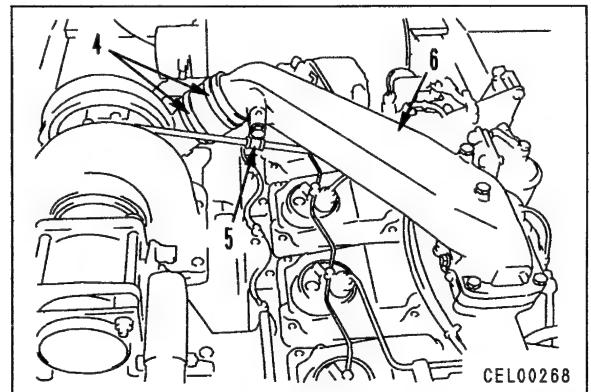
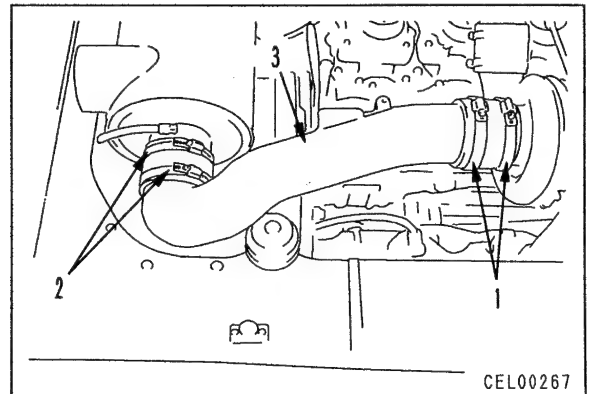


023S02

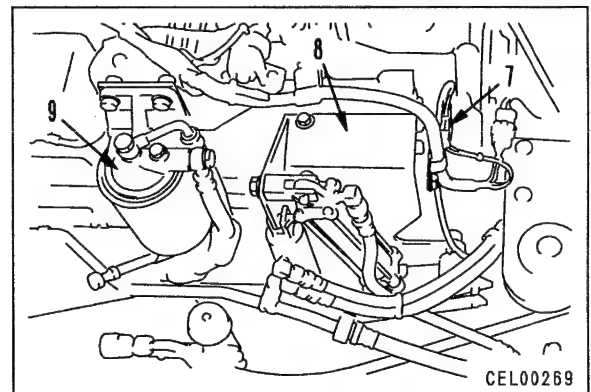
REMOVAL OF CYLINDER HEAD ASSEMBLY

! Disconnect the cable from the negative (-) terminal of the battery.

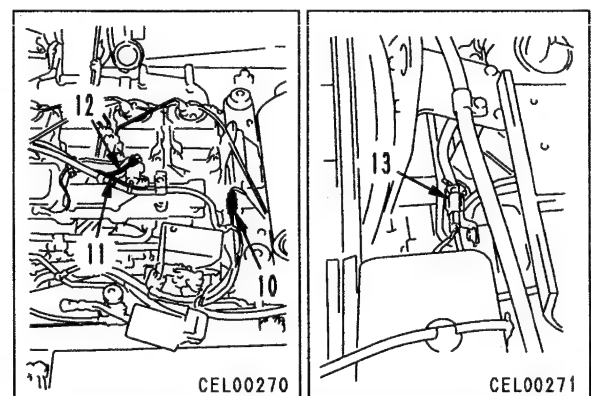
1. Remove muffler.
For details, see REMOVAL OF MUFFLER.
2. Loosen radiator drain valve and drain coolant.
3. Remove clamps (1) and (2), and tube vibration stopper bolt, then remove suction tube (3).
4. Loosen clamps (4), then disconnect turbocharger lubrication inlet tube clamp (5), and remove intake connector (6).



5. Disconnect wiring connector (E02) (7).
6. Remove accelerator control cylinder and PTO set cylinder bracket assembly (8) from intake manifold, and move towards outside.
7. Remove fuel filter assembly (9) together with bracket and move towards outside.

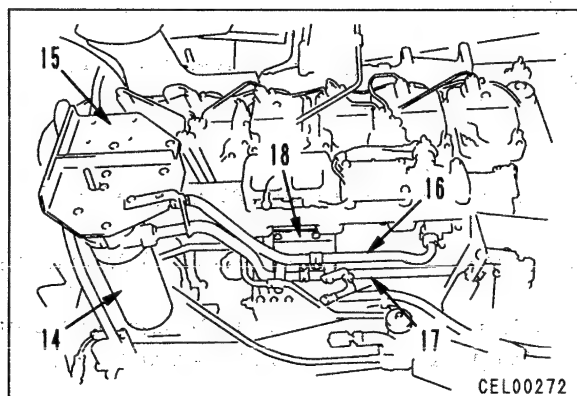


8. Disconnect wiring connector (E05) (10).
9. Disconnect electrical intake air heater wiring (E07) (11) and (E08) (12), and wiring connector (E01) (13), and move towards radiator.



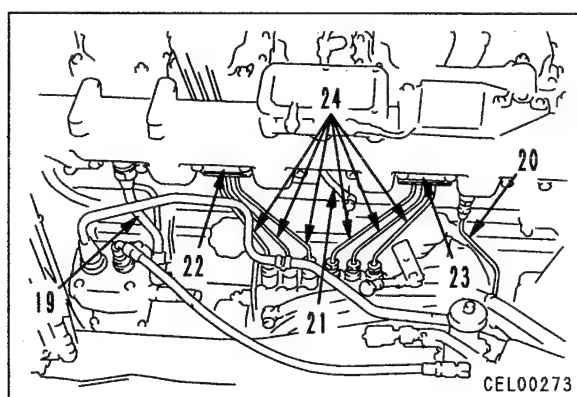
023S02

9. Remove oil filter assembly (14) together with bracket (15) from intake manifold.
10. Remove oil filter tubes (16) and (17).
11. Remove tube bracket (18).



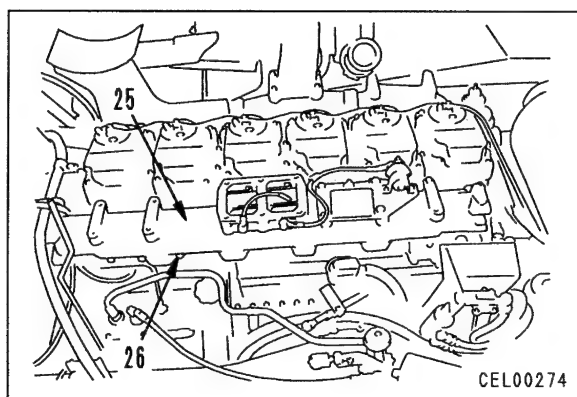
12. Remove air compressor tube (19).
13. Remove boost compensator tube (20).
14. Remove turbocharger lubrication inlet tube (21).
15. Remove vibration stopper plates (22) and (23), then remove fuel injection tubes (24).

※ 1



16. Remove mounting bolts (26), then remove intake manifold assembly (25).

※ 2

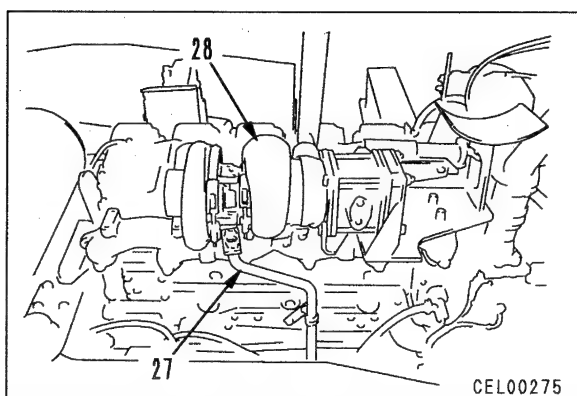


17. Disconnect turbocharger lubrication outlet tube (27).
18. Sling turbocharger, exhaust manifold, and exhaust brake assembly (28), then remove mounting bolts, and lift off assembly.

※ 3



Turbocharger • exhaust manifold,
• exhaust brake assembly:
60 kg



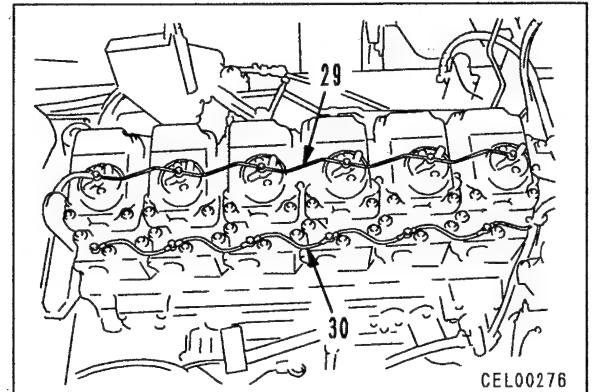
023S02

19. Remove spill tube (29).

※ 4

20. Remove water tube (30).

※ 5



21. Remove fan bracket (31).

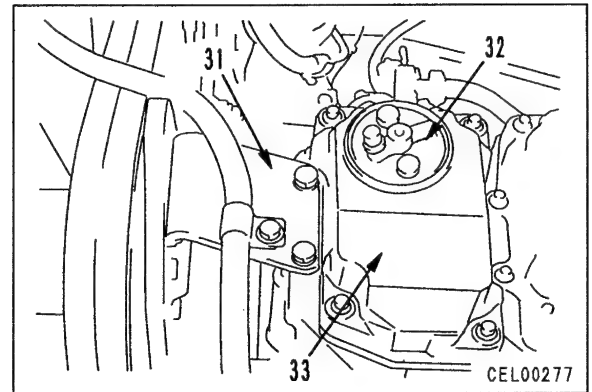
22. Remove 6 nozzle holder assemblies (32).

※ 6

- ★ When removing the nozzle holder assembly, clean the area around the nozzle holder first and be careful not to let any dirt or dust get inside the mount.

23. Remove cylinder head cover (33).

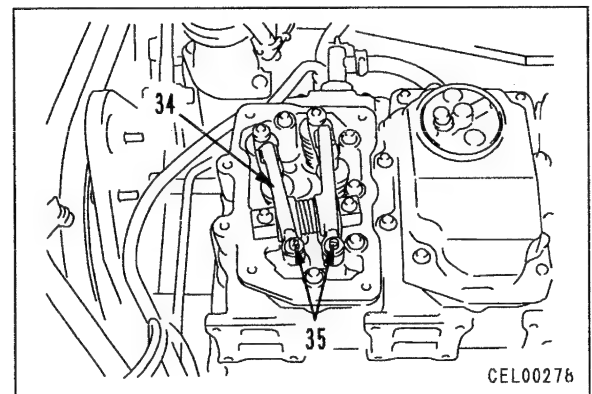
※ 7



24. Remove rocker arm assembly (34).

※ 8

- ★ Loosen the locknut, then loosen adjustment screws (35) 2 – 3 turns.



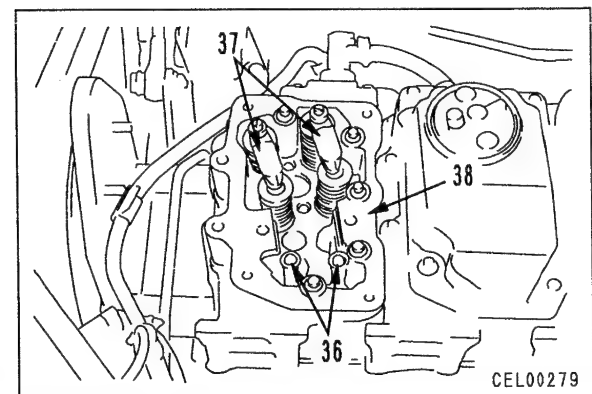
25. Remove 12 push rods (36).

26. Remove crossheads (37).

※ 9

27. Remove rocker arm housing (38).

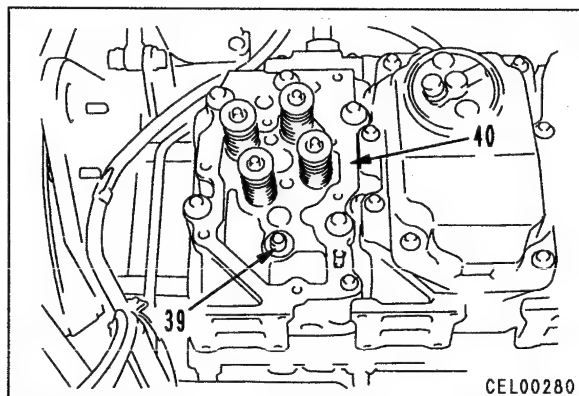
※ 10



023S02

28. Remove head bolts (39), then remove cylinder head assembly (40).

※ 11




023S02


INSTALLATION OF CYLINDER HEAD ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1


 Fuel injection tube sleeve nut :
 $23.5 \pm 1.0 \text{ Nm } \{2.4 \pm 0.1 \text{ kgm}\}$

※ 2


 Intake manifold mounting bolt :
 $66.15 \pm 7.35 \text{ Nm } \{6.75 \pm 0.75 \text{ kgm}\}$

※ 3

- ★ Tighten exhaust manifold mounting bolts ① – ③, then tighten the remaining mounting bolts.

 Exhaust manifold mounting bolt :
 $66.15 \pm 7.35 \text{ Nm } \{6.75 \pm 0.75 \text{ kgm}\}$

※ 4

 Fuel return spill tube :
 $11.25 \pm 1.45 \text{ Nm } \{1.15 \pm 0.15 \text{ kgm}\}$

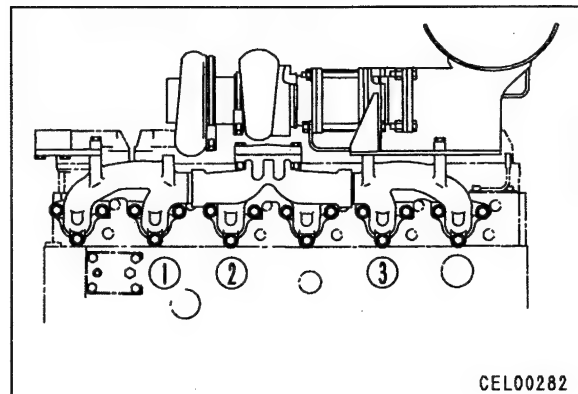
※ 5

 Water tube :
 $11.25 \pm 1.45 \text{ Nm } \{1.15 \pm 0.15 \text{ kgm}\}$

※ 6

- ★ Check that there is no dirt or dust inside the nozzle holder sleeve.
- ★ Tighten the nozzle holder mounting bolts in turn uniformly and make sure that they are not tightened more on one side.


 Nozzle holder mounting bolt :
 $21.55 \pm 2.95 \text{ Nm } \{2.20 \pm 0.30 \text{ kgm}\}$



CEL00282


023S02

※ 7

 **kgm** Cylinder head cover mounting bolt:
9.65 ± 1.0 Nm {0.98 ± 0.10 kgm}


※ 8

- ★ Check that the ball of the adjustment screw is fitted properly into the socket of the push rod.
- ★ Adjust the valve clearance.
For details, see TESTING AND ADJUSTING, Adjusting valve clearance.


 **kgm** Rocker arm assembly mounting bolt :
66.15 ± 7.35 Nm (6.75 ± 0.75 kgm)

※ 9

- ★ Adjust the crosshead as follows.
 - i) Loosen the locknut and turn back the adjustment screw.
 - ii) Press down lightly with a finger on the top of the contact surface of the crosshead and rocker arm to keep the crosshead in contact with the valve stem, and screw in the adjustment screw.
 - iii) When the adjustment screw contacts the valve stem, tighten it a further 20 x .
 - iv) Tighten the locknut to hold the adjustment screw in position.

 **kgm** Adjustment screw locknut :
66.15 ± 7.35 Nm (6.75 ± 0.75 kgm)

※ 10

 **kgm** Rocker arm housing mounting bolt:
66.15 ± 7.35 Nm (6.75 ± 0.75 kgm)

023S02

※ 11

- ★ If any rust of more than 5 mm square is found on the shaft or thread of any head bolt, replace with a new bolt.
- ★ Check that there is no dirt or dust on the cylinder head mounting surface or inside the cylinder.
- ★ Check that the grommet does not come out when installing the gasket.
- ★ Coat the bolt thread, seat surface, and cylinder head hole seat surface completely with molybdenum disulphide lubricant (LM-P).
- ★ Screw in the cylinder head mounting bolts 2 – 3 turns by hand, then tighten in the order shown in the diagram.

Mounting bolt :



Molybdenum disulphide lubricant



Munting cylinder head

1st step : Tighten to 68.6 ± 9.8 Nm (7.0 ± 1.0 kgm)2nd step : Tighten again to 107.8 ± 4.9 Nm
(11.0 ± 0.5 kgm)

3rd step : 1. When using tool A1.

- Using an angle tightening wrench, tighten the bolt $90^{\circ} \begin{smallmatrix} +30^{\circ} \\ 0 \end{smallmatrix}$.

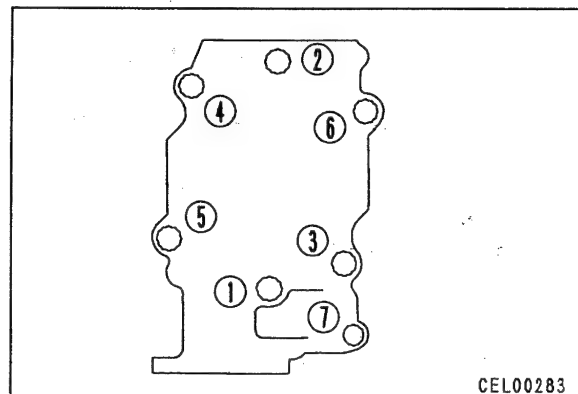
2. When not using tool A1.

- 1) Using the angle of the bolt head as the base, make start marks on the cylinder head and socket.
- 2) Make an end mark at a point $90^{\circ} \begin{smallmatrix} +30^{\circ} \\ 0 \end{smallmatrix}$ from the start mark.
- 3) Tighten so that the start mark on the socket is aligned with the end mark on the cylinder head at the $90^{\circ} \begin{smallmatrix} +30^{\circ} \\ 0 \end{smallmatrix}$ position.

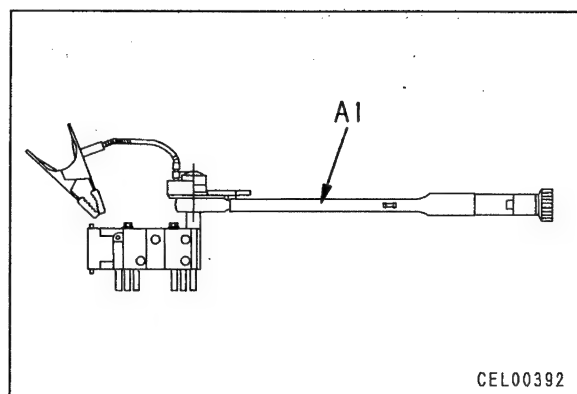
- ★ After tightening, make one punch mark on the bolt head to indicate the number of times it has been tightened.
 - If any bolt already has five punch marks, do not reuse it. Replace it with a new bolt.

• Refilling with water

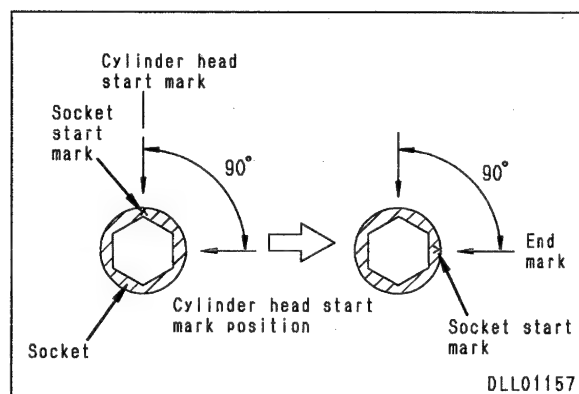
Add water to the specified level. Run the engine to circulate the water through the system. Then check the water level in the reserve tank again.



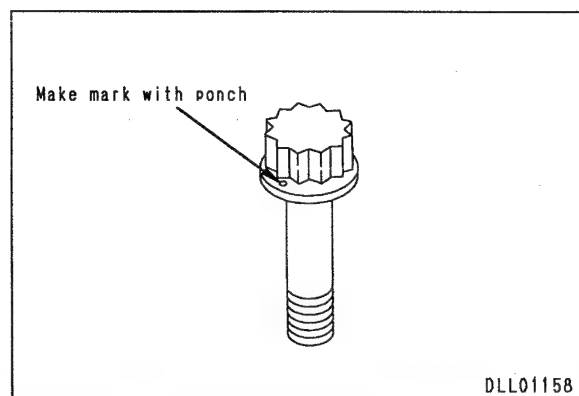
CEL00283



CEL00392



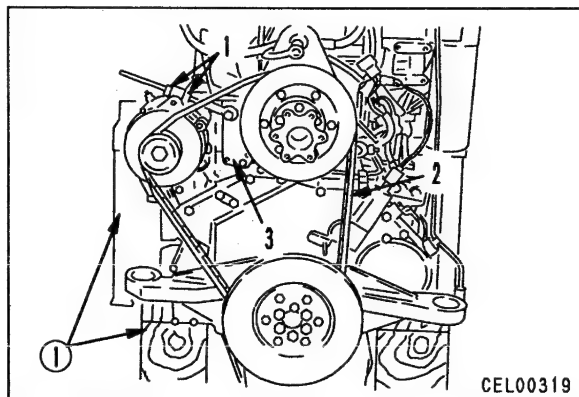
DLL01157



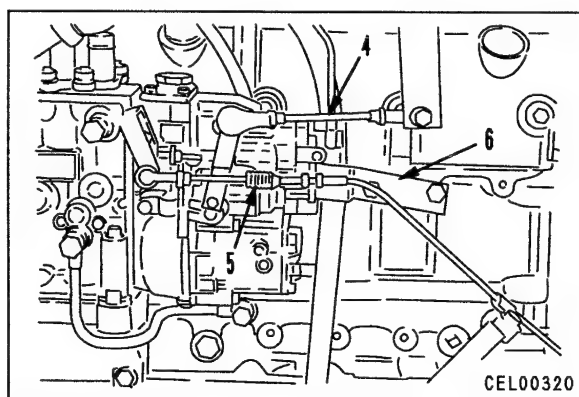
DLL01158

REMOVAL OF AIR COMPRESSOR ASSEMBLY

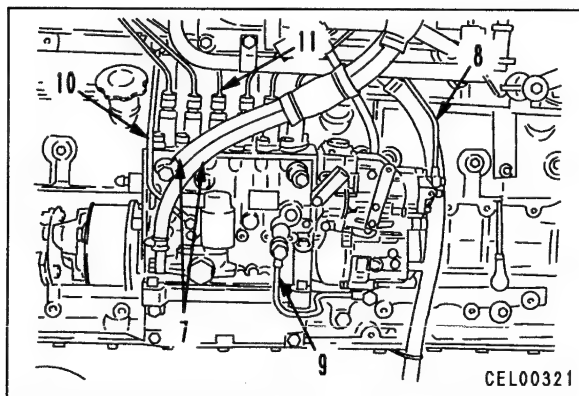
1. Remove engine assembly and set on stand ① securely.
For details, see REMOVAL OF ENGINE ASSEMBLY.
2. Loosen fan belt adjustment nut (1), and remove fan belt (2). ※ 1
3. Remove bracket (3). ※ 1



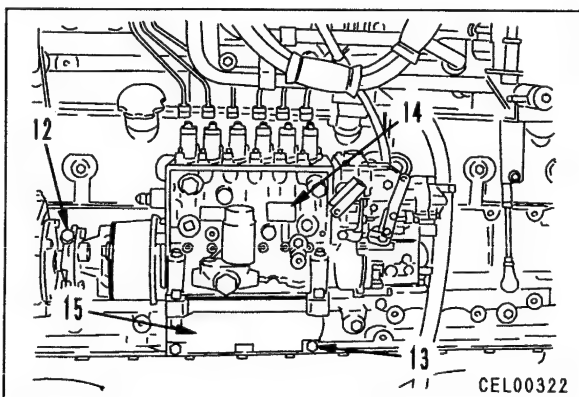
4. Disconnect engine control rod (4).
5. Disconnect engine stop cable (5) together with bracket (6). ※ 2



6. Disconnect fuel hoses (7). ※ 3
7. Remove boost compensator tube (8). ※ 4
8. Remove lubrication tubes (9) and (10). ※ 5
9. Disconnect fuel injection tube (11). ※ 6



10. Remove mounting bolts (12) of coupling connecting air compressor and fuel injection pump, remove 4 mounting bolts (13), then remove fuel injection pump assembly (14) together with bracket (15). ※ 7



023S02

11. Remove air compressor lubrication tube (16).

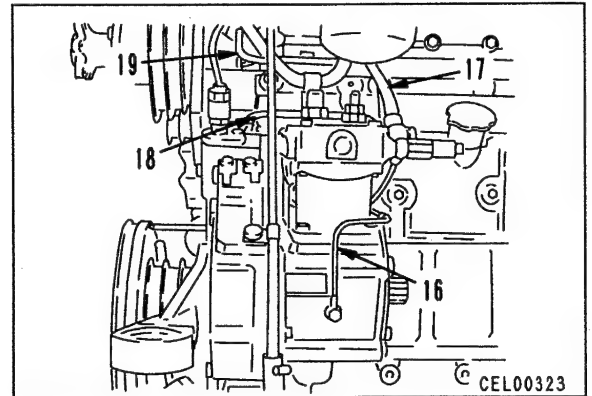
※ 8

12. Remove air tube (17).

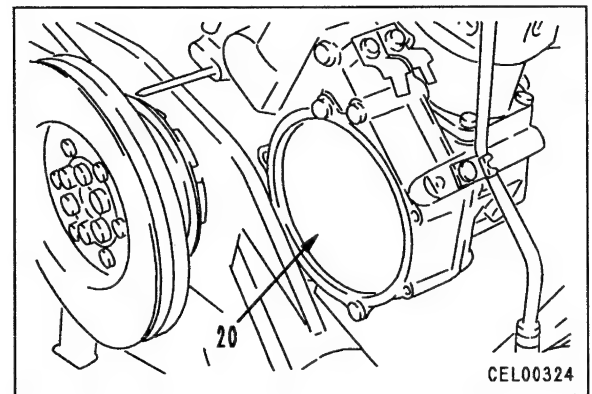
※ 9

13. Remove tube vibration stopper clamp, then remove water tubes (18) and (19).

※ 10



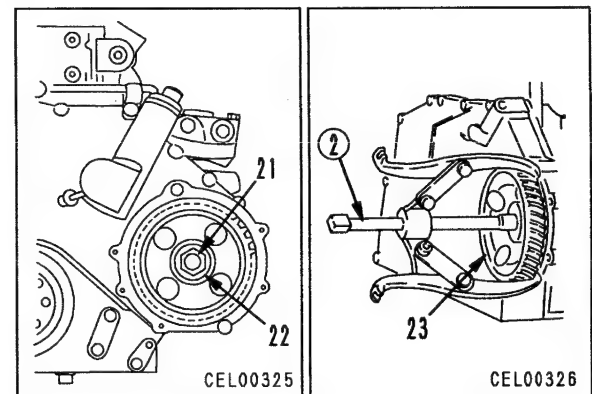
14. Remove cover (20).



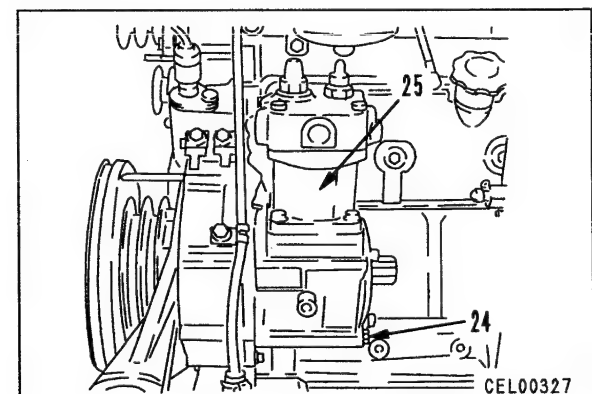
15. Loosen nut (21), and remove washer (22). ※ 11

- ★ Be extremely careful not to drop the nut or washer inside the front case when removing.
- ★ Loosen the nut to a point just before the crankshaft starts to move.

16. Using puller ②, pull out drive gear (23).



17. Remove mounting bolts (24), then remove air compressor assembly (25).



INSTALLATION OF AIR COMPRESSOR ASSEMBLY

- Carry out installation in the reverse order to removal.


※ 1

- ★ Adjust the fan belt.
For details, see TESTING AND ADJUSTING
Testing and adjusting fan belt tension.

※ 2

- ★ Connect the cable.
For details, see TESTING AND ADJUSTING,
Adjusting engine stop motor cable.

※ 3


 Fuel hose joint bolt :
 $22.05 \pm 2.45 \text{ Nm}$ ($2.25 \pm 0.25 \text{ kgm}$)

※ 4


 Boost compensator tube joint bolt :
 $11.25 \pm 1.45 \text{ Nm}$ ($1.15 \pm 0.15 \text{ kgm}$)

※ 5


 Lubrication tube joint bolt (9) :
 $26.95 \pm 2.45 \text{ Nm}$ ($2.75 \pm 0.25 \text{ kgm}$)

 Lubrication tube joint bolt (10) :
 $17.15 \pm 2.45 \text{ Nm}$ ($1.75 \pm 0.25 \text{ kgm}$)

※ 6


 Fuel injection tube sleeve nut :
 $23.52 \pm 0.98 \text{ Nm}$ ($2.40 \pm 0.10 \text{ kgm}$)

※ 7


 Coupling mounting bolt :
 $78.40 \pm 4.90 \text{ Nm}$ ($8.00 \pm 0.50 \text{ kgm}$)


023S02

※ 8


 **kgm** Air compressor lubrication tube joint bolt:
 $11.25 \pm 1.45 \text{ Nm}$ { $1.15 \pm 0.15 \text{ kgm}$ }

※ 9

 **kgm** Air tube joint bolt :
 $56.35 \pm 7.35 \text{ Nm}$ { $5.75 \pm 0.75 \text{ kgm}$ }


 **kgm** Air tube sleeve nut :
 $25.48 \pm 5.88 \text{ Nm}$ { $2.6 \pm 0.6 \text{ kgm}$ }

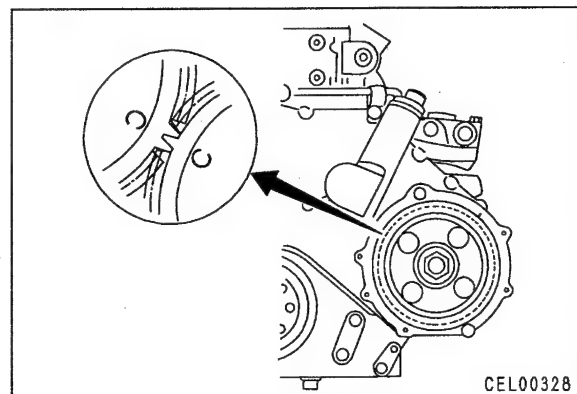
※ 10

 **kgm** Water tube joint bolt :
 $29.90 \pm 5.00 \text{ Nm}$ { $3.00 \pm 0.50 \text{ kgm}$ }

※ 11

- ★ Check that match marks "C" in the air compressor drive gear and cam gear are aligned when installing the air compressor assembly.

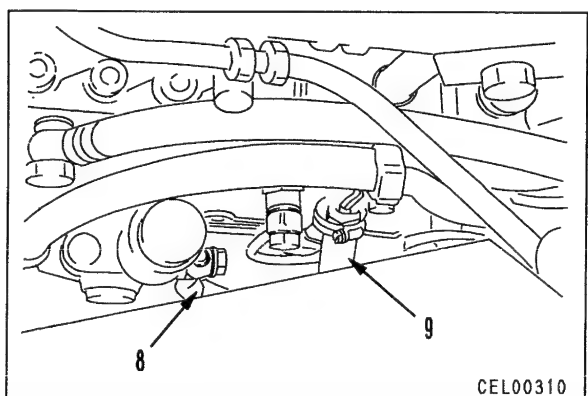
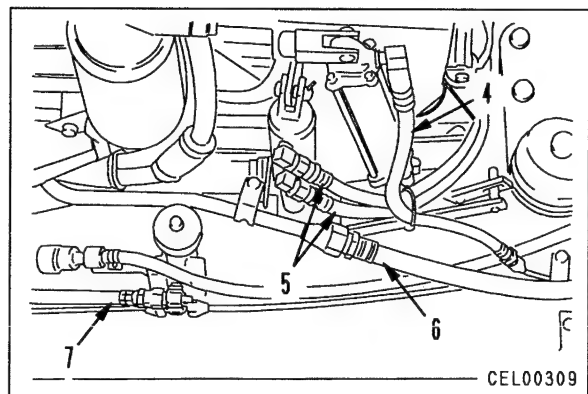
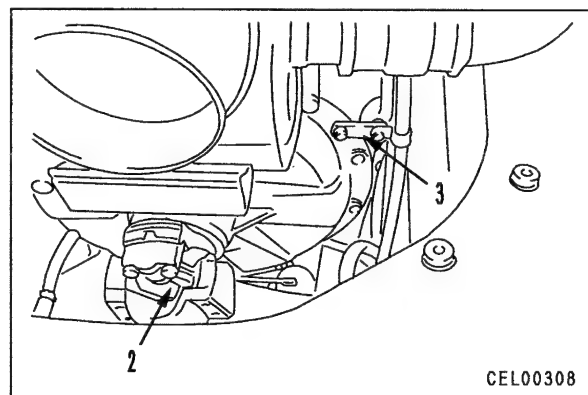
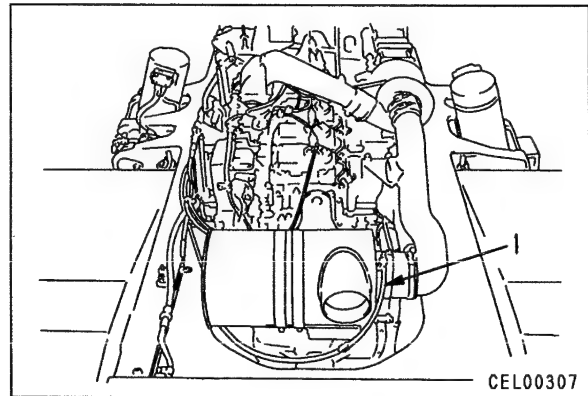
 **kgm** Gear mounting nut :
 $240.1 \pm 14.70 \text{ Nm}$ { $24.5 \pm 1.50 \text{ kgm}$ }



REMOVAL OF ENGINE ASSEMBLY

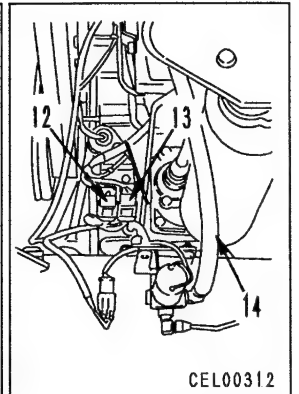
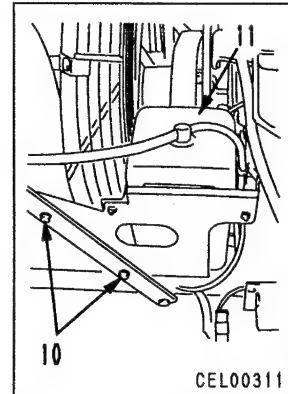
! Disconnect the cable from the negative (–) terminal of the battery.

1. Remove muffler.
For details, see REMOVAL OF MUFFLER.
2. Loosen radiator drain valve and drain coolant.
3. Disconnect dust indicator hose (1).
4. Disconnect drive shaft (2). ※ 1
5. Remove mounting bolts of starting motor wiring clamp (3), and disconnect.
6. Disconnect hoses (4) and (5) from PTO set and accelerator control cylinder.
7. Disconnect air compressor hoses (6) and (7).
8. Disconnect fuel inlet hose (8) and fuel return hose (9).

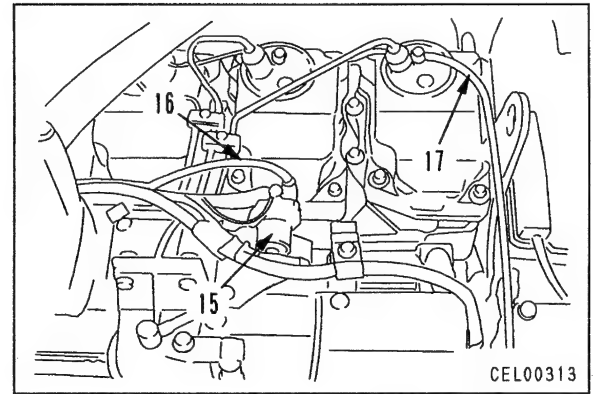


023S02

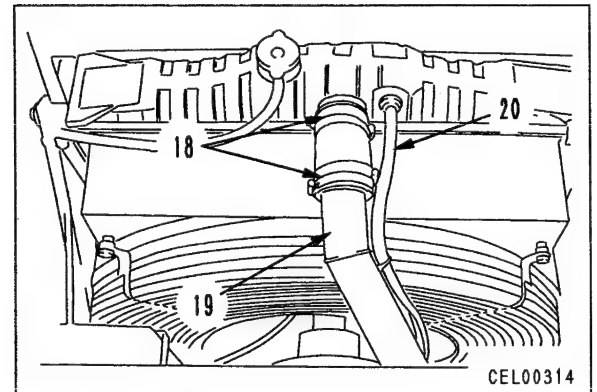
9. Remove bolts (10), then remove reserve tank (11) together with bracket.
10. Disconnect wiring connectors (EL1) (12) and (EL2) (13).
11. Disconnect exhaust brake air hose (14).



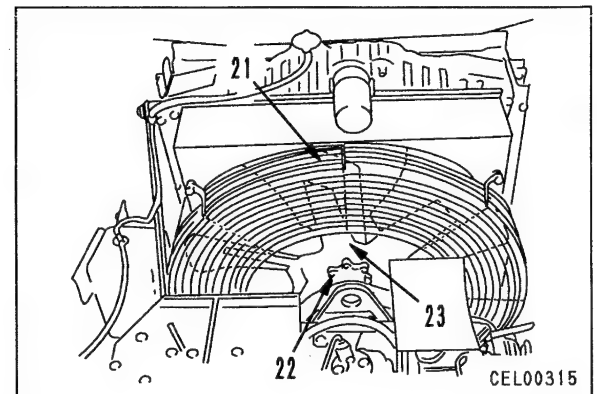
12. Disconnect wiring (E08) (16) of electrical intake air heater switch (15).
13. Disconnect spill hose (17).



14. Loosen clamps (18), and remove radiator inlet tube (19).
15. Disconnect aeration hose (20).

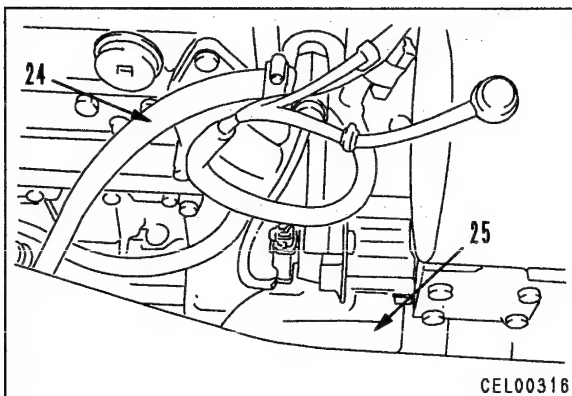


16. Remove fan guard (21).
17. Loosen fan mounting bolts (22), then remove fan (23), and set on radiator.
 - ★ Be extremely careful not to damage the radiator fins when setting the fan on the radiator.



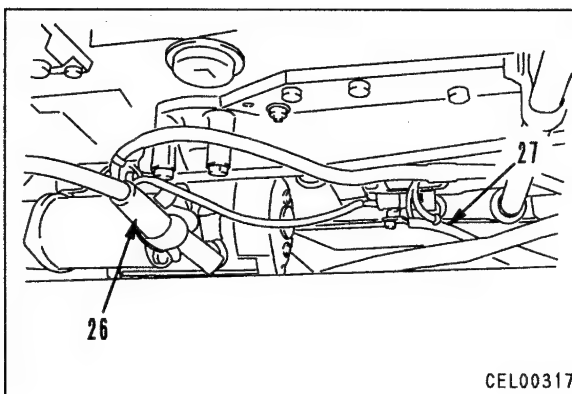
18. Disconnect heater hose (24).

19. Disconnect water pump inlet tube (25) and move towards chassis.



20. Disconnect starting motor cable (26).

21. Disconnect ground connection (27).

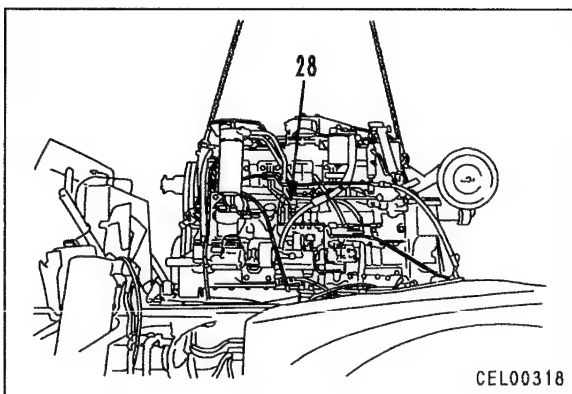


22. Remove mount bolt, then raise engine assembly (28), and remove from chassis.

※ 2



Engine assembly : 1,200 kg





023S02



INSTALLATION OF ENGINE ASSEMBLY

- Carry out installation in the reverse order to removal.
- ★ Replace the O-rings and gaskets with new parts. When using the parts again, check carefully that there is no damage, settling, cracks, or other deterioration.

※ 1

-  **kgm** Drive shaft mounting bolt :
110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}
-  **kgm** Damper mounting bolt :
66.15 ± 7.65 Nm {6.75 ± 0.75 kgm}

※ 2

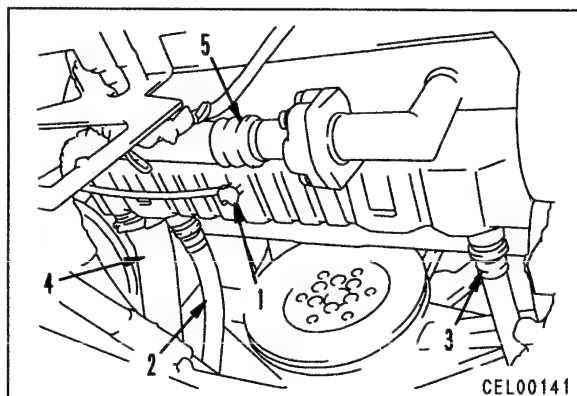
-  Engine mount bolt thread :
Thread tightener (LT-2)
-  **kgm** Engine mount bolt :
382 ± 39 Nm {39 ± 4.0 kgm}

- **Refilling with water**
Add water to the specified level. Run the engine to circulate the water through the system. Then check the water level in the reserve tank again.

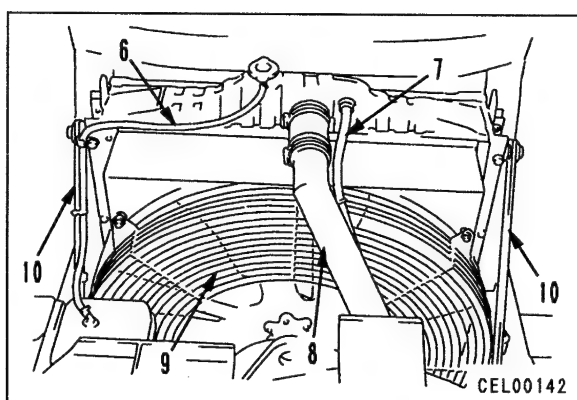
023S02

REMOVAL OF RADIATOR, POWER TRAIN OIL COOLER, HYDRAULIC COOLER ASSEMBLY

1. Remove hood assembly.
For details, see REMOVAL OF HOOD ASSEMBLY.
2. Remove radiator bottom cover.
3. Loosen drain valve (1) of radiator and drain coolant.
4. Disconnect power train oil cooler inlet hose (2) and outlet hose (3).
5. Disconnect radiator outlet hose (4).
6. Disconnect hydraulic cooler outlet hose (5).



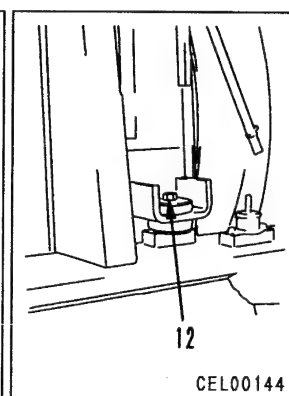
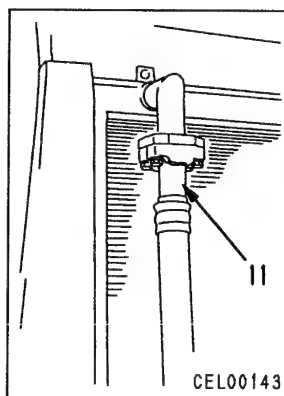
7. Disconnect overflow hose (6) at reserve tank end.
8. Disconnect aeration hose (7) and radiator inlet tube (8).
9. Remove fan guard (9).
10. Remove radiator support (10).



11. Disconnect hydraulic cooler inlet hose (11).
12. Sling radiator assembly, remove left and right mount bolts (12), then raise radiator assembly (13) slightly and move to rear to remove.

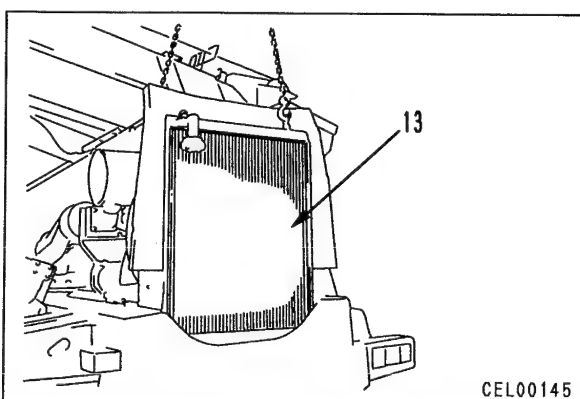


Radiator, power train oil cooler, hydraulic cooler assembly : **150 kg**



INSTALLATION OF RADIATOR, POWER TRAIN OIL COOLER, HYDRAULIC COOLER ASSEMBLY

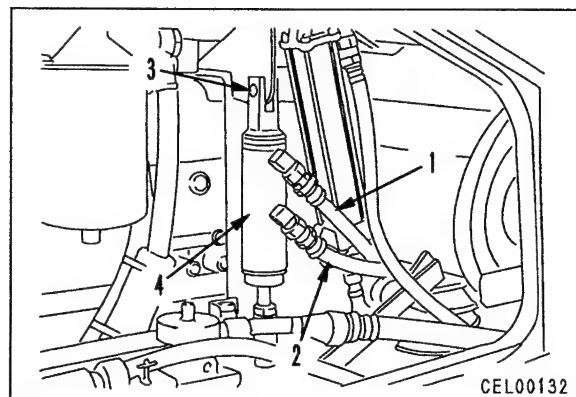
- Carry out installation in the reverse order to removal.
- **Refilling with water**
Add water to the specified level. Run the engine to circulate the water through the system. Then check the water level in the reserve tank again.



023S02

REMOVAL OF PTO SET CYLINDER ASSEMBLY

1. Remove engine side cover.
2. Disconnect hoses (1) and (2).
3. Pull out pin (3) at PTO set cylinder bottom end.
4. Lift off PTO set cylinder assembly (4).





INSTALLATION OF PTO SET CYLINDER ASSEMBLY

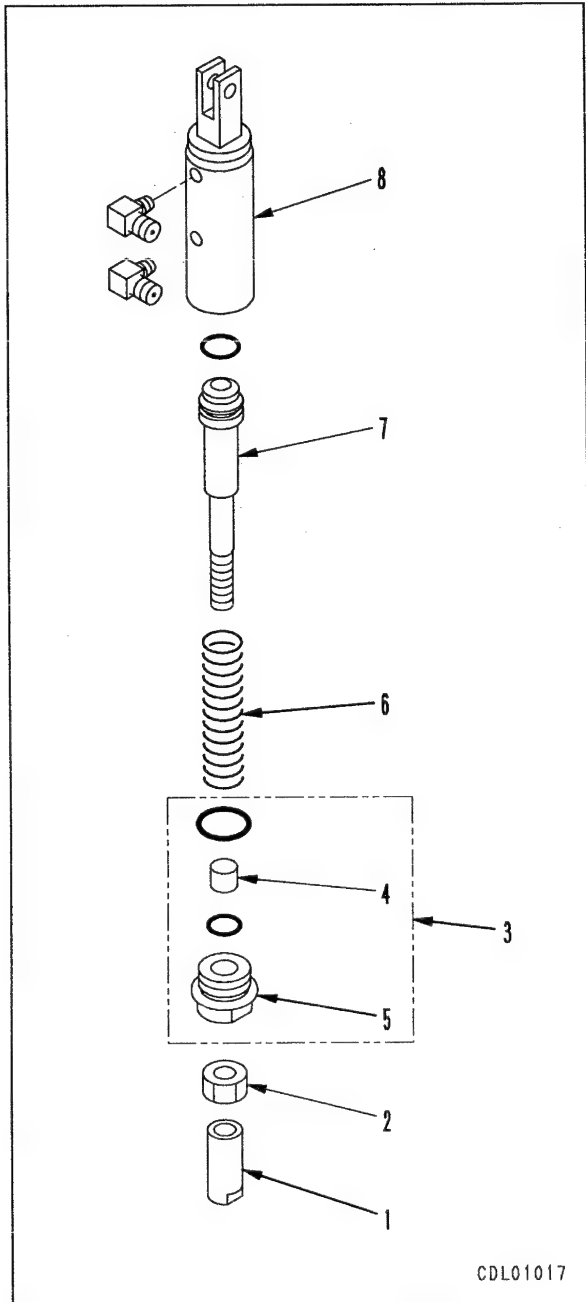
- Carry out installation in the reverse order to removal.

DISASSEMBLY OF PTO SET CYLINDER ASSEMBLY

1. Remove shaft (1) and nut (2).
★ Measure the mounting dimension before removing the nut.
2. Remove plug assembly (3).
3. Remove bushing (4) from plug (5).
4. Remove spring (6).
5. Remove piston (7).

ASSEMBLY OF PTO SET CYLINDER ASSEMBLY

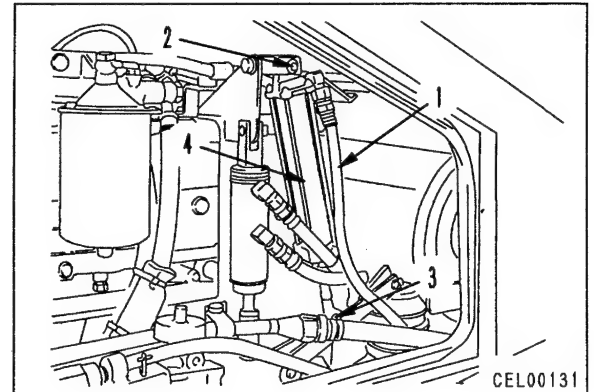
1. Fit O-ring and assemble piston (7) to cylinder (8).
2. Assemble spring (6).
 Spring : **Grease (G2-LI)**
3. Fit O-ring and assemble bushing (4) to plug (5).
4. Install plug assembly (3).
 Plug assembly : 1
 $29.85 \pm 17.15 \text{ Nm}$ { $13.25 \pm 1.75 \text{ kgm}$ }
5. Install nut (2) and shaft (1).
★ Install the nut to the dimension measured during disassembly.



023S02

REMOVAL OF ACCELERATOR CONTROL CYLINDER ASSEMBLY

1. Remove right engine side cover.
2. Disconnect hose (1).
3. Pull out pin (2) at accelerator control cylinder bottom end, and loosen mounting nut (3) at piston end, then remove.
4. Remove accelerator control cylinder assembly (4).

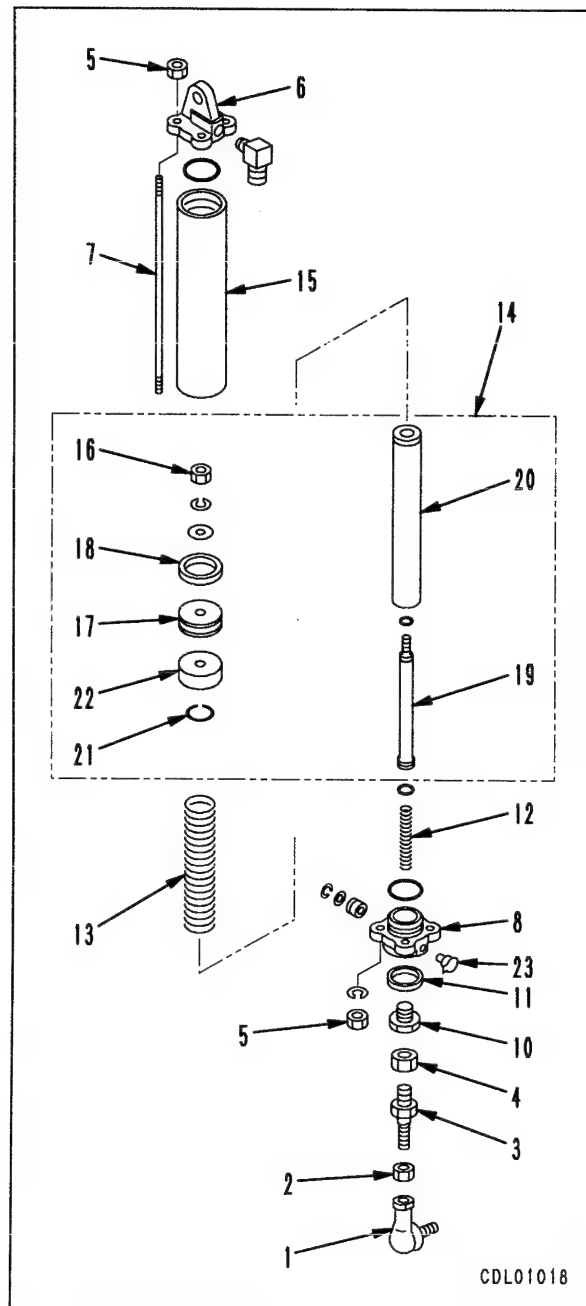


INSTALLATION OF ACCELERATOR CONTROL CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

DISASSEMBLY OF ACCELERATOR CONTROL CYLINDER ASSEMBLY


1. Remove joint (1), nut (2), rod (3), and nut (4).
★ Measure the mounting dimension before removing the rod.
2. Remove nut (5), then remove cap (6).
3. Remove rod (7) and cap assembly (8).
4. Remove adapter (10) and felt ring (11) from cap (9).
5. Remove springs (12) and (13).
6. Remove piston rod and push tube assembly (14) from cylinder (15).
7. Disassemble piston rod and push tube assembly (14) as follows.
 - 1) Remove nut (16), then remove piston (17) and cup (18).
 - 2) Remove piston rod (19).
 - 3) Remove retaining ring (21) and bushing (22) from push tube (20).





023S02


ASSEMBLY OF ACCELERATOR CONTROL CYLINDER ASSEMBLY


1. Assemble piston rod and push tube assembly (14) as follows.
 - 1) Install bushing (22) and retaining ring (21) to push tube (20).
 - 2) Fit O-ring and assemble piston rod (19), piston (17), and cup (18).

 O-ring : **Grease (G2-LI)**
- 3) Tighten nut (16).

 **Nut : $52.92 \pm 14.7 \text{ Nm}$ ($5.4 \pm 1.5 \text{ kgm}$)**
2. Assemble piston rod and push tube assembly (14) to cylinder (15).
3. Assemble springs (12) and (13).
4. Install felt ring (11) and adapter (10) to cap (9).

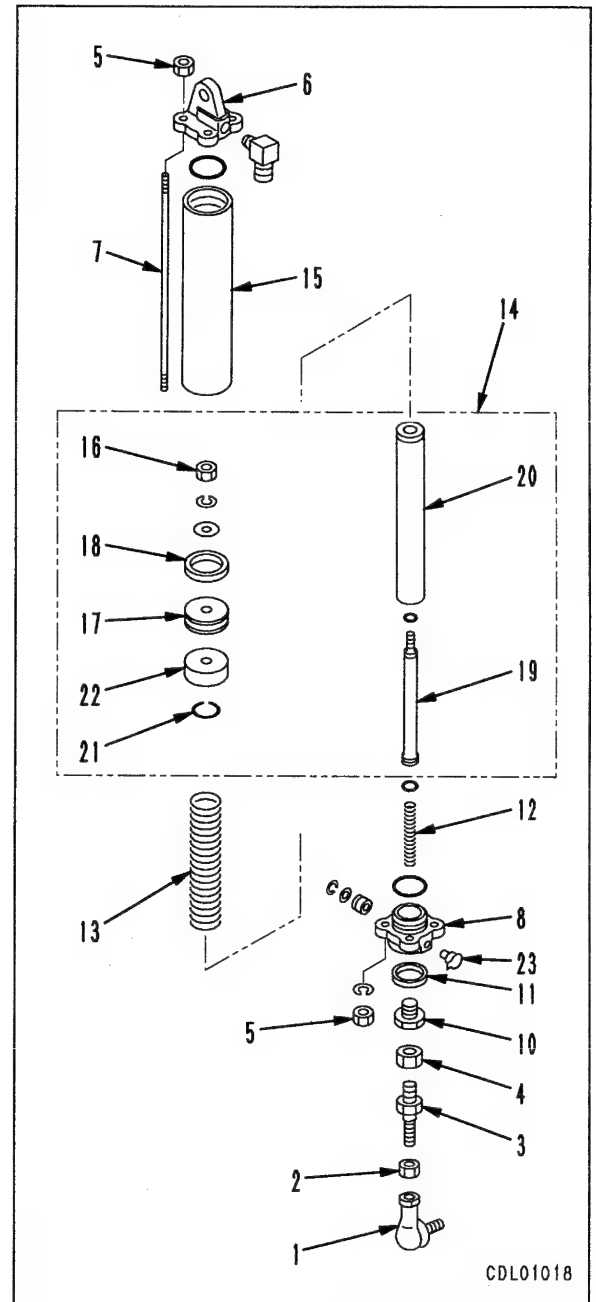
 Felt ring : **Grease (G2-LI)**

 Adapter thread portion : **Thread tightener (LT-2)**

 **Adapter : $382.2 \pm 49 \text{ Nm}$ ($39 \pm 5 \text{ kgm}$)**
5. Install cap assembly (8), rod (7), and cap (6), then tighten nut (5).
6. Install nut (4), rod (3), nut (2), and joint (1).
 - ★ Install the rod to the dimension measured during disassembly.

Refilling with oil (accelerator control cylinder)

- Add the correct amount of hydraulic oil (HO56) through oil cup (23).
- After installing the accelerator control leakage, add hydraulic oil (HO56) once every 3 months.



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023S02

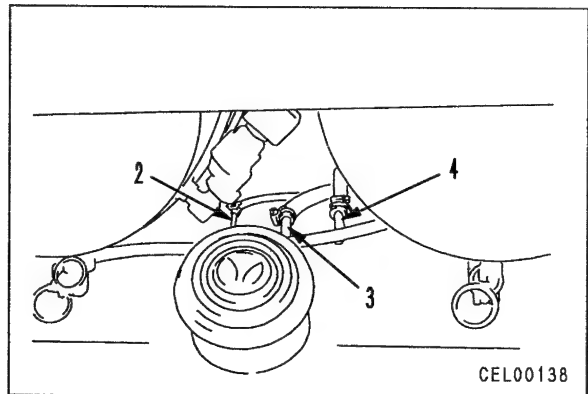
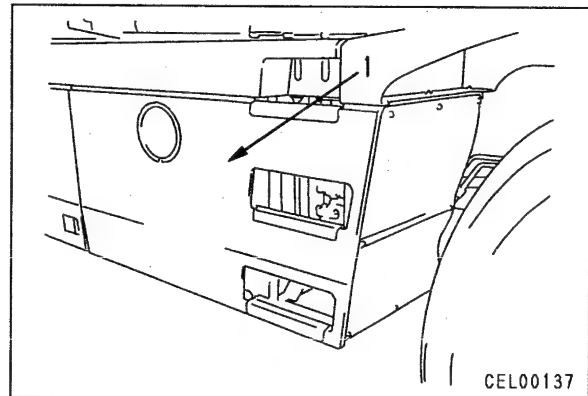
REMOVAL OF FUEL TANK ASSEMBLY

⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Remove fuel tank side cover (1).
2. Loosen drain valve at bottom of fuel tank and drain fuel.
3. Disconnect hoses (2), (3), and (4) connected to top of fuel tank.
4. Disconnect wiring connectors (L85) (5) and (L86) (6) connected to fuel gauge at top of fuel tank.
5. Remove fuel tank mounting band (7), pull fuel tank assembly (8) out to a point where it does not fall, then set on transmission jack (1) and remove from chassis.



Fuel tank assembly : **40 kg**

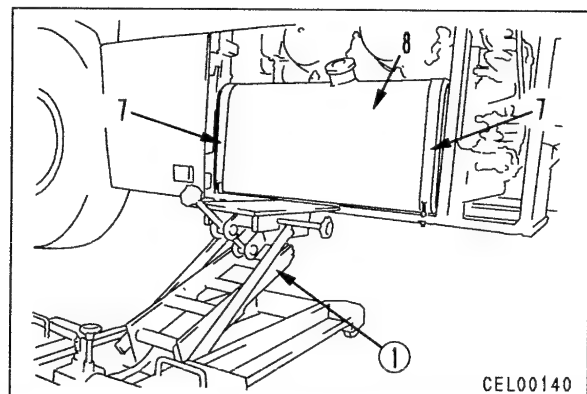
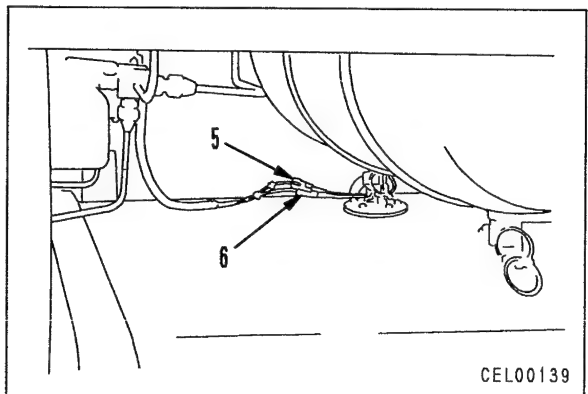


INSTALLATION OF FUEL TANK ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ There is little space between the fuel tank and the air tank, so be careful not to hit it.
- ★ When tightening the band, do not forget to set the pad in position.

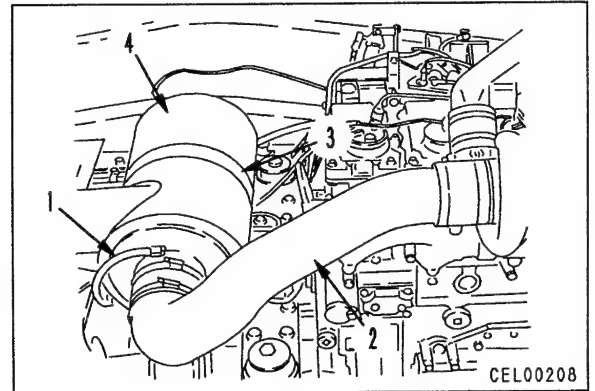


023S02

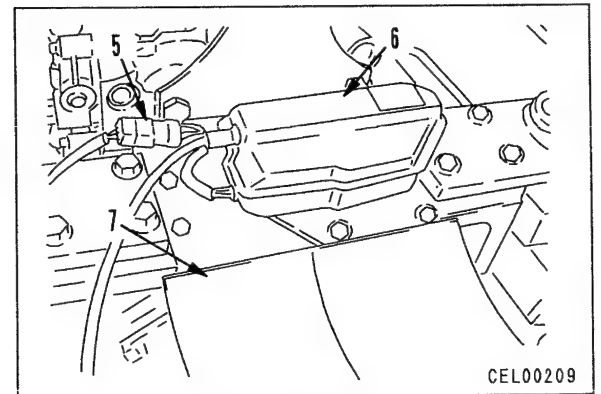
REMOVAL OF DAMPER

1. Remove hood assembly.
For details, see REMOVAL OF HOOD ASSEMBLY.
2. Remove top cover of transmission, steering, and swing pump assembly.

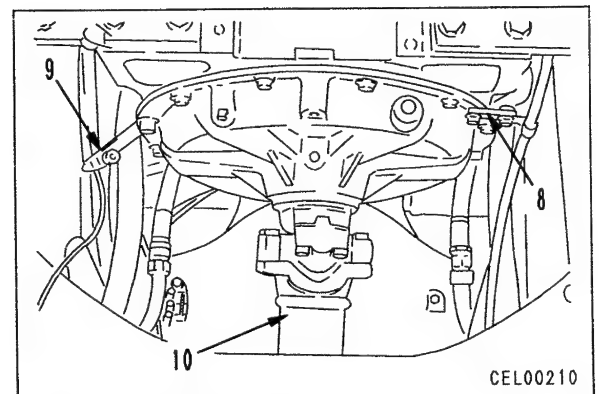
3. Disconnect dust indicator hose (1).
4. Loosen clamp, and remove mounting bolts of intermediate bracket, then remove intake connector (2).
5. Remove band (3), then remove air cleaner assembly (4).



6. Disconnect wiring connector (E05) (5), then remove engine stop motor assembly (6), and move towards outside.
7. Remove air cleaner bracket (7).



8. Disconnect bracket (8) of starting motor wiring.
9. Disconnect bracket (9) of engine stop motor cable.
10. Remove mounting bolts (11) at transmission end and damper end of drive shaft (10), and move towards transmission. ※ 1

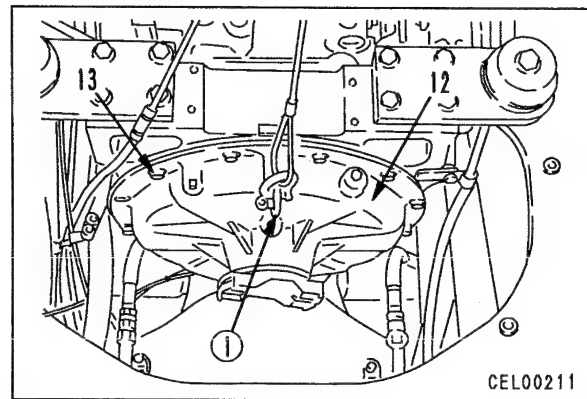


023S02

11. Fit eyebolt (1) and sling cover assembly (12), then remove 10 mounting bolts (13), and lift off. ※ 2



Cover assembly : 30 kg

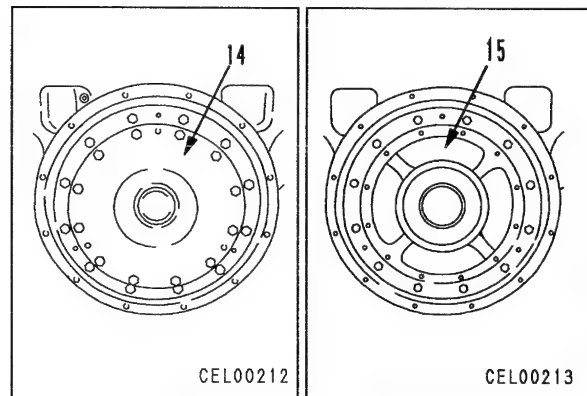


12. Remove cover (14).

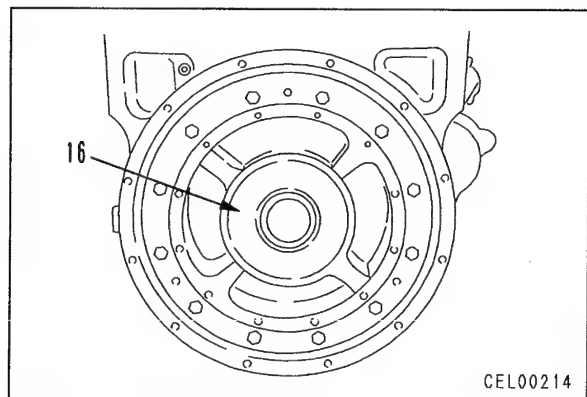
※ 3

13. Remove 4 rubbers (15).

※ 4



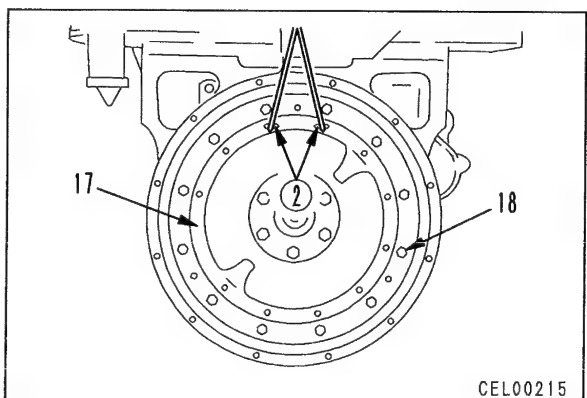
14. Remove inner body (16).



15. Fit eyebolts (2) and sling outer body (17), then remove 12 mounting bolts (18), and lift off. ※ 5



Outer body : 40 kg




023S02


INSTALLATION OF DAMPER

- Carry out installation in the reverse order to removal.



※ 1

 Drive shaft mounting bolt :
 $110.25 \pm 12.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }


※ 2

 Cover assembly mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }



※ 3

 Mating surface of cover and outer body :
Gasket sealant (LG-4)
 Cover mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }

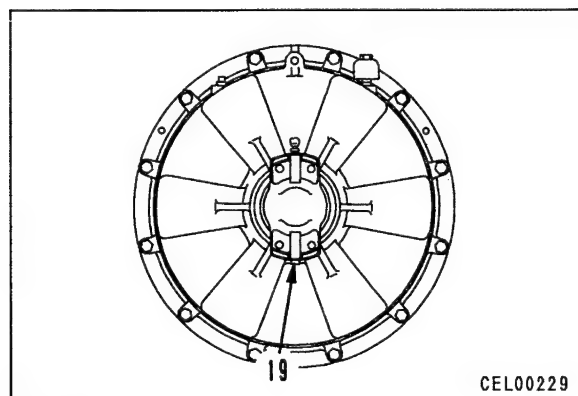
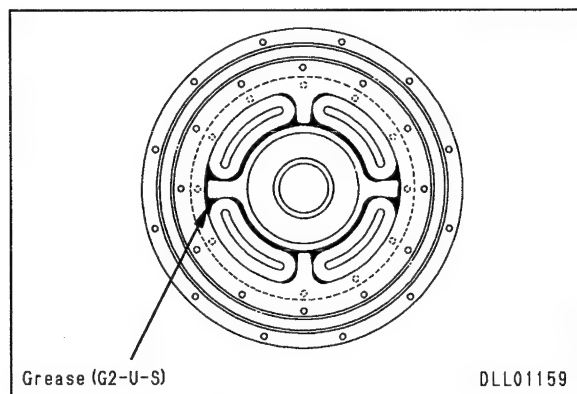
※ 4

 Clearance between rubber and outer body, inner body: Fill portion marked ■ completely with grease (G2-U-S)

※ 5

 Mating surface of flywheel and outer body:
Gasket sealant (LG-4)
 Outer body mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }

- Greasing**
 Remove plug (19), fill with $310 \pm 30 \text{ cc}$ of grease (G2-U-S), then tighten the plug.

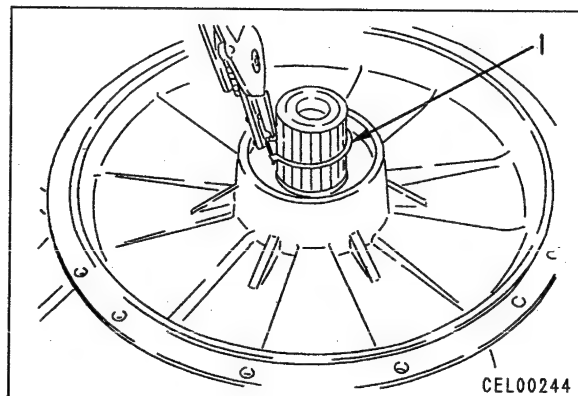


023S02

DISASSEMBLY OF DAMPER COVER ASSEMBLY

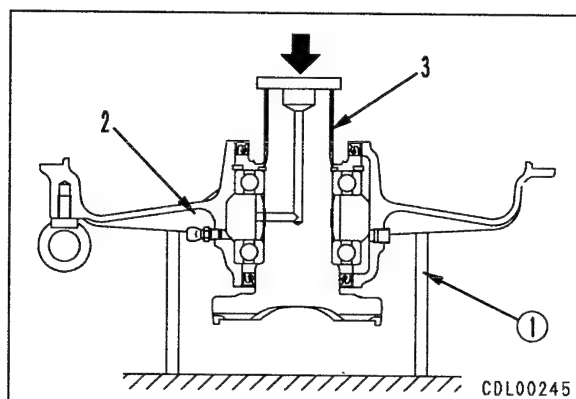
1. Snap ring

Remove snap ring (1).



2. Shaft

Set damper cover assembly (3) on block (1), then pull out shaft (3).

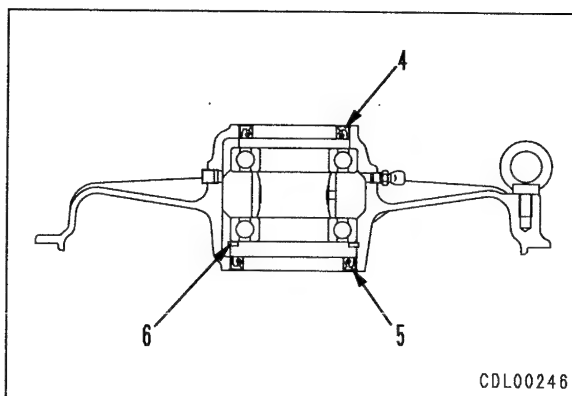


3. Oil seals

Remove oil seals (4) and (5).

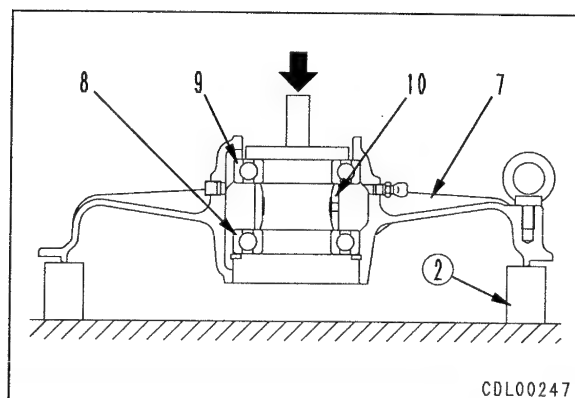
4. Snap ring

Remove snap ring (6).



5. Bearings, spacer

Set cover (7) on block (2), then remove bearings (8) and (9), and spacer (10) from cover.



023S02

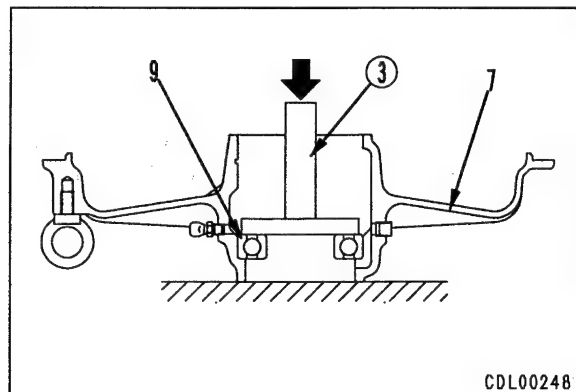
ASSEMBLY OF DAMPER COVER ASSEMBLY

1. Bearings, spacer

- 1) Using push tool (3), press fit bearing (9) to cover (7).



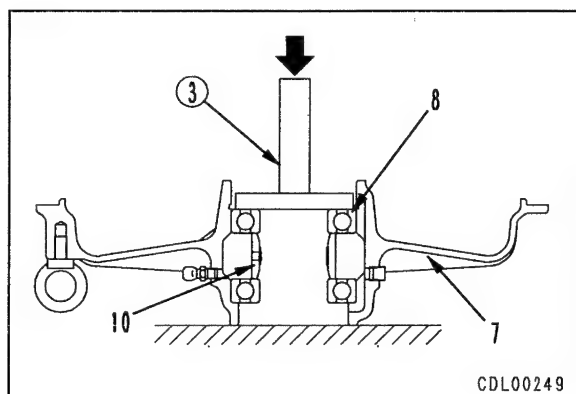
Coat bearing press-fitting surface with thread tightener (Loctite 601) before press fitting.



- 2) Assemble spacer (10), then using push tool (3), press fit bearing (8) to cover (7).



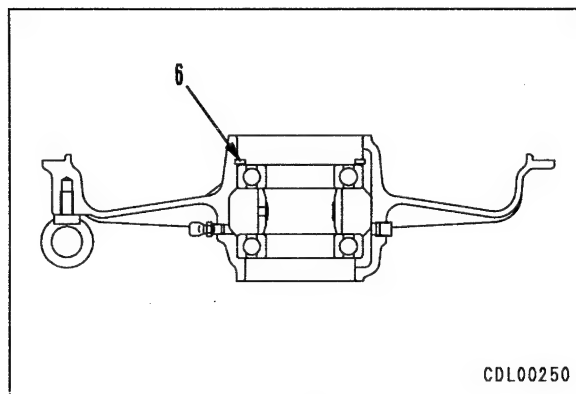
Coat bearing press-fitting surface with thread tightener (Loctite 601) before press fitting.



2. Snap ring

Install snap ring (6).

- ★ Check that the snap ring is fitted securely in the groove of the cover.

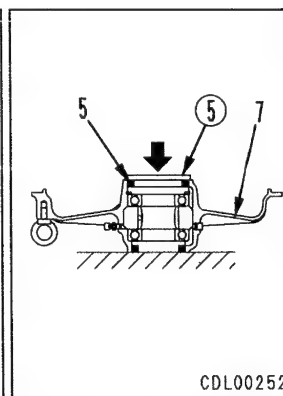
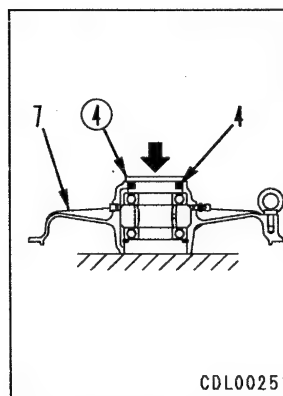


3. Oil seals

- 1) Using push tool (4), press fit oil seal (4) to cover (7).
- 2) Using push tool (5), press fit oil seal (5) to cover (7).

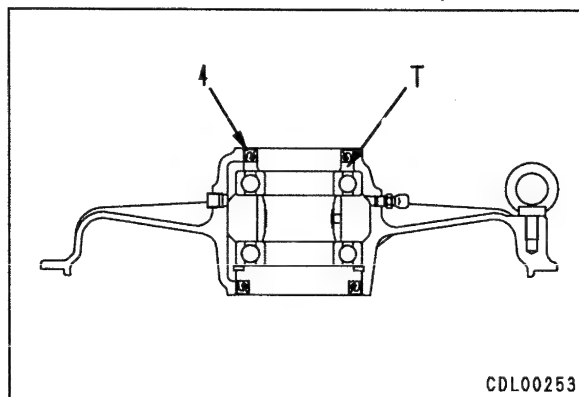


Coat outside circumference of oil seal uniformly with a thin layer of gasket sealant (LG-5) and after press fitting oil seal, wipe off sealant that is pushed out.



4. Shaft

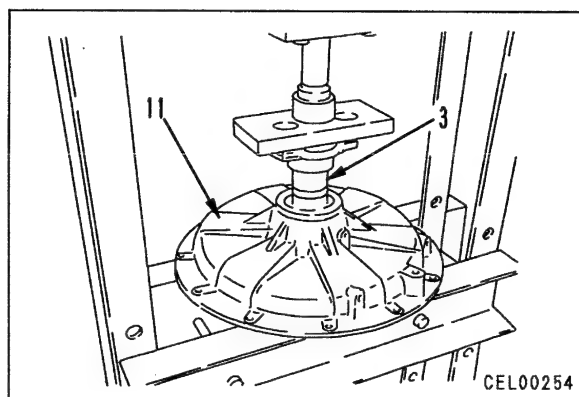
- 1) Fill space **T** between oil seal and bearing with 40cc of grease (G2-U-S) (Kyodo Grease Martemp SRL or equivalent).
- 2) Coat lip of oil seal (4) with grease (G2-U-S) (Kyodo Grease Martemp SRL or equivalent).



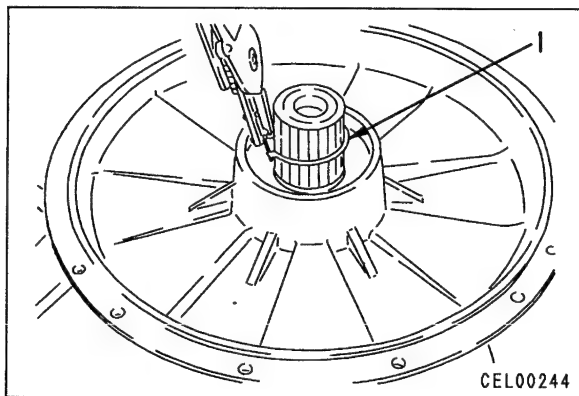
- 3) Set cover assembly (11) in press and press fit shaft (3).



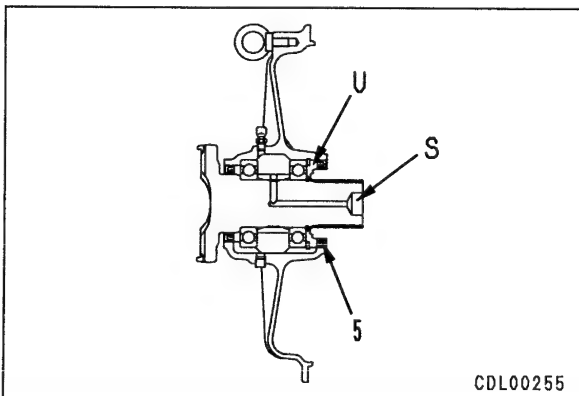
Coat bearing press-fitting surface with thread tightener (Loctite 601) before press fitting.

**5. Snap ring**

- 1) Install snap ring (1).
- ★ Check that the snap ring is fitted securely in the groove of the shaft.

**6. Greasing**

- 1) Fill space **U** between oil seal and bearing with 70cc of grease (G2-U-S) (Kyodo Grease Martemp SRL or equivalent).
- 2) Coat lip of oil seal (5) with grease (G2-U-S) (Kyodo Grease Martemp SRL or equivalent).
- 3) Fill space **S** of shaft with 30cc of grease (G2-U-S) (Kyodo Grease Martemp SRL or equivalent).



023S02

REMOVAL OF TRANSMISSION ASSEMBLY

- ⚠ Extend the outriggers fully, set blocks (height: approx. 350 mm) under the outriggers, raise the machine fully, then swing the revolving frame 90°.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Drain oil from hydraulic tank and transmission.

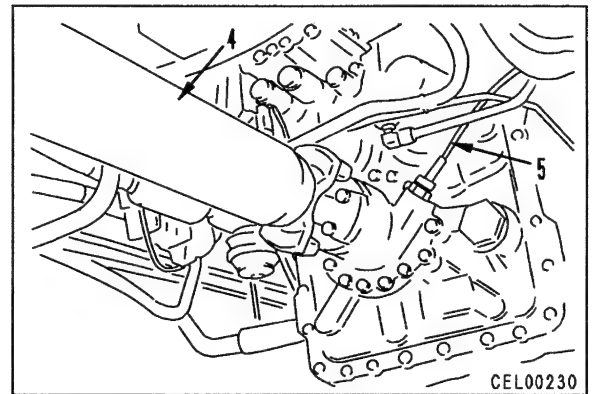
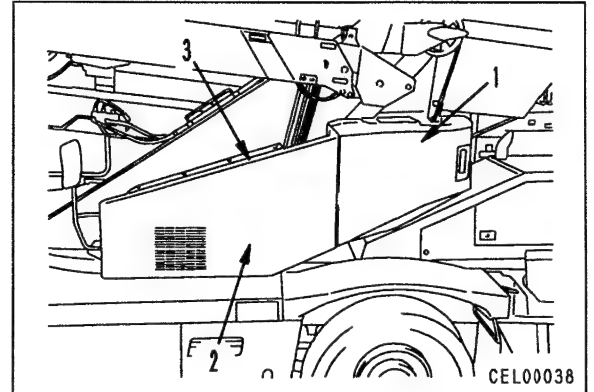


Hydraulic tank : 420 ℓ

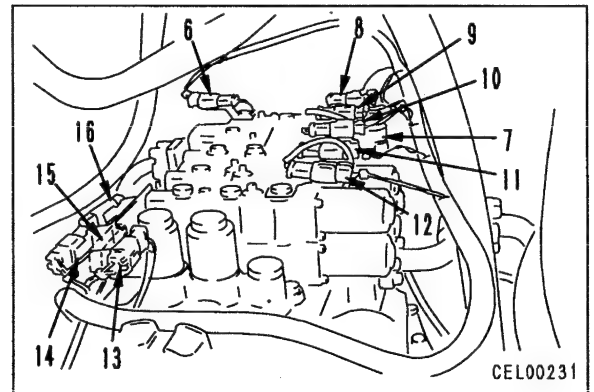


Transmission : 25 ℓ

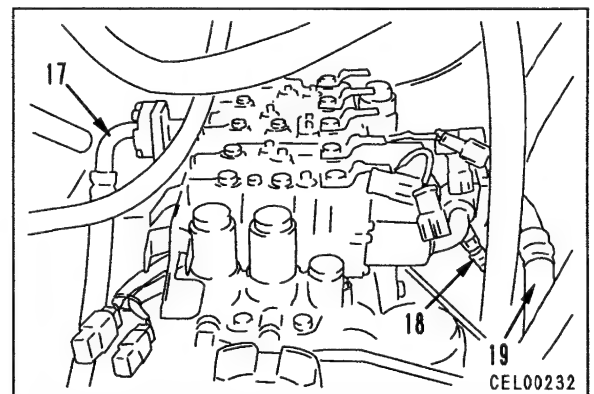
2. Remove top cover of transmission, steering, and swing pump assembly.
3. Remove covers (1), (2), and (3) on left side of revolving frame.
 - ★ Disconnect wiring connectors (R15), (R33), (R34), and (R35) from inside the cover.
4. Disconnect front drive shaft (4) at transmission end. ※ 1
5. Disconnect tachograph cable (5).



6. Disconnect wiring connectors (L105)(6), (L90)(7), (L92)(8), (L94)(9), (L97)(10), (L95)(11), (L93)(12), (L104)(13), (L103)(14), (L99)(15), and (L101)(16) from transmission control valve assembly.
 - ★ After disconnecting the connectors, fit tags to distinguish them.



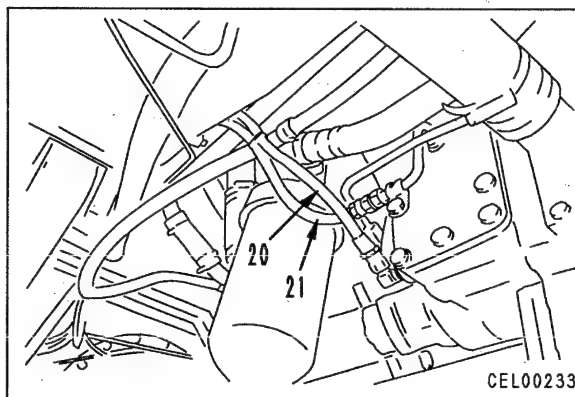
7. Disconnect hoses (17), (18), and (19).



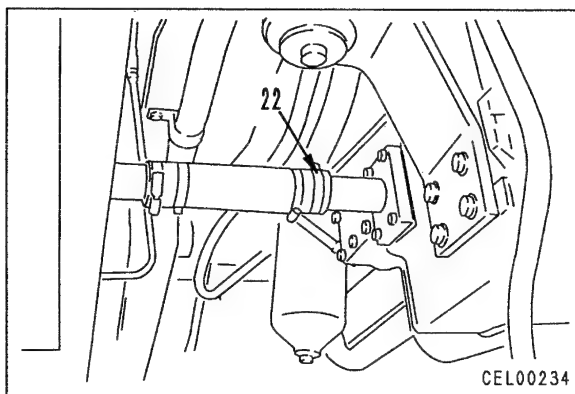
023S02

8. Disconnect hoses (20) and (21).

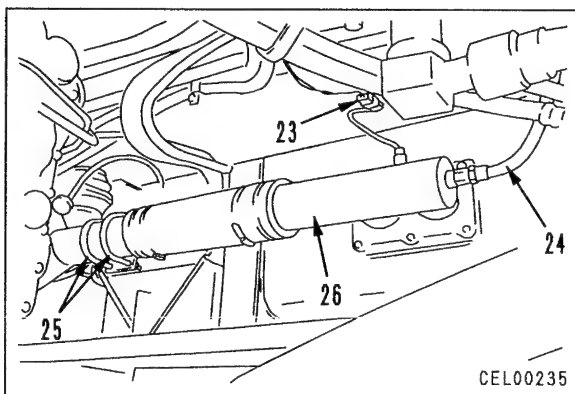
★ After disconnecting the hoses, fit tags to distinguish them.



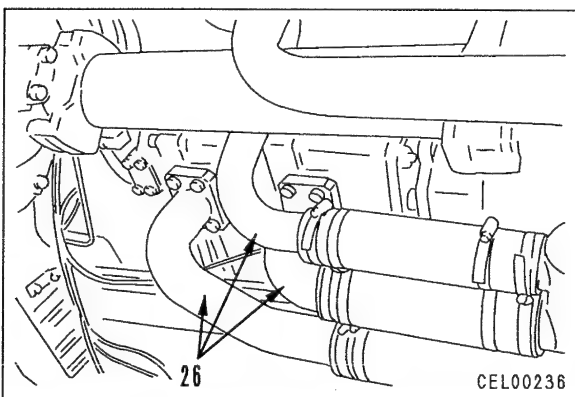
9. Remove oil supply pipe (22) from left side of transmission. ※ 1



10. Disconnect wiring connector (L108)(23) and hose (24), then remove U-clamps (25).

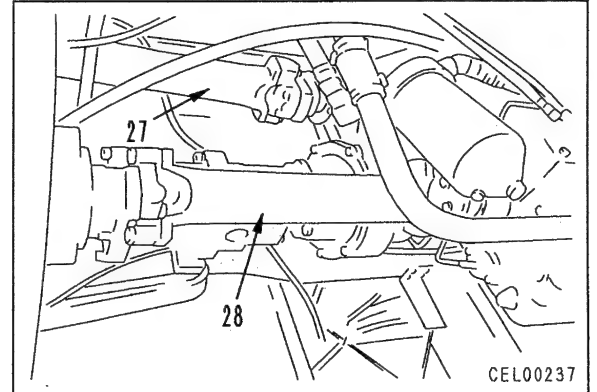


11. Disconnect suction tubes (26) between pump and hydraulic tank at pump end and hydraulic tank end, then remove.

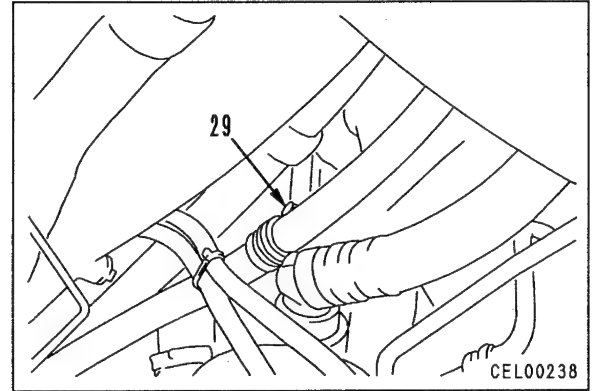


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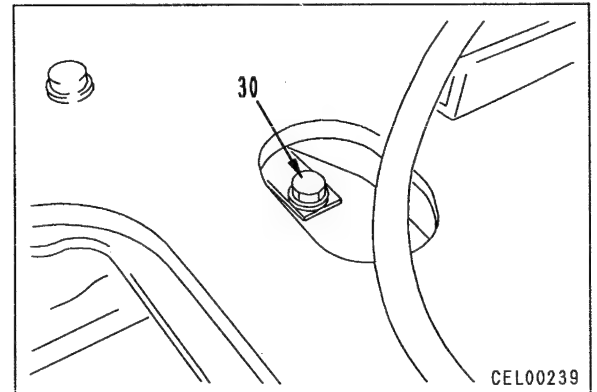
12. Disconnect rear drive shafts (27) and (28). ※ 1



13. Remove hose clamp bracket mounting bolt (29) from top of oil filter.

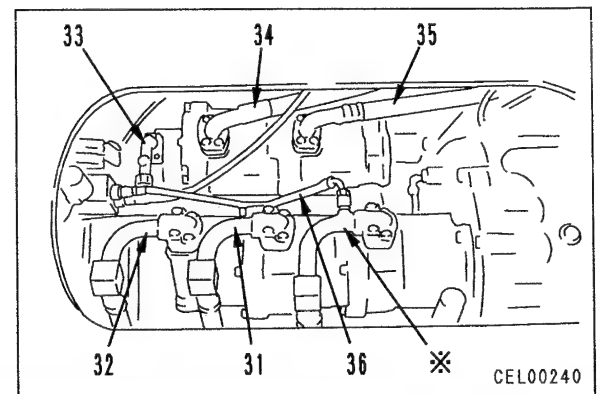


14. Remove hose clamp bracket mounting bolt (30) from top of chassis.




15. Disconnect tubes (31), (32), and (33), and hoses (34), (35), and (36) from pump.

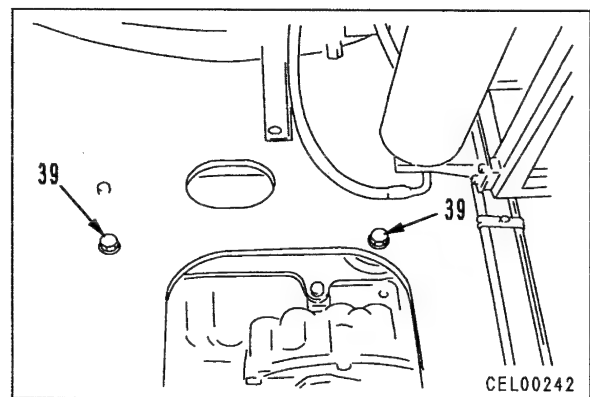
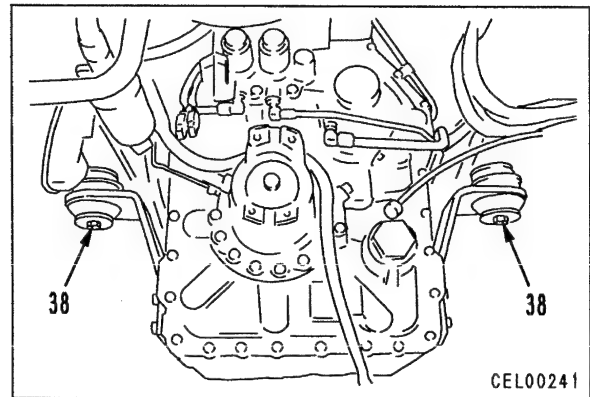
- ★ Do not disconnect the tube marked ※.
- ★ After disconnecting the hoses and tubes, fit tags to distinguish them.



023S02

16. Sling transmission assembly (37).
 - ★ Sling the coupling at the front, the oil pan in the middle, and the pump at the rear.
17. Remove front mounting bolt (38) and rear mounting bolt (39). ※ 4
18. Set steel board (1) under oil pan and transmission jack (2) under torque converter, then lower transmission assembly (37) slowly and slide it on steel plate to remove from chassis.
 - ★ Check that all wiring and piping has been disconnected before removing the transmission assembly.
 - ★ Be careful not to damage the wiring and piping when removing.


 Transmission assembly : **650 kg**




INSTALLATION OF TRANSMISSION ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1 ※ 3

 Drive shaft mounting bolt :
 $110.25 \pm 12.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }

※ 2

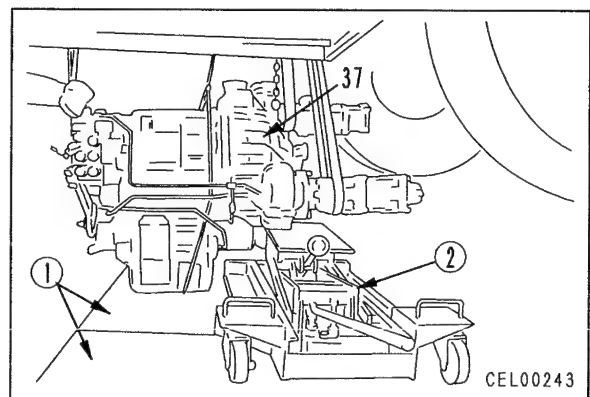
 Dipstick tube mounting bolt (transmission end) : **$66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }**

 Dipstick tube mounting bolt (middle of dipstick tube): **$53.9 \pm 19.6 \text{ Nm}$ { $5.5 \pm 2 \text{ kgm}$ }**

※ 4

- ★ There is no washer on the bolt at the front mount, so check when installing.

- **Refilling with oil (hydraulic tank, transmission)**
Add oil through oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.



023S02

DISASSEMBLY OF TRANSMISSION ASSEMBLY

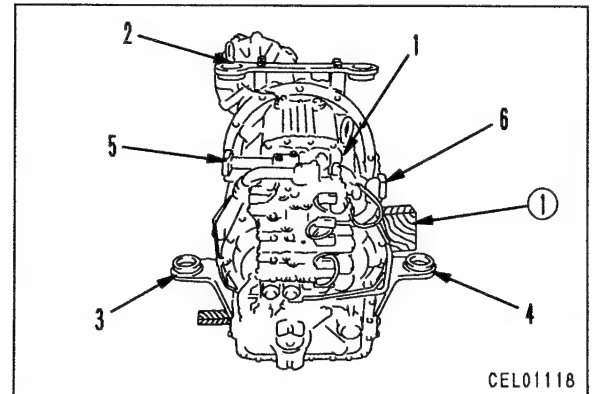
- ⚠** Set block (1) securely to transmission assembly (1).

1. Supports

Remove supports (2), (3), and (4).

2. Tubes

Remove tubes (5) and (6).

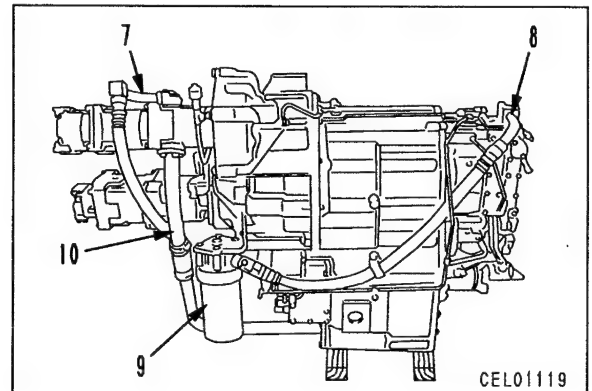


3. Transmission filter assembly

Disconnect tubes (7) and (8), and remove transmission filter assembly (9) together with bracket.

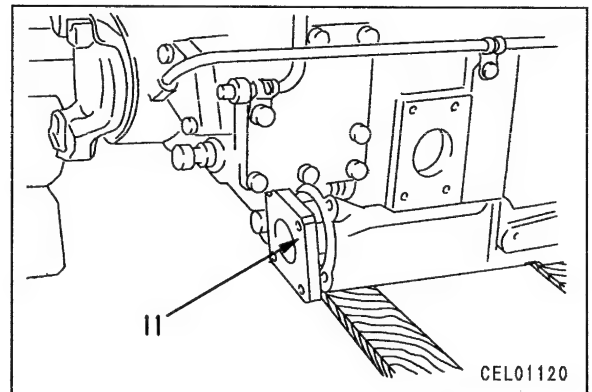
4. Suction tube

Remove suction tube (10).



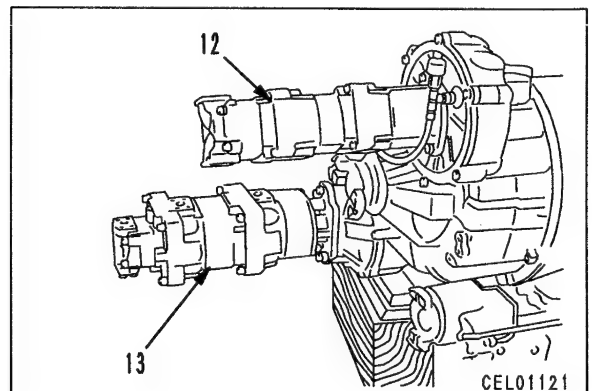
5. Strainer assembly

Remove strainer assembly (11).



6. Pump assembly

- 1) Sling transmission, steering (outrigger), and swing pump assembly (12), then remove mounting bolts, and remove.
- 2) Sling winch, boom, and PPC pump assembly (13), then remove



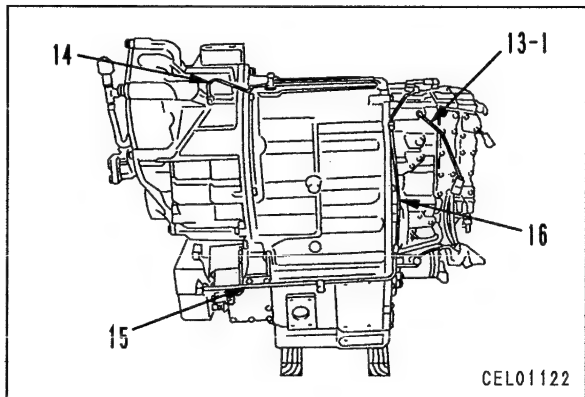
023S02

7. Oil temperature sensor

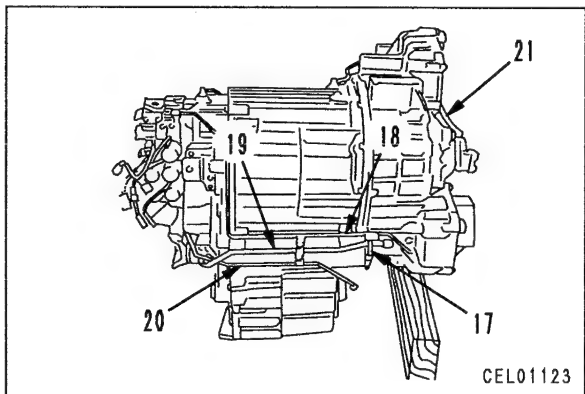
Remove oil temperature sensor (13-1).

8. Piping

- 1) Remove lubrication tube (14).
- 2) Remove tubes (15) and (16).

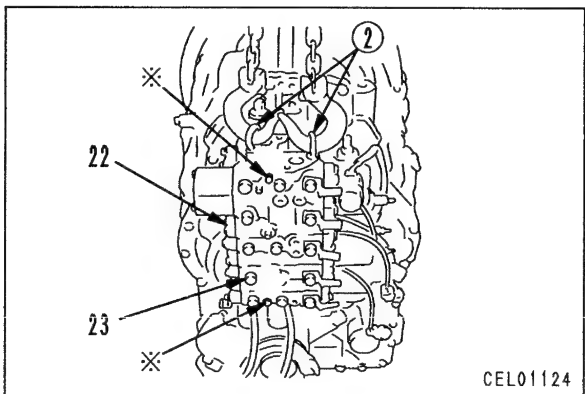


- 3) Remove engine tube (17), then remove PTO tube (18).
- 4) Remove tube (19).
- 5) Remove Hi/Lo tube (20).
- 6) Remove breather hose (21).

**9. Transmission control valve assembly**

Using eyebolts (2), sling transmission control valve assembly (22), then remove 13 mounting bolts (23), and lift off.

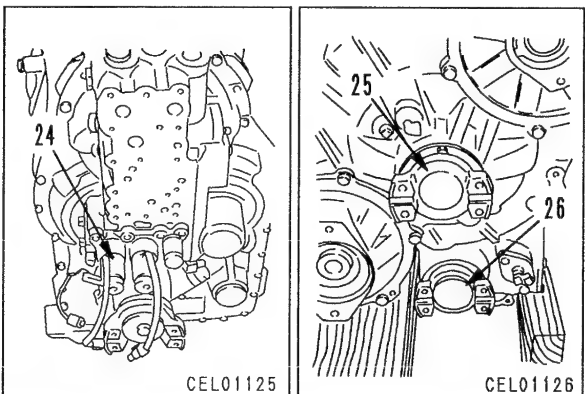
★ Do not remove the 2 bolts marked ※.

**10. Hi/Lo and 2WD/4WD valve assembly**

Remove Hi/Lo and 2WD/4WD valve assembly (24).

11. Couplings

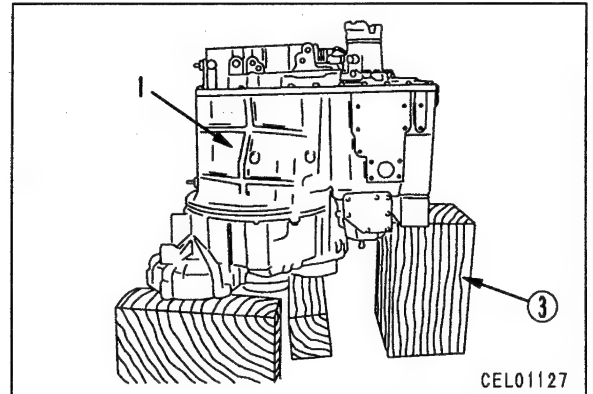
Remove couplings (25) and (26).



023S02

12. Turning over transmission assembly

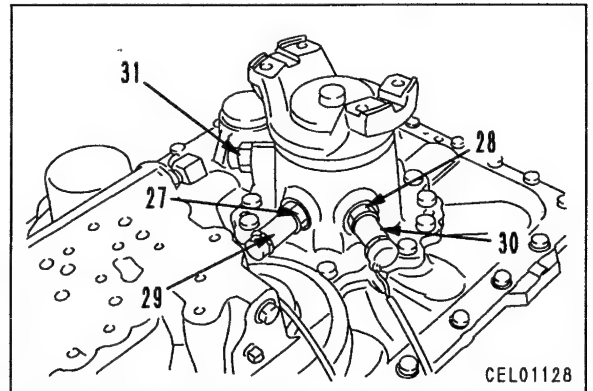
Turn over transmission assembly (1) so that rear case end is facing down, then set block ③ in position securely.

**13. Output shaft speed sensor**

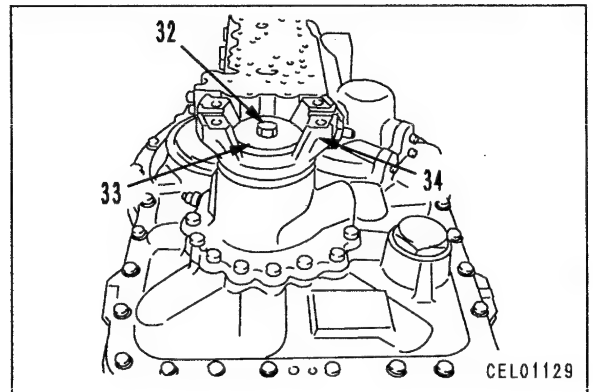
Loosen locknuts (27) and (28), and remove output shaft speed sensors (29) and (30).

14. Output detection pinion

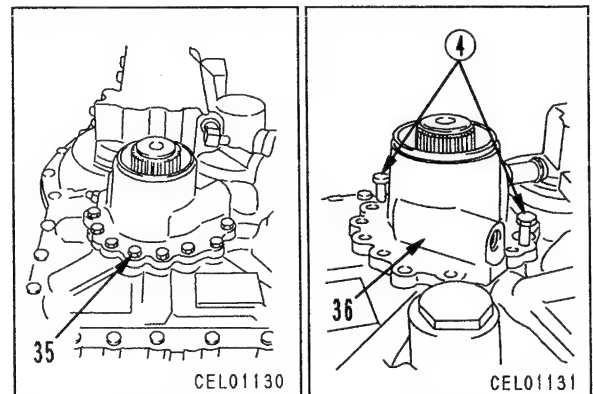
Remove sleeve (31), then remove output detection pinion.

**15. Coupling**

Remove mounting bolt (32), remove holder (33) and O-ring, then remove coupling (34).

**16. Cage assembly**

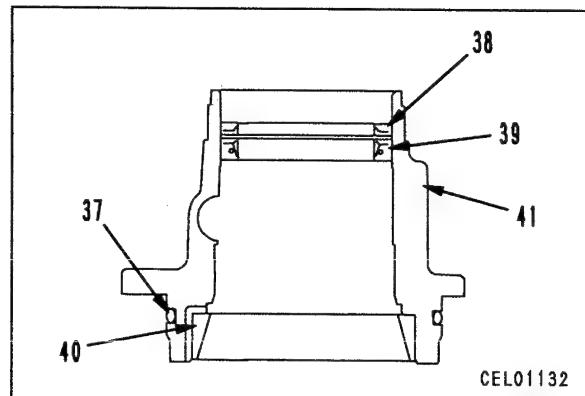
- 1) Remove cage assembly mounting bolts (35).
- 2) Using forcing screws ④, remove cage assembly (36).



023S02

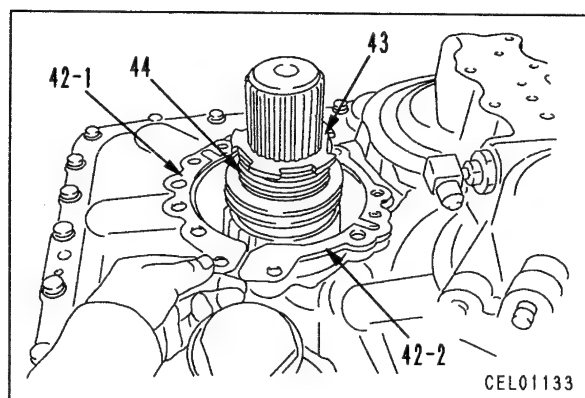
3) Disassembly of cage assembly

- i) Remove O-ring (37).
- ii) Remove oil seal (38), oil seal (39), and outer race (40) from cage (41).



4) Remove shims (42-1) and (42-2).

- ★ Check the number and thickness of the shims, and keep in a safe place.

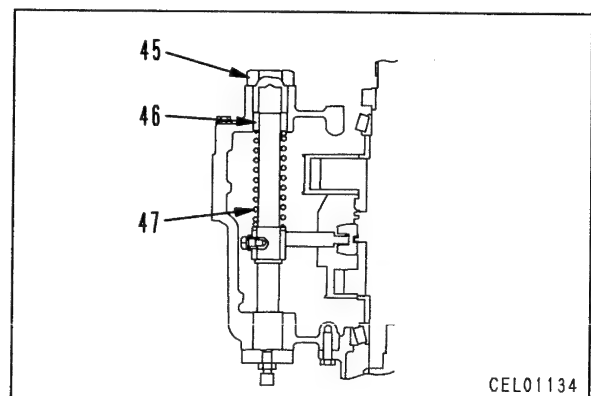


17. Plate, worm

Remove plate (43) and worm (44).

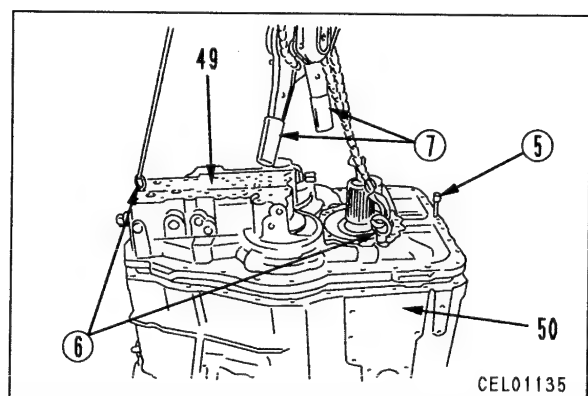
18. Hi/Lo spring

Remove plug (45), then remove spacer (46) and Hi/Lo spring (47).



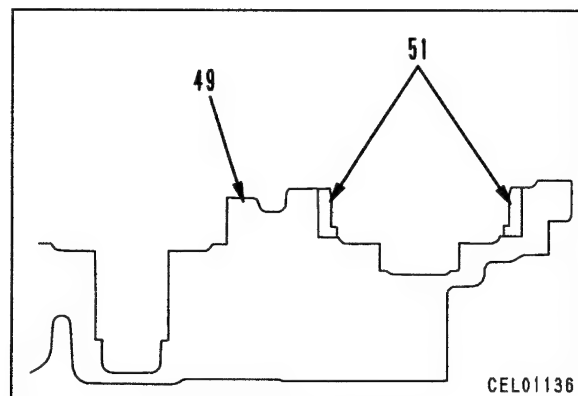
19. Front cover

- 1) Remove mounting bolts of front cover (49), then using forcing screw (5), disconnect from middle case (50).
 - ★ Tighten the forcing screws in turn to keep the clearance uniform between the front cover and middle case.
- 2) Using eyebolts (6), remove front cover (49).
 - ★ Adjust with lever block (7) to keep the clearance uniform between the front cover and middle case when removing.



023S02

- 3) Remove outer race (51) from front cover (49).

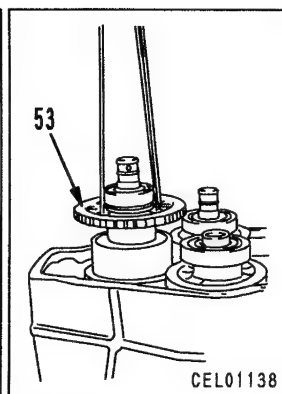
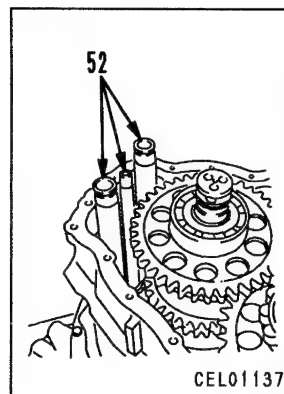


20. Tubes

Remove tubes (52).

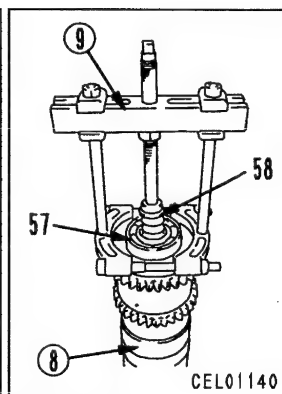
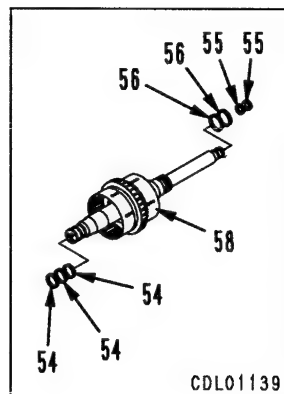
21. 3rd, REVERSE clutch assembly

- 1) Lift off 3rd and REVERSE clutch assembly (53).
 - ★ Remove slowly and be careful not to interfere with the other gears.

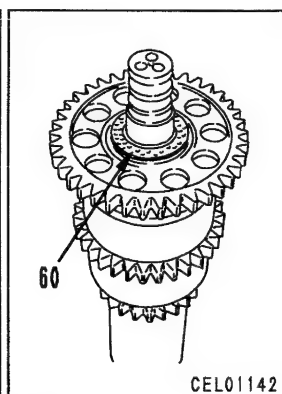
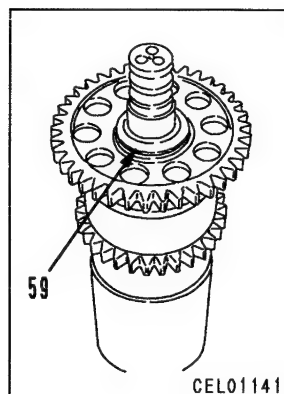


- 2) Disassembly of 3rd and REVERSE clutch assembly

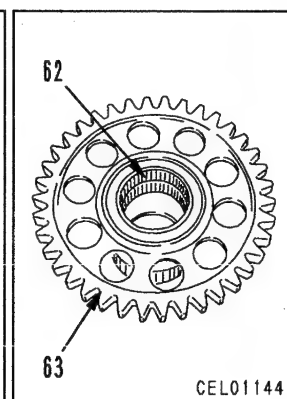
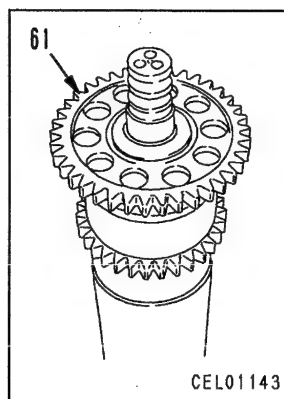
- i) Remove seal rings (54), (55), and (56) from shaft.
- ii) Set 3rd and REVERSE clutch assembly to block ⑧, then using puller ⑨, remove bearing (57) from shaft (58).



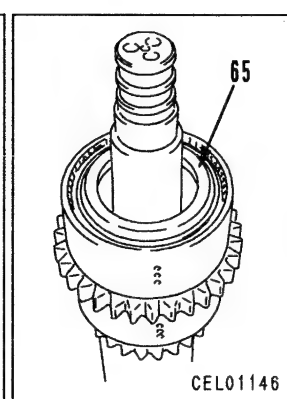
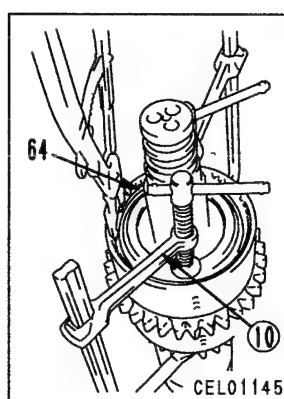
- iii) Remove spacer (59), then remove thrust washer (60).



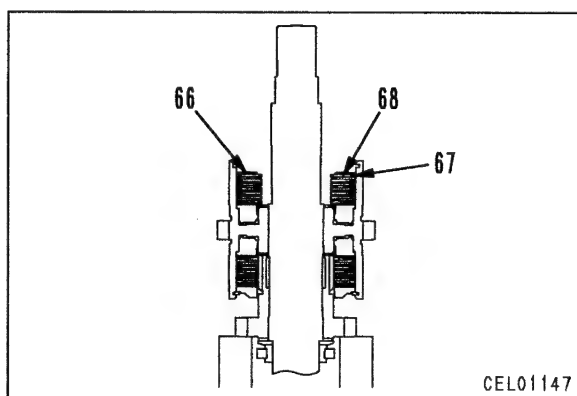
- iv) Remove 3rd gear assembly (61).
- v) Remove needle bearing (62) from 3rd gear (63).



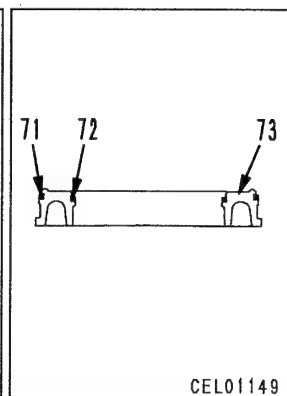
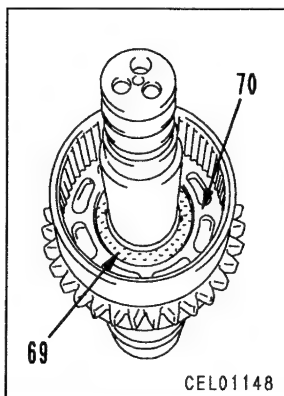
- vi) Push in end plate with bar handle (10) and remove snap ring (64).
- vii) Remove end plate (65).



- viii) Remove 8 plates (66), 7 springs (67), and 7 discs (68) in turn.
- ★ After removing the discs and plates, keep them in a flat place to prevent them from becoming distorted.

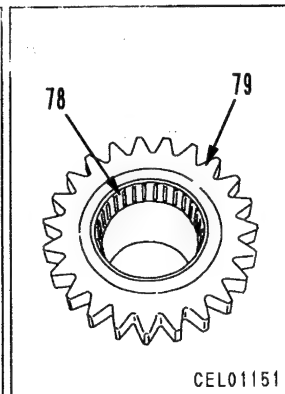
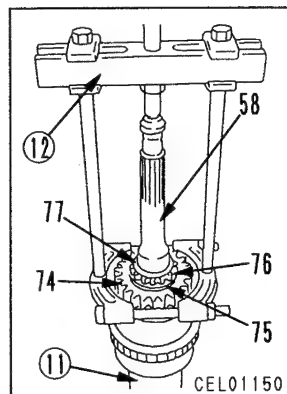


- ix) Remove thrust washer (69).
- x) Remove piston assembly (70).
- xi) Remove seal rings (71) and (72) from piston (73).
- ★ If the piston is at an angle and cannot be removed, push it back in and try again.
- ★ Be careful not to use force when removing the piston. The inside surface of the cylinder may be damaged.

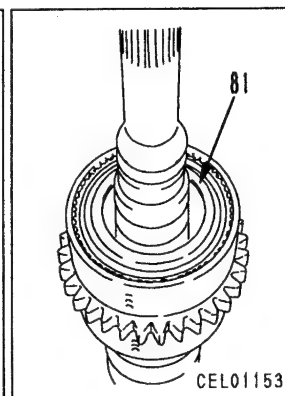
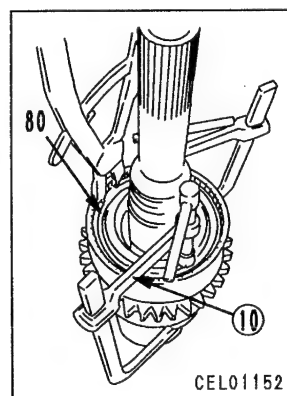


023S02

- xii) Turn over REVERSE clutch assembly and set to block (11), then using puller (12), remove REVERSE gear assembly (74), thrust washer (75), spacer (76), and bearing (77) as one set from shaft (58).
- xiii) Remove needle bearing (78) from REVERSE gear (79).

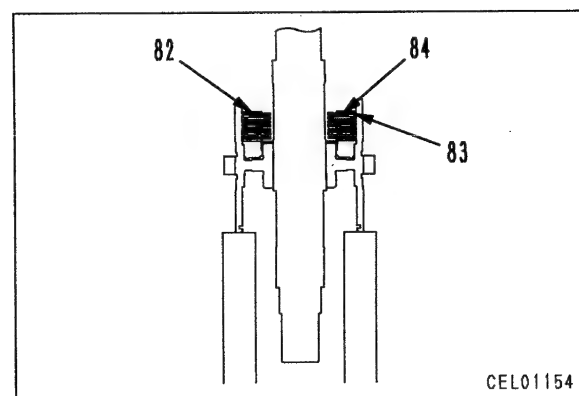


- xiv) Push in end plate with bar handle (10) and remove snap ring (80).
- xv) Remove end plate (81).



- xvi) Remove 8 plates (82), 7 springs (83), and 7 discs (84) in turn.

★ After removing the discs and plates, keep them in a flat place to prevent them from becoming distorted.



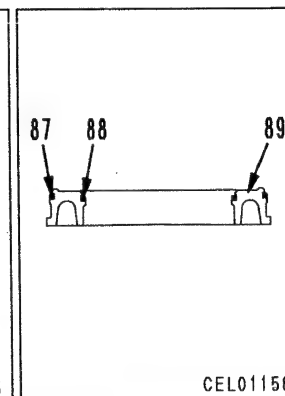
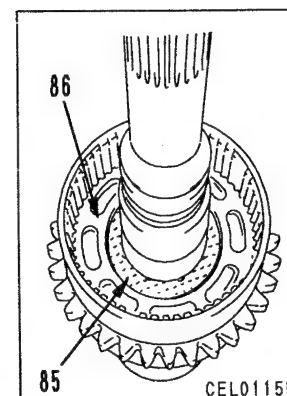
- xvii) Remove thrust washer (85).

- xviii) Blow in air through REVERSE oil hole of shaft to remove piston assembly (86).

★ If the piston is at an angle and cannot be removed, push it back in and try again.

★ Be careful not to use force when removing the piston. The inside surface of the cylinder may be damaged.

- xix) Remove seal rings (87) and (88) from piston (89).

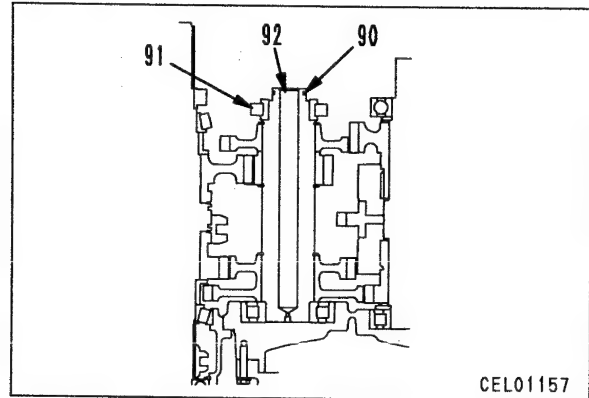


22. Seal ring

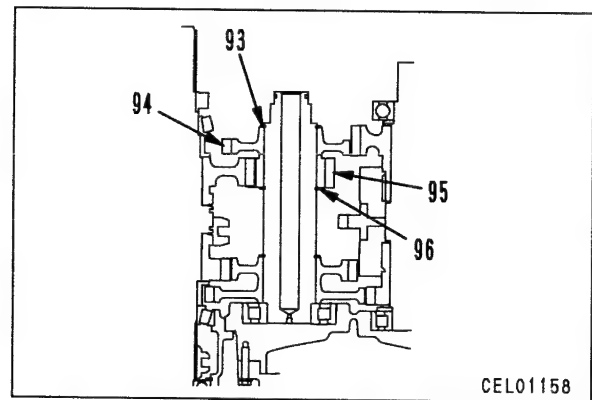
Remove seal ring (90).

23. Bearing

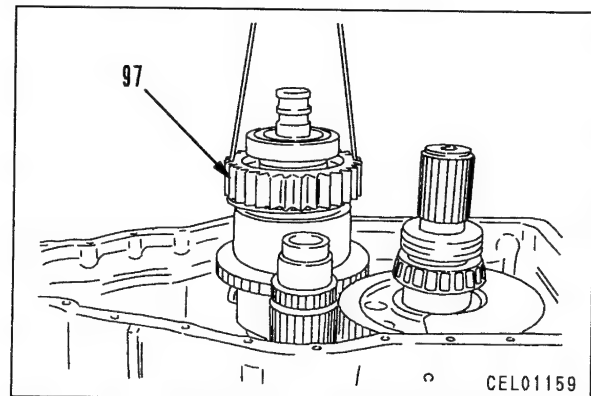
Using puller, remove bearing (91) from Hi/Lo shaft (92).

**24. Snap rings, gears**

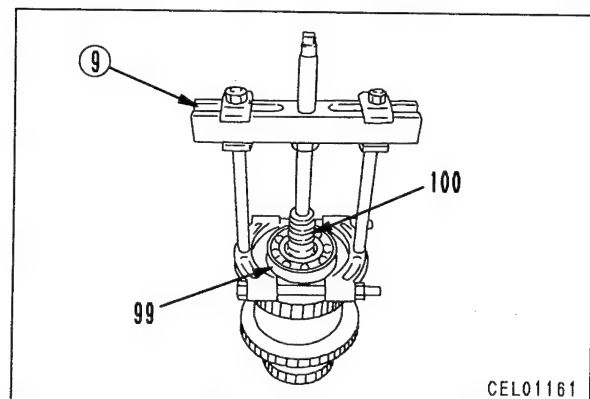
- 1) Remove snap ring (93), then remove gear (94).
- 2) Remove low gear (95).
- 3) Remove snap ring (96).

**25. 1st, 2nd clutch assembly**

- 1) Lift off 1st and 2nd clutch assembly (97).
 - ★ Remove slowly and be careful not to interfere with the other gears.

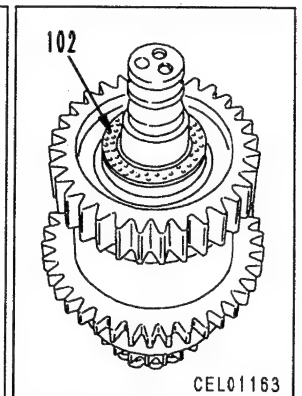
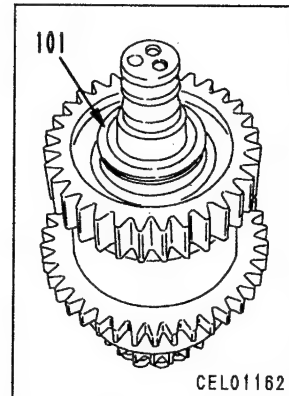


- 2) Disassembly of 1st, 2nd assembly
 - i) Remove seal ring (98) from shaft.
 - ii) Using puller ⑨, remove bearing (99) from shaft (100).

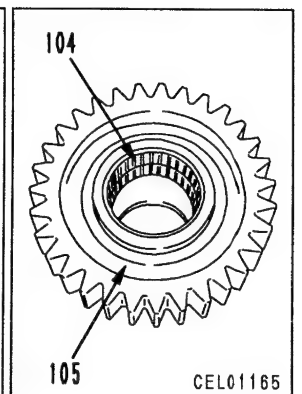
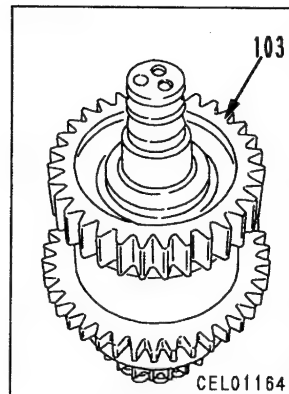


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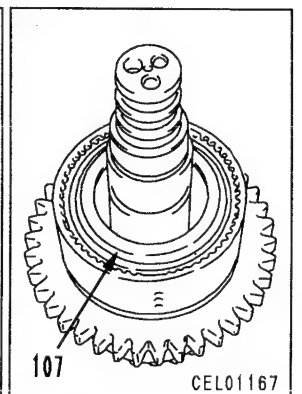
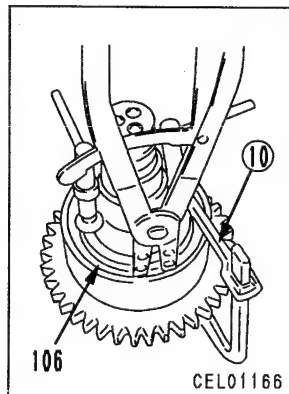
- iii) Remove spacer (101), then remove thrust washer (102).



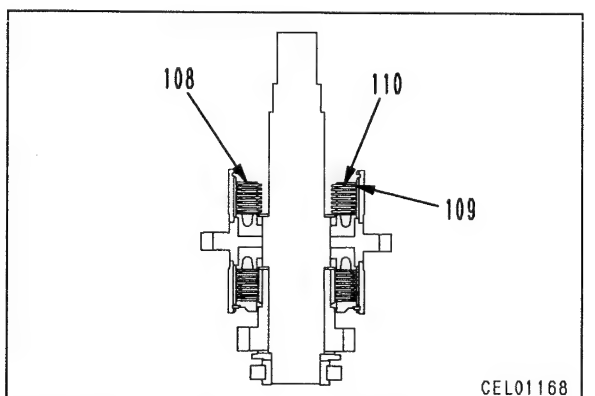
- iv) Remove 2nd gear assembly (103).
v) Remove 2 needle bearings (104) from 2nd gear (105).



- vi) Push in end plate with bar handle ⑩ and remove snap ring (106).
vii) Remove end plate (107).

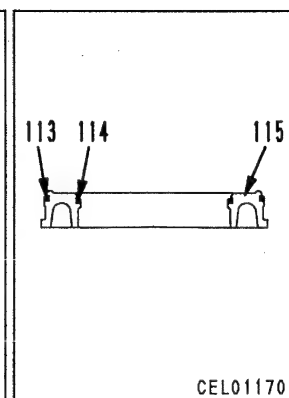
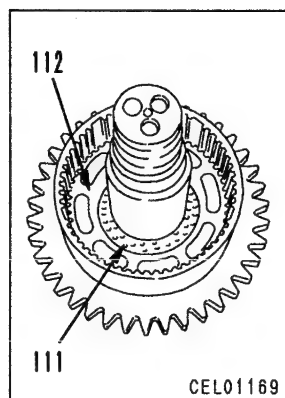


- viii) Remove 8 plates (108), 7 springs (109), and 7 discs (110) in turn.
★ After removing the discs and plates, keep them in a flat place to prevent them from becoming distorted.

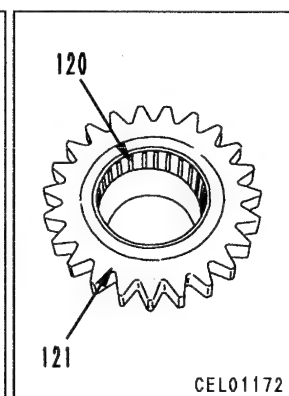
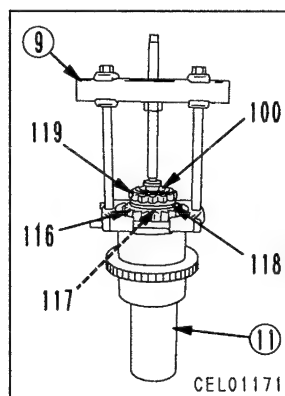


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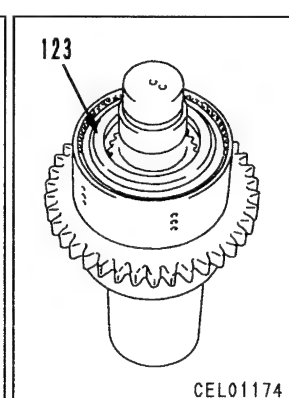
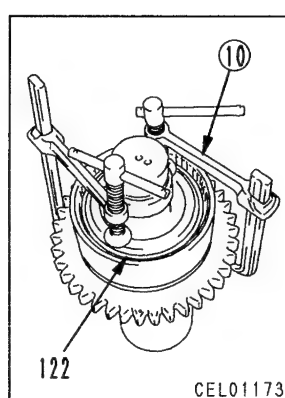
- ix) Remove thrust washer (111).
- x) Blow in air through 2nd oil hole of shaft to remove seal ring assembly (112).
 - ★ If the piston is at an angle and cannot be removed, push it back in and try again.
 - ★ Be careful not to use force when removing the piston. The inside surface of the cylinder may be damaged.
- xi) Remove seal rings (113) and (114) from piston (115).



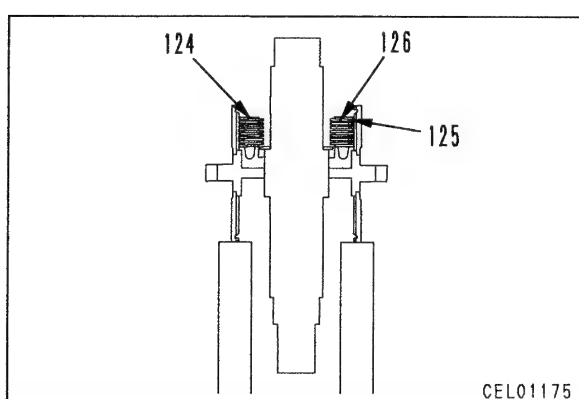
- xii) Turn over 1st clutch assembly and set to block (11), then using puller ⑨, remove 1st gear assembly (116), thrust washer (117), spacer (118), and bearing (119) as one set from shaft (100).
- xiii) Remove needle bearing (120) from 1st gear (121).



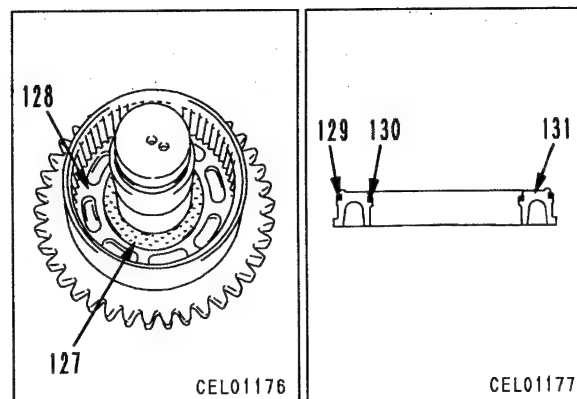
- xiv) Push in end plate with bar handle ⑩ and remove snap ring (122).
- xv) Remove end plate (123).



- xvi) Remove 8 plates (124), 7 springs (125), and 7 discs (126) in turn.
 - ★ After removing the discs and plates, keep them in a flat place to prevent them from becoming distorted.

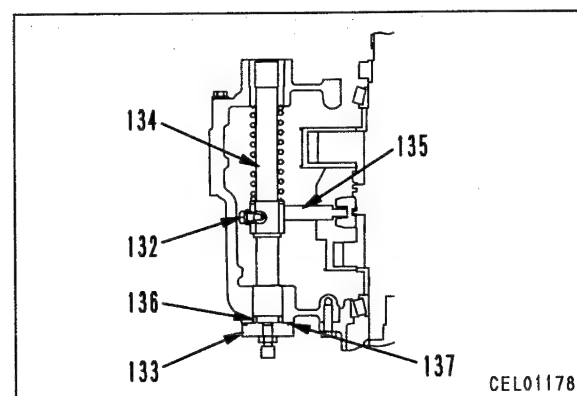


- xvii) Remove thrust washer (127).
- xviii) Blow in air through 1st oil hole of shaft to remove piston assembly (128).
 - ★ If the piston is at an angle and cannot be removed, push it back in and try again.
 - ★ Be careful not to use force when removing the piston. The inside surface of the cylinder may be damaged.
- xiv) Remove seal rings (129) and (130) from piston (131).



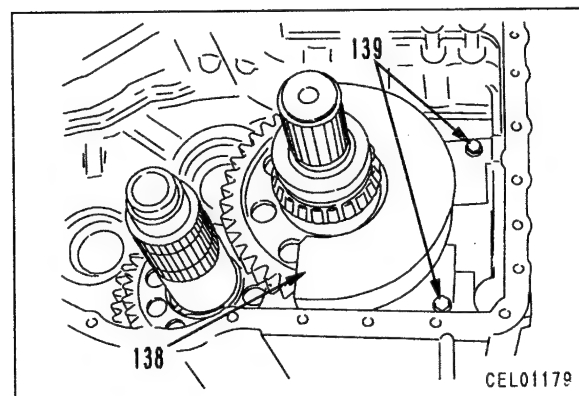
26. Hi/Lo fork, shaft

- 1) Remove screw (132).
- 2) Remove flange (133), and pull out shaft (134), then remove Hi/Lo fork (135).
- 3) Remove O-ring (136) from shaft.
- 4) Remove O-ring (137) from flange.

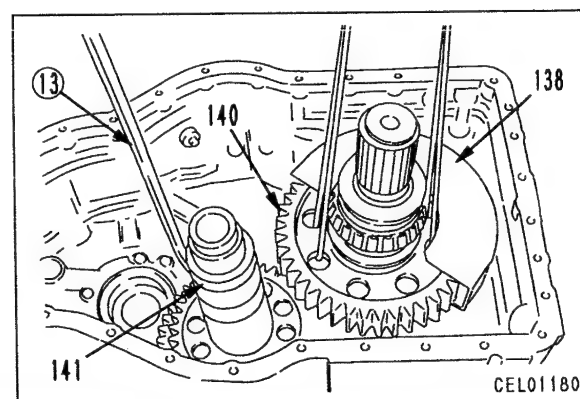


27. Hi/Lo output shaft assembly, Hi/Lo shaft assembly

- 1) Remove mounting bolts (139) of gear cover (138).

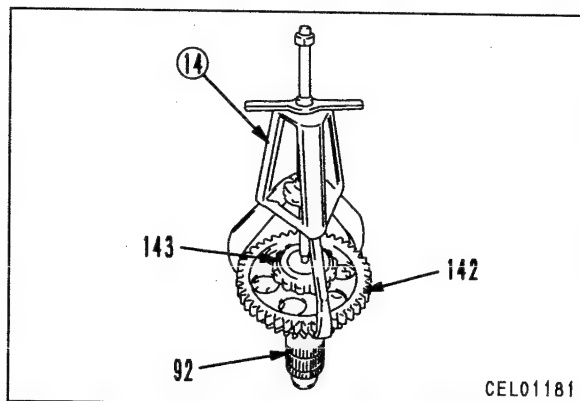


- 2) Raise Hi/Lo output shaft assembly (140) slowly, lever up Hi/Lo output shaft assembly (141) with bar ⑬, and remove Hi/Lo output shaft assembly and Hi/Lo shaft assembly.
 - ★ If only the Hi/Lo output shaft assembly is raised, the Hi/Lo shaft assembly gear will hit the bearing at portion F. This will damage the bearing, so lever up the Hi/Lo output shaft assembly when removing.
- 3) Remove gear cover (138) from Hi/Lo output shaft assembly.

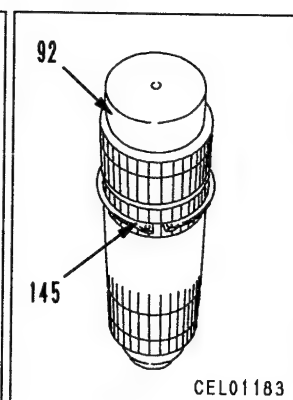
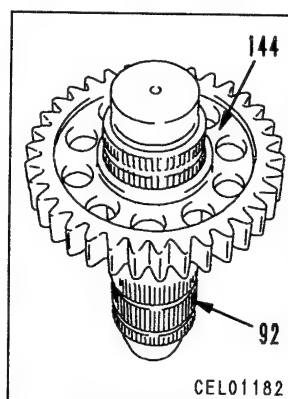


4) Disassembly of Hi/Lo shaft assembly

- i) Using puller ⑭, remove gear (142) together with bearing (143) from shaft (92).

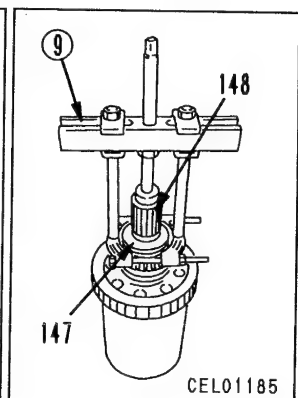
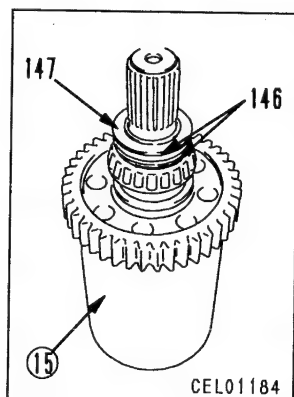


- ii) Remove Hi gear (144), then remove snap ring (145) from shaft (92).

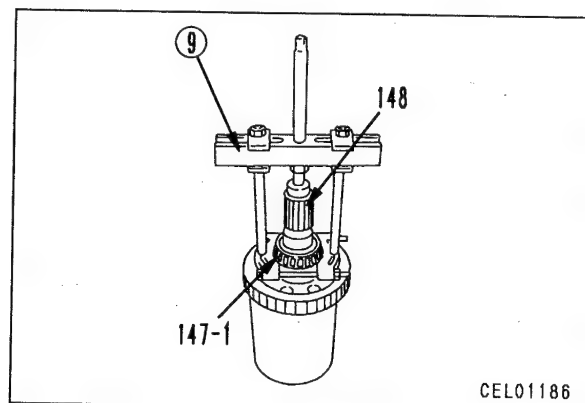


5) Disassembly of Hi/Lo output shaft assembly

- i) Set Hi/Lo output shaft assembly to block (15).
- ii) Remove seal ring (146) from spacer (147).
- iii) Using puller ⑨, remove spacer (147) from shaft (148).



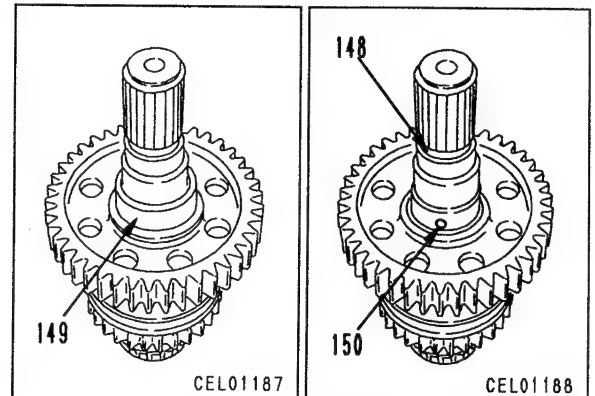
- iv) Using puller ⑨, remove bearing (147-1) from shaft (148).



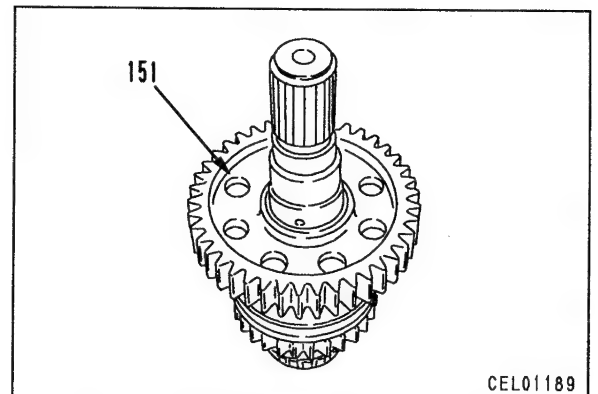
023S02

- v) Remove spacer (149), then remove ball (150) from shaft (148).

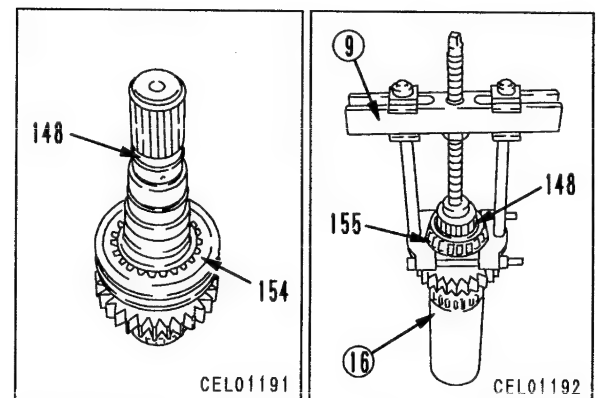
★ Be extremely careful not to lose the ball.



- vi) Remove Lo gear assembly (151).

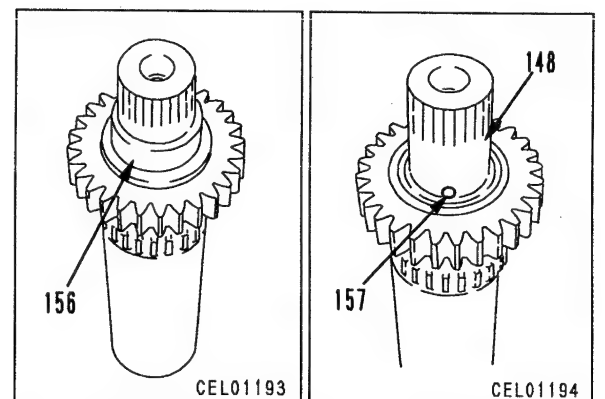


- vii) Remove Hi/Lo gear (154) from shaft (148).
viii) Turn over shaft and set to block (16), then using puller (9), remove bearing (155) from shaft (148).



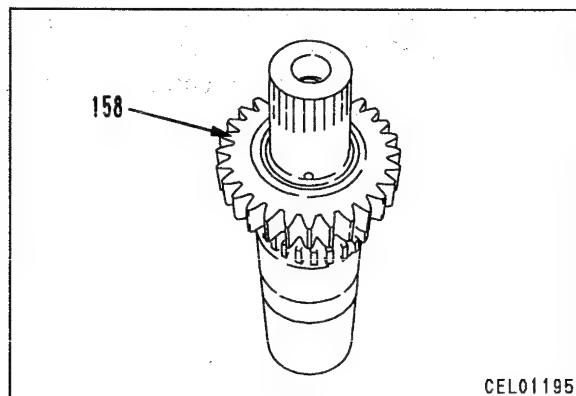
- ix) Remove spacer (156), then remove ball (157) from shaft (148).

★ Be extremely careful not to lose the ball.



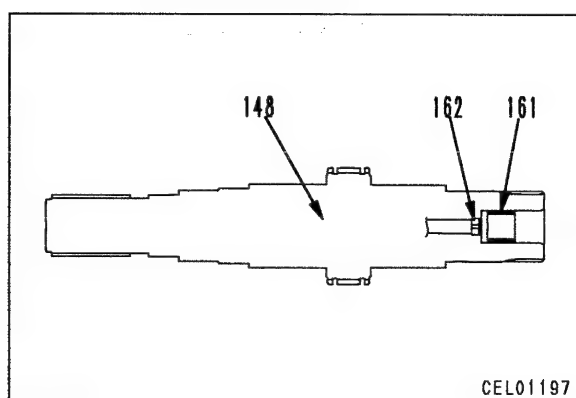
023S02

- x) Remove Hi gear assembly (158).



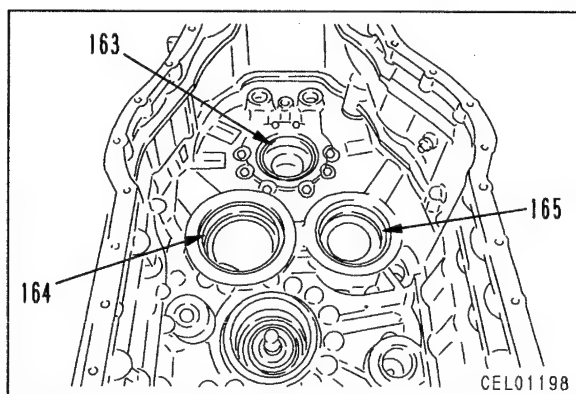
- xi) Remove needle bearing (161) from shaft (148).

- xii) Remove plug (162).



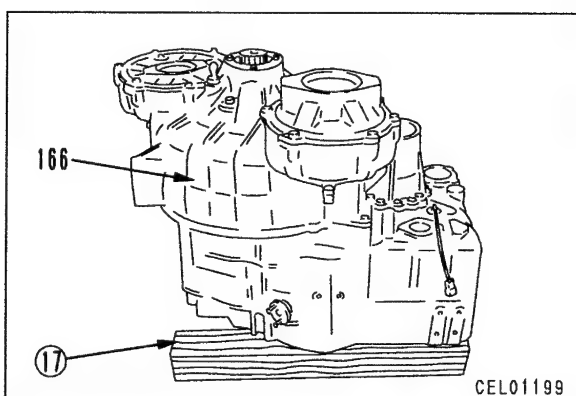
28. Outer races

Remove outer races (163), (164), and (165) from middle case.



29. Turning over torque converter, middle case assembly

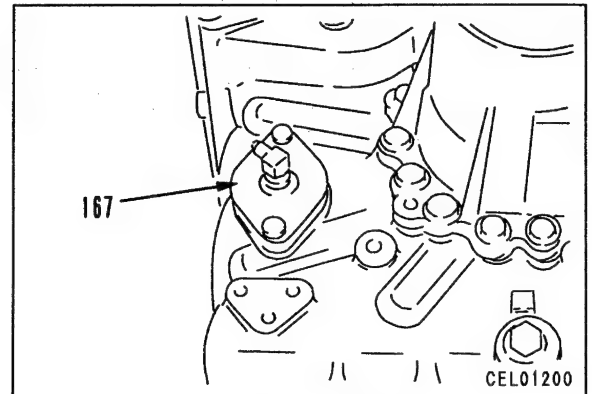
Turn over torque converter and middle case assembly (166) so that middle case is facing down, then set to block ⑰.



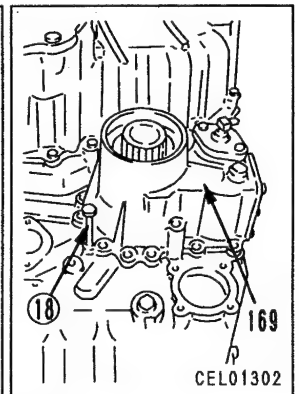
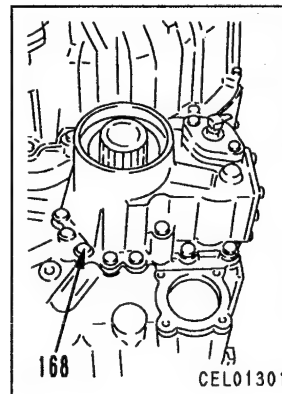
023S02

30. Flange

Remove flange (167).

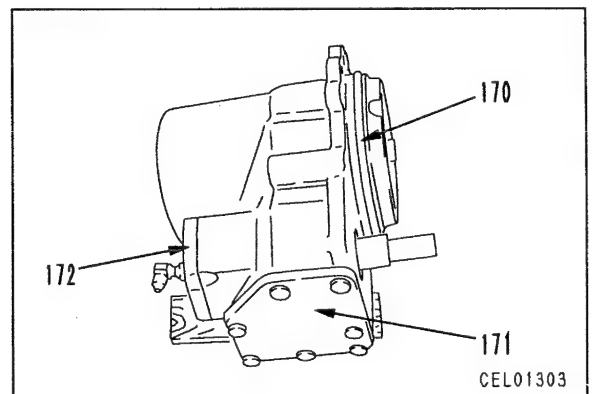
**31. Rear cage assembly**

- 1) Remove mounting bolts (168), then using forcing screw (18), remove rear cage assembly (169) from middle case.

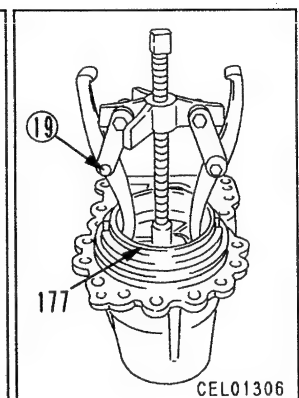
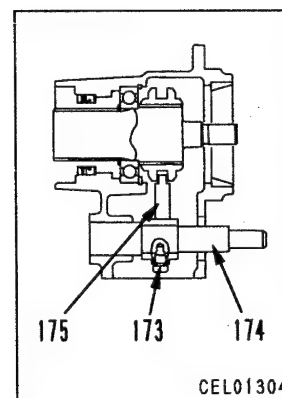


- 2) Disassembly of rear cage assembly

- i) Remove O-ring (170).
- ii) Remove plate (171).
- iii) Remove flange (172).

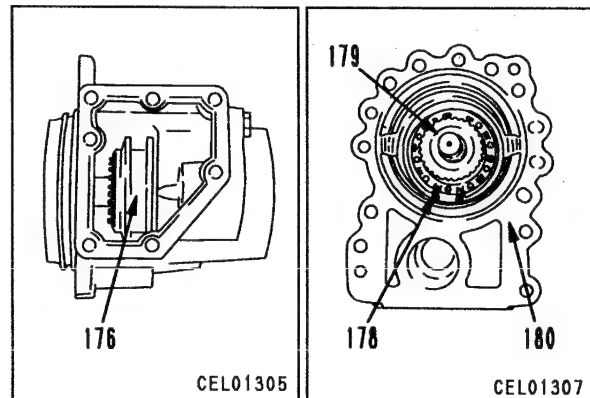


- iv) Remove screw (173), pull out shaft (174), then remove fork (175).
- v) Using puller (19), remove outer race (177).

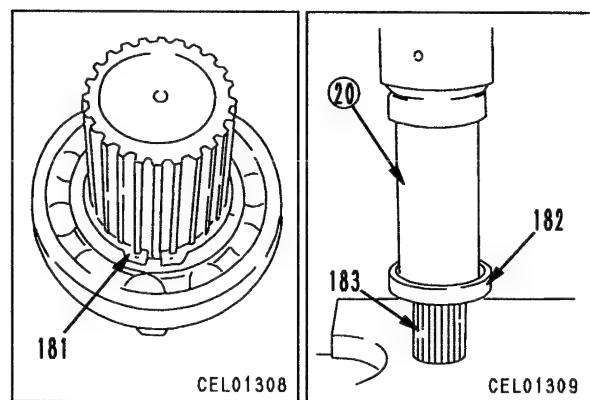


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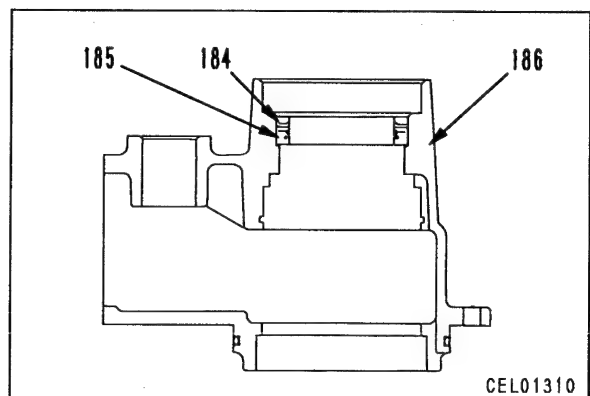
- vi) Remove transmitter (176) from rear output shaft.
- vii) Remove snap ring (178), then remove rear output shaft assembly (179) from rear cage assembly (180).



- viii) Remove snap ring (181), then using push tool ②, remove bearing (182) from rear output shaft (183).

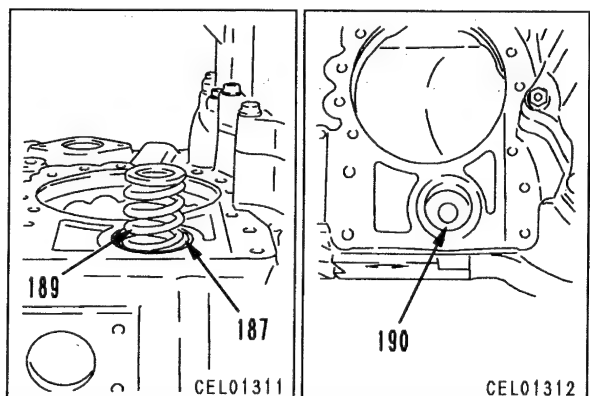


- ix) Remove dust seal (184) and oil seal (185) from rear cage (186).



32. Washer, spring, sleeve

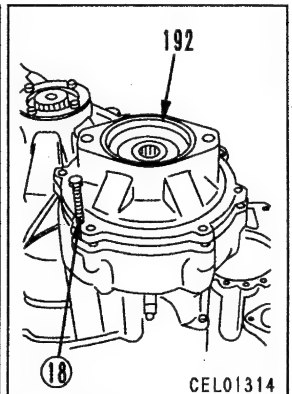
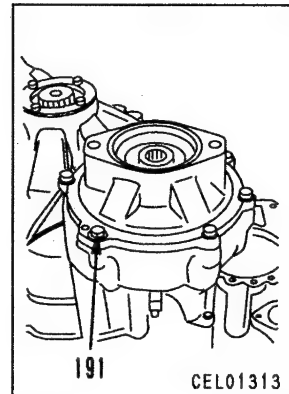
- 1) Remove O-ring (187).
- 2) Remove spring (189), then remove sleeve (190) from middle case.



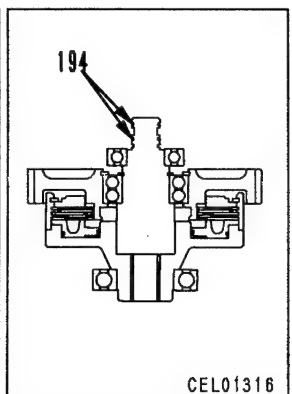
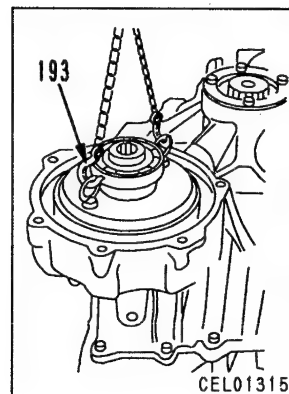
023S02

33. PTO cover

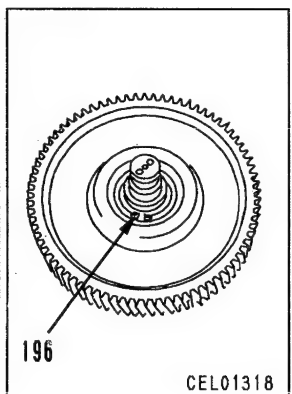
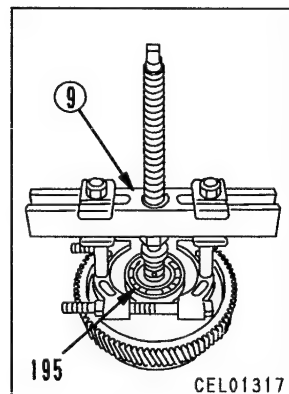
Remove mounting bolts (191), using forcing screw ⑱, remove PTO cover (192).

**34. PTO clutch assembly**

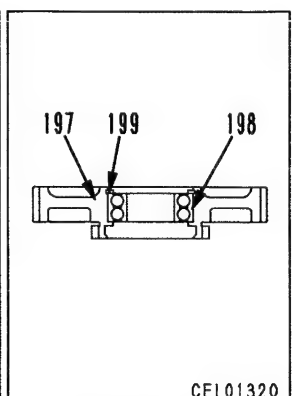
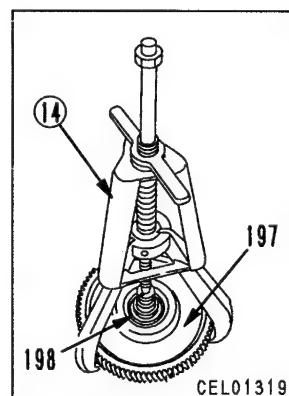
- 1) Using eyebolts, remove PTO clutch assembly (193) from rear case.
 - ★ Remove slowly and be careful not to interfere with the rear case.
- 2) Disassembly of PTO clutch assembly
 - i) Remove seal ring (194) from shaft assembly.



- ii) Using puller ⑨, remove bearing (195) from shaft assembly.
- iii) Remove snap ring (196).

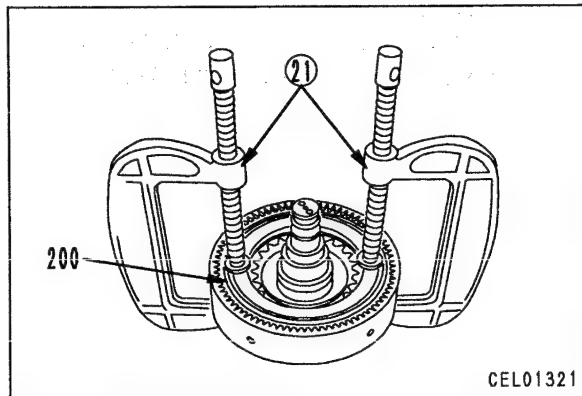


- iv) Using puller ⑭, remove PTO gear (197) together with bearing (198).
- v) Remove snap ring (199), then remove bearing (198) from PTO gear (197).

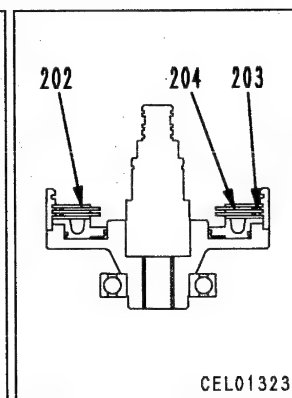
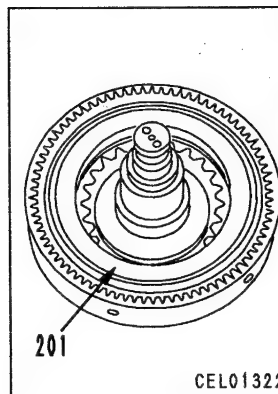


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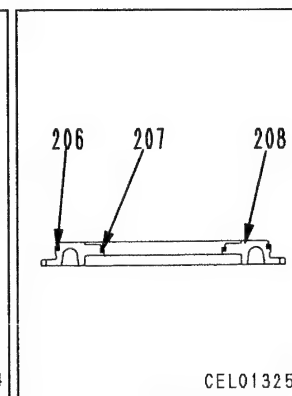
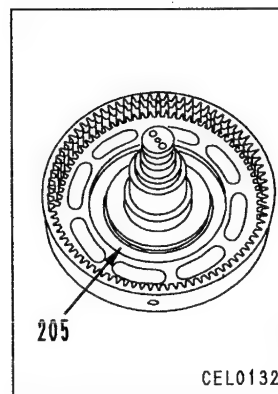
- vi) Using garage vice ②①, push end plate, and remove snap ring (200).



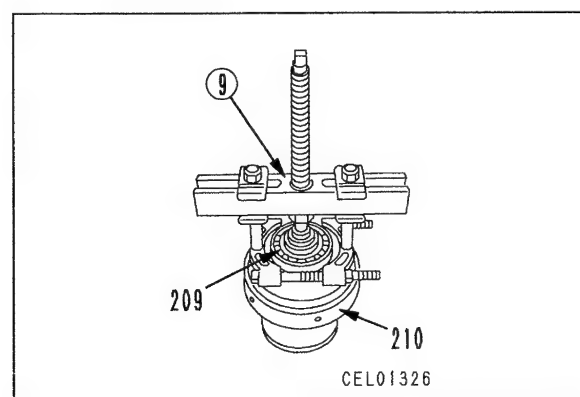
- vii) Remove end plate (201).
 viii) Remove 3 plates (202), 2 springs (203), and 2 discs (204) in turn.
 ★ After removing the discs and plates, keep them in a flat place to prevent them from becoming distorted.



- ix) Remove piston assembly (205).
 ★ If the piston is at an angle and cannot be removed, push it back in and try again.
 ★ Be careful not to use force when removing the piston. The inside surface of the cylinder may be damaged.
 x) Remove seal rings (206) and (207) from piston (208).



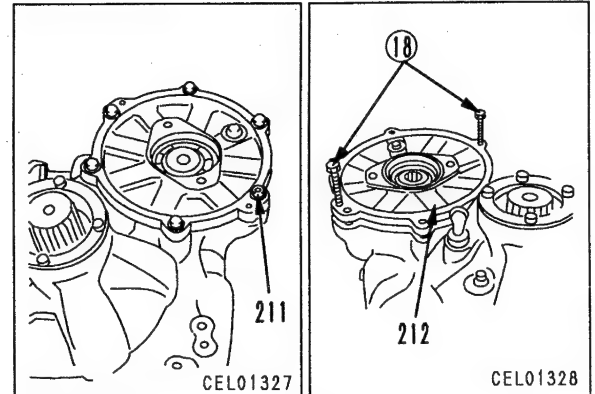
- xi) Using puller ⑨, remove bearing (209) from shaft assembly (210).



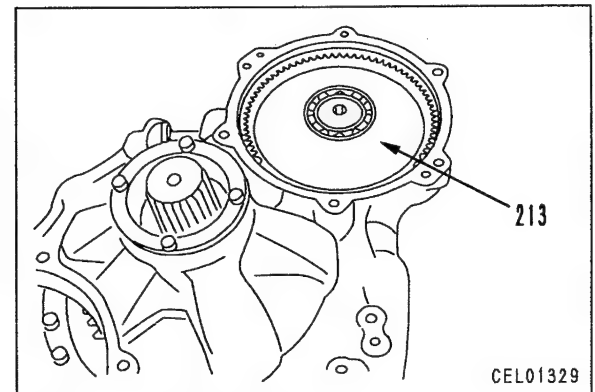
023S02

35. Cover

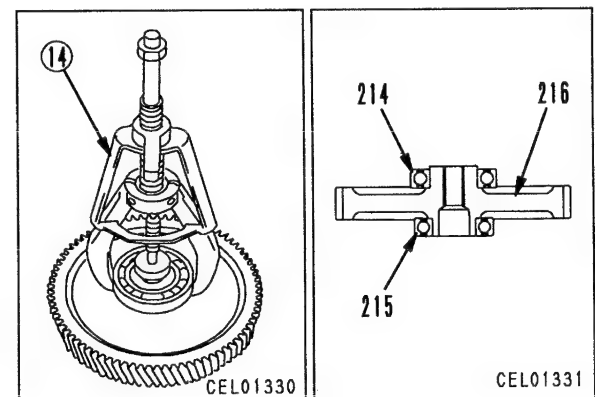
Remove mounting bolts (211), then using forcing screws (18), remove cover (212).

**36. PTO gear assembly**

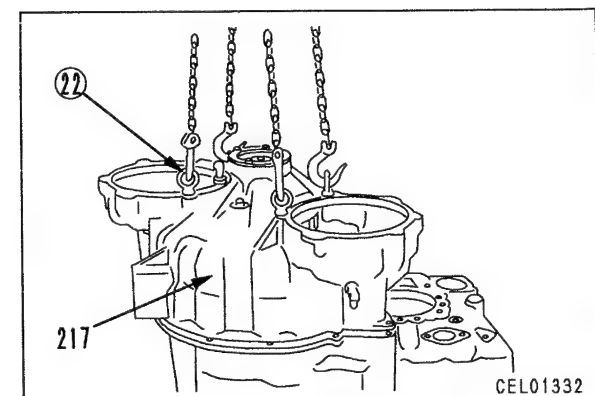
- 1) Remove PTO gear assembly (213) from rear case.
- ★ Remove slowly and be careful not to interfere with the rear case.



- 2) Disassembly of PTO gear assembly
Using puller (14), remove bearings (214) and (215) from PTO gear (216).

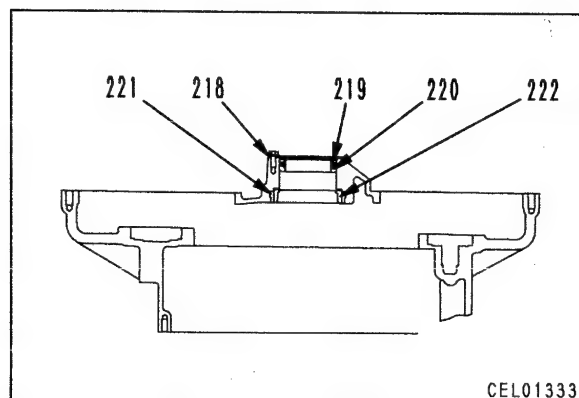
**37. Rear case assembly**

- 1) Remove mounting bolts of rear case assembly (217), then using eyebolts (22), remove rear case assembly from middle case.



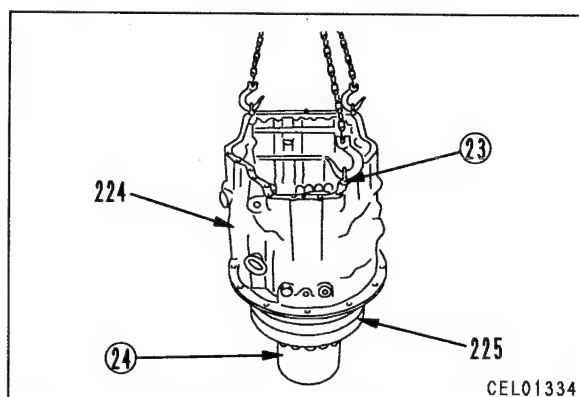
023S02

- 2) Disassembly of rear case assembly
 - i) Remove plate (218), then remove dust seal (219) and oil seal (220) from rear case (221).
 - ii) Remove outer race (222) from rear case.

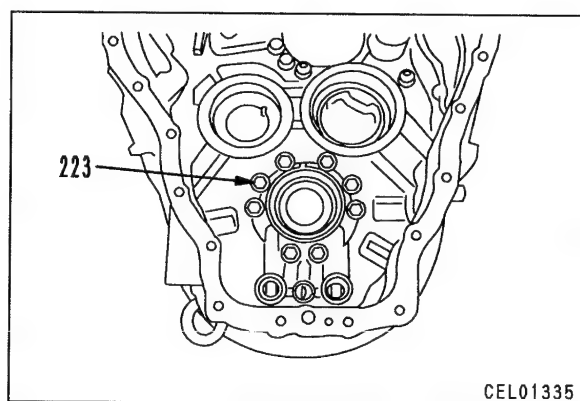


38. Middle case

- 1) Turn over torque converter and middle case assembly, then using eyebolts ②③, raise torque converter and middle case assembly, and set block ②④ under torque converter.
★ Leave the torque converter and middle case suspended.



- 2) Remove mounting bolts (223), then remove middle case (224) from torque converter assembly (225).



023S02

ASSEMBLY OF TRANSMISSION ASSEMBLY

- ★ Clean all parts, and check for dirt or damage before assembling.

1. Middle case

- 1) Set torque converter assembly (225) to block ②④.
- 2) Using eyebolts ②③, set middle case (224) to torque converter assembly, then tighten mounting bolts (223).



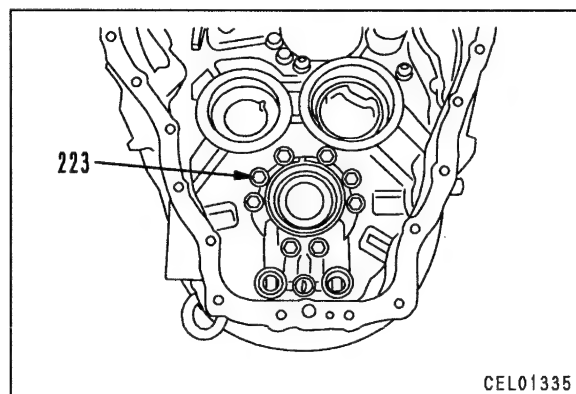
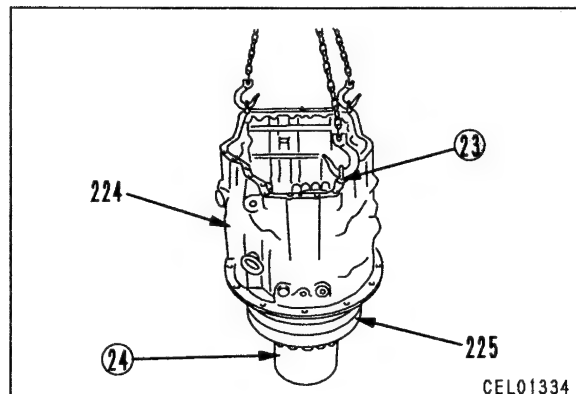
Mounting bolt :

Thread tightener (LT-2)



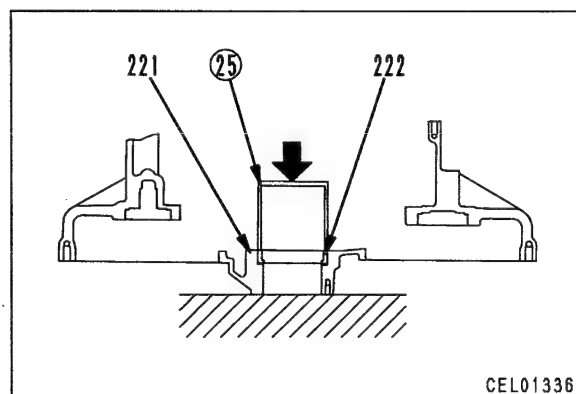
Mounting bolt :

$110.25 \pm 12.25 \text{ Nm } \{11.25 \pm 1.25 \text{ kgm}\}$



2. Rear case assembly

- 1) Assembly of rear case assembly
 - i) Using push tool ②⑤, press fit rear case outer race (222) to rear case (221).



- ii) Using push tool, press fit oil seal (220) and dust seal (219) to rear case (221) to positions a and b.

- ★ Press-fitting dimension a:

$11.0 \pm 0.2 \text{ mm}$

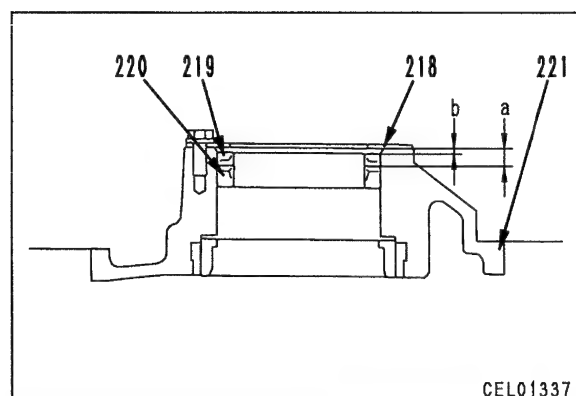
Press-fitting dimension b:

$3.0 \pm 0.2 \text{ mm}$



Seal lip : **Grease (G2-LI)**

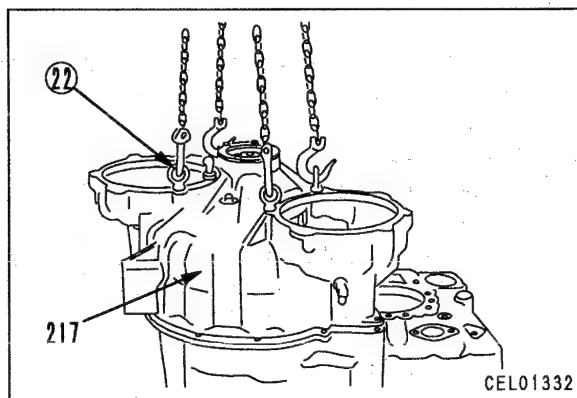
- iii) Install plate (218).



023S02

- 2) Fit O-ring to middle case, then using eyebolts ②, raise rear case assembly (217), and install to middle case.

★ Check that there is no dirt or damage on the O-ring insertion surface.

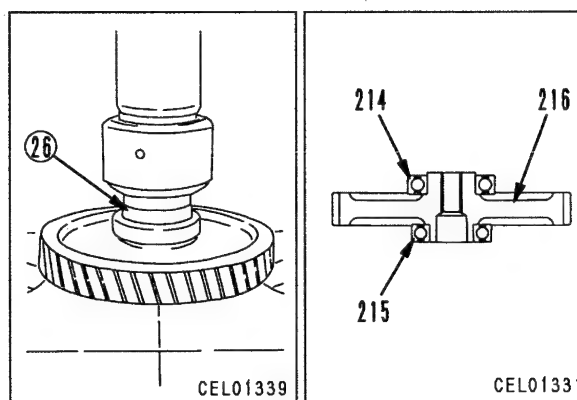


3. PTO gear assembly

- 1) Assembly of PTO gear assembly

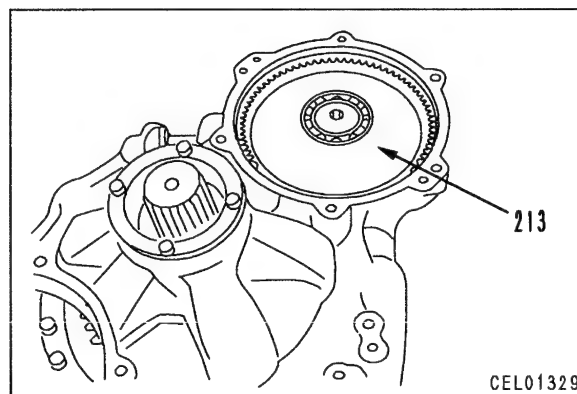
Using push tool ②⑥, press fit bearings (214) and (215) to PTO gear (216).

★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the gear.



- 2) Install PTO gear assembly (213) to rear case.

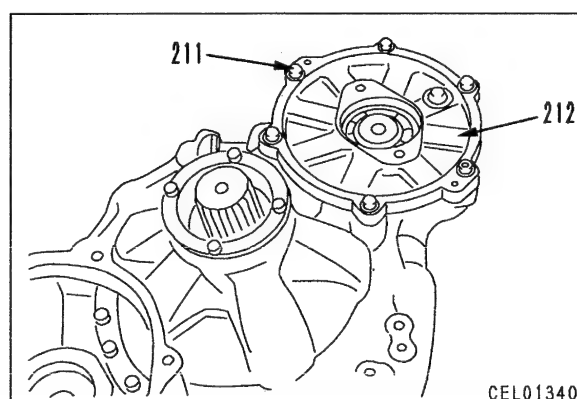
★ Remove slowly and be careful not to interfere with the rear case.



4. Cover

Fit O-ring, then fit cover (212) to rear case, and tighten mounting bolts (211).

★ Check that there is no dirt or damage on the mating surface of the cover or on the insertion surface of the O-ring.

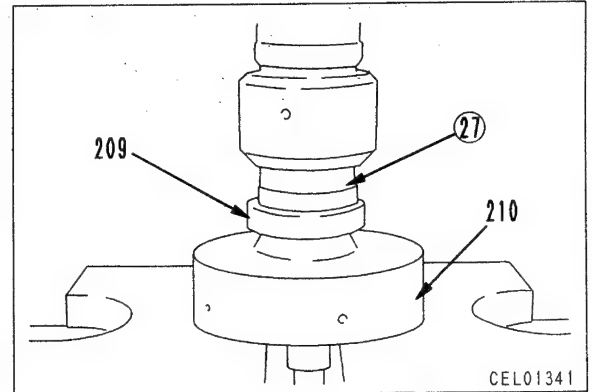


023S02

5. PTO clutch assembly**1) Assembly of PTO clutch assembly**

- i) Using push tool ②⑦, press fit bearing (209) to shaft assembly (210).

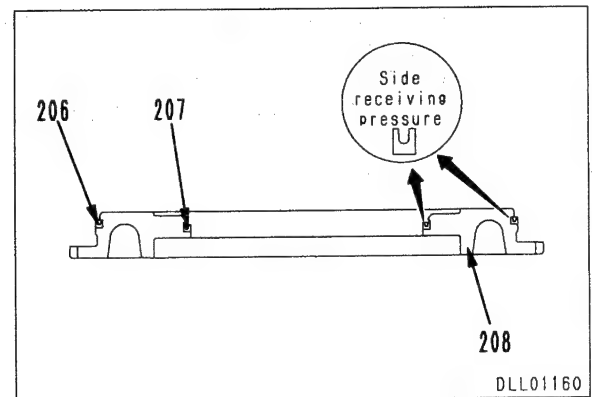
★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the shaft.



- ii) Assemble seal rings (206) and (207) to piston (208).

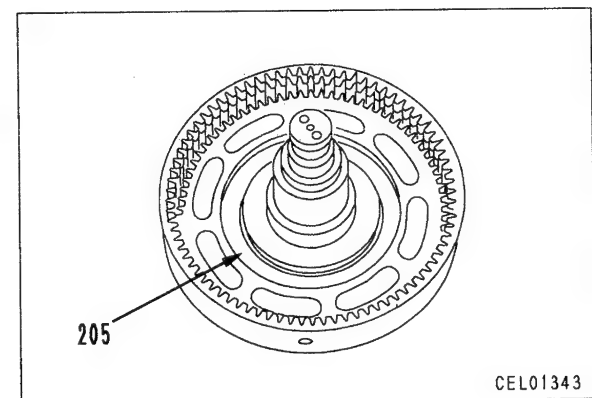
★ Be careful to assemble with the pressure-receiving side of the seal ring facing in the correct direction.

★ Use a new part for the seal ring.



- iii) Install piston assembly (205) to shaft assembly.

★ When installing the piston assembly to the shaft assembly, coat the outside circumference, inside circumference, and contact surface of the seal ring with transmission oil.

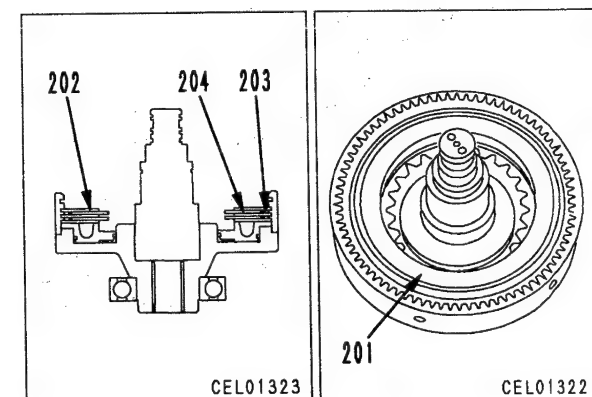


- iv) Assemble 3 plates (202), 2 springs (203), and 2 discs (204) in turn.

★ Soak the discs in clean transmission oil for at least 2 minutes before assembling.

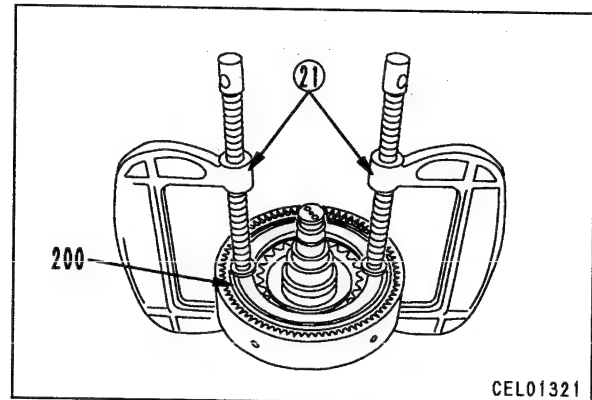
★ Be careful that the spring and disc are not stacked on top of each other.

- v) Install end plate (201).



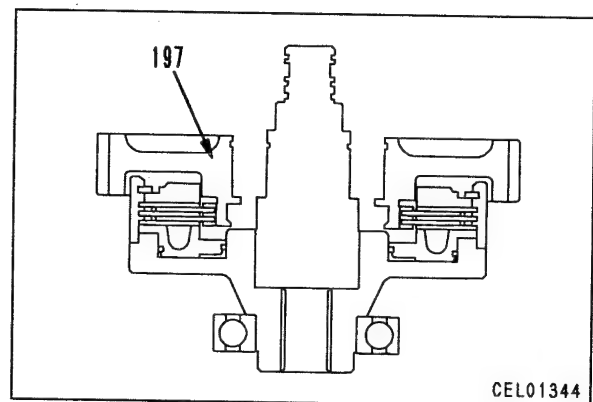
- vi) Using garage vice (21), push end plate and install snap ring (200).

★ Check that the snap ring is fitted securely in the groove.



- vii) Align the teeth of the discs and install PTO gear (197).

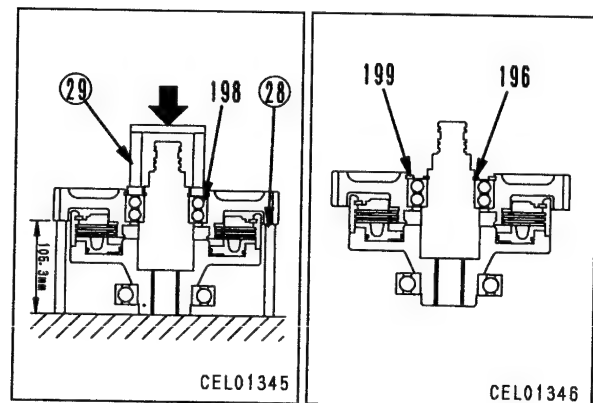
★ If the teeth of the gear and discs cannot be aligned, rotate the gear lightly and install. Never use force to push them up.



- viii) Set block (29) to gear, then using push tool (28), press fit bearing (198).

- ix) Install snap rings (196) and (199).

★ Check that the snap ring is fitted securely in the groove.

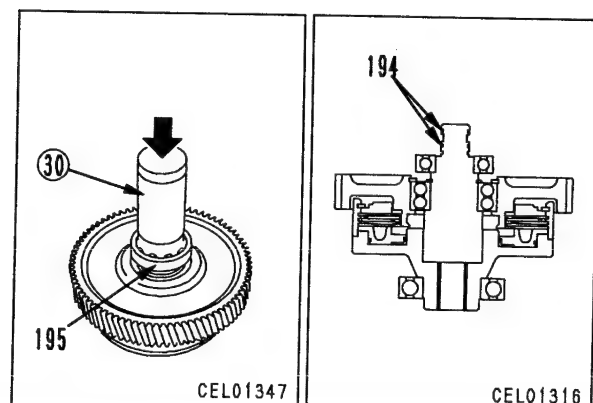


- x) Using push tool (30), press fit bearing (195) to shaft.

★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the shaft.

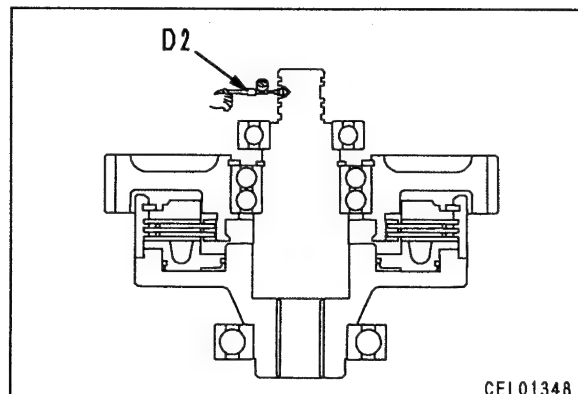
- xi) Install seal ring (194) to shaft.

★ Coat the outside circumference of the seal ring with grease (G2-LI) and take care not to install it off center.



023S02

- 2) Using tool D2, blow air in from oil hole and check that clutch works.
 - ★ If the gear is held in position when air is blown in, the clutch is working normally.
 - ★ Air pressure: 0.5 – 0.6 MPa {5 – 6 kg/cm²}

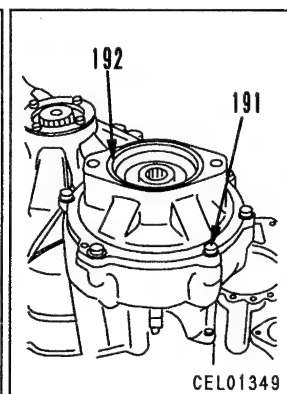
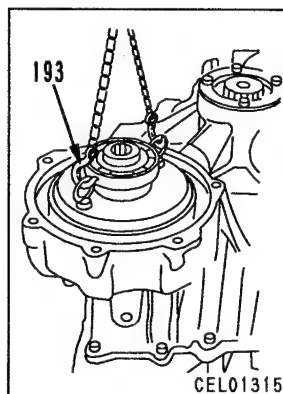


- 3) Install PTO clutch assembly (193) to rear case.
 - ★ Remove slowly and be careful not to interfere with the rear case.

6. PTO cover

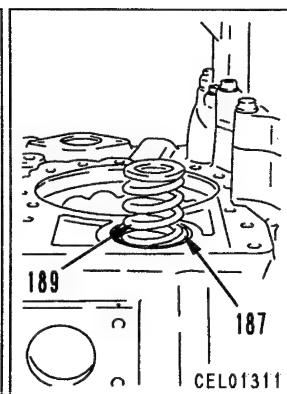
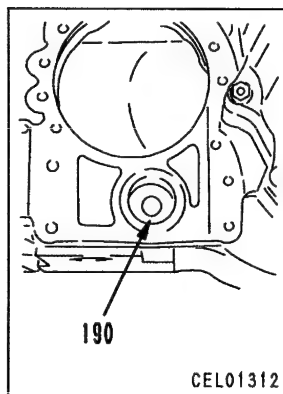
Fit O-ring and install PTO cover (192) to rear cover, then tighten mounting bolts (191).

- ★ Check that there is no dirt or damage to the PTO cover and O-ring insertion surface.



7. Washer, spring, sleeve

- 1) Assemble sleeve (190) to middle case.
 - ★ Assemble the sleeve to the case with the stepped side at the bottom.
- 2) Install spring (189).
- 3) Install O-ring (187).

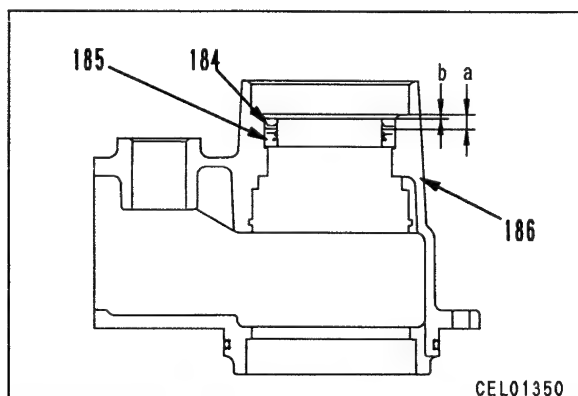


8. Rear cage assembly

- 1) Assembly of rear cage assembly
 - i) Using push tool, press fit oil seal (185) and dust seal (184) to rear cage (186) to positions a and b.
 - ★ Press fitting dimension a: 11.0 ± 0.2 mm
 - ★ Press fitting dimension b: 3.0 ± 0.2 mm

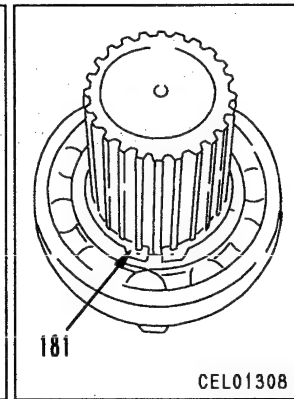
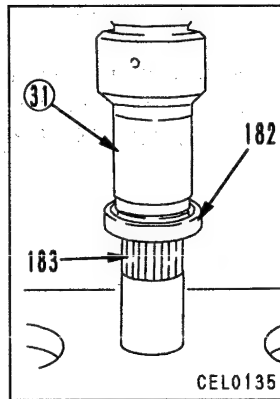


Seal lip : Grease (G2-LI)



- ii) Using push tool ③, press fit bearing (182) to rear output shaft (183), then install snap ring (181).

★ Check that the snap ring is fitted securely in the groove.



- iii) Install rear output shaft assembly (179) to rear cage assembly (180).

- iv) Install snap ring (178).

★ Check that the snap ring is fitted securely in the groove.

- v) Using push tool (32), press fit outer race (177) to cage.

★ After press fitting the outer race, check that there is no clearance between the end face of the outer race and the cage.

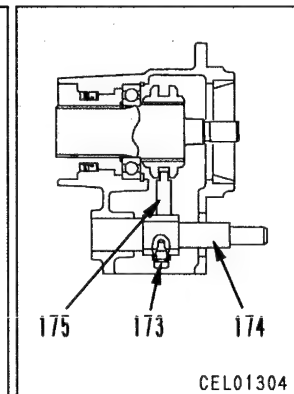
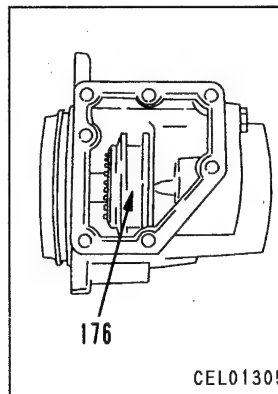
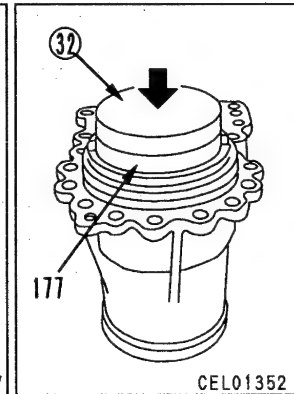
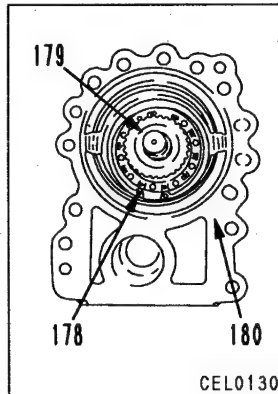
- vi) Install transmitter (176) to rear output shaft.

- vii) Set fork (175) to transmitter, then fit O-ring and install shaft (174).

- viii) Tighten screw (173), then fix it in position with wire.


 Screw : **Thread tightener (LT-2)**

 Screw : **$46.55 \pm 2.45 \text{ Nm}$ { $4.75 \pm 0.25 \text{ kgm}$ }**

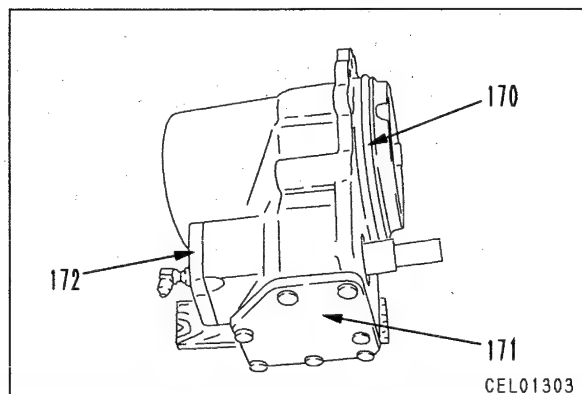


- ix) Fit O-ring and install flange (172).

- x) Fit gasket and install plate (171).

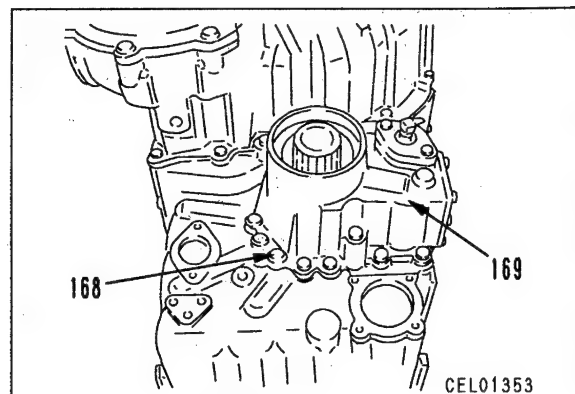
 Mounting bolt : **$66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }**

- xi) Install O-ring (170).



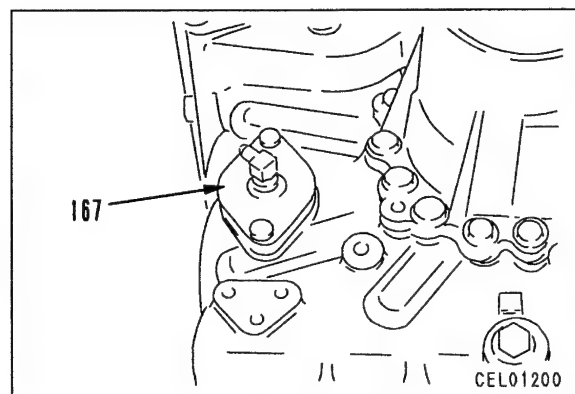
- 2) Install rear cage assembly (169) to middle case and tighten mounting bolts (168).

★ Tighten the mounting bolts gradually to prevent gouging of the shifting fork shaft.



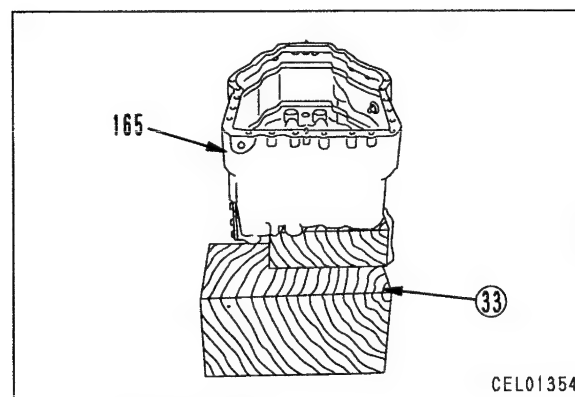
9. Flange

Fit O-ring and install flange (167).



10. Turning over torque converter, middle case assembly

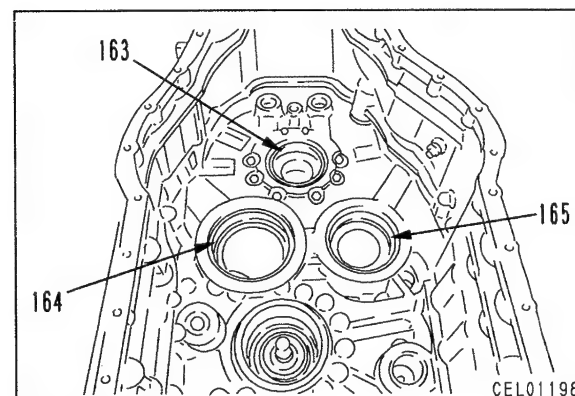
Turn over torque converter and middle case assembly (166) so that rear case is facing down, then set to block ㊟ securely.



11. Outer races

Install outer races (163), (164), and (165) to middle case.

★ After press fitting the outer races, check that there is no clearance between the end face of the outer races and the case.




023S02

12. Hi/Lo output shaft assembly

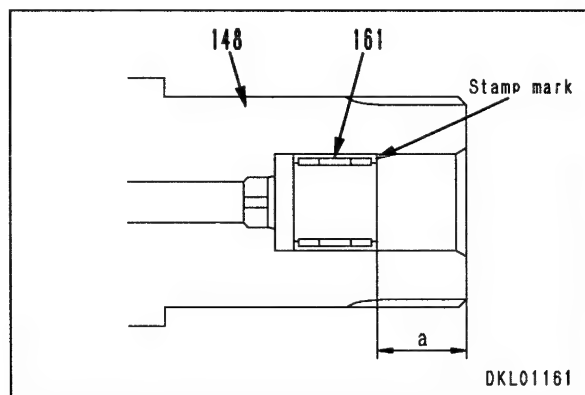
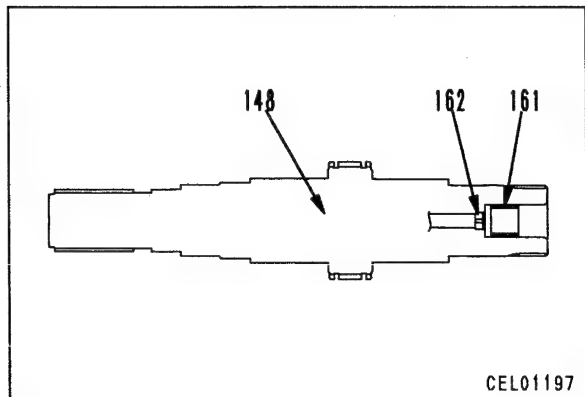
- 1) Assembly of Hi/Lo output shaft assembly
 i) Install plug (162) to shaft assembly (148).

 Plug : **Thread tightener (LT-2)**

 kgm Plug :
 $7.35 \pm 2.45 \text{ Nm}$ ($0.75 \pm 0.25 \text{ kgm}$)

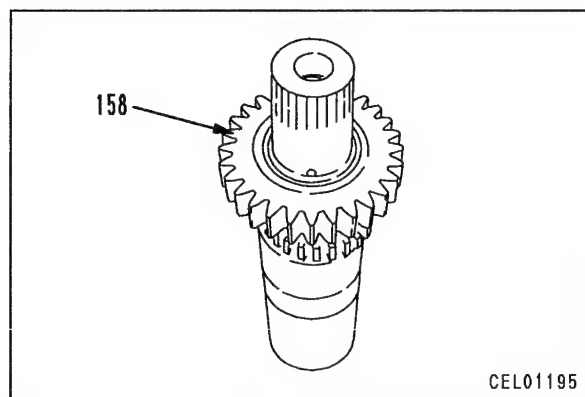
- ii) Using push tool, press fit needle bearing (161) to shaft (148).

★ Push the stamped side of the outer cage when press fitting the needle bearing.

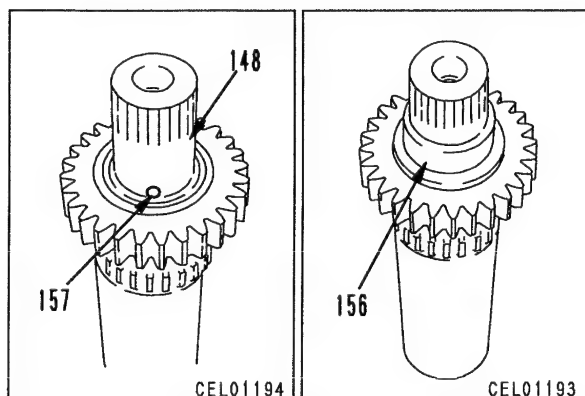


- iii) Install Hi gear assembly (158) to shaft.

 Sliding surface of bushing:
Engine oil (EO10-CD)



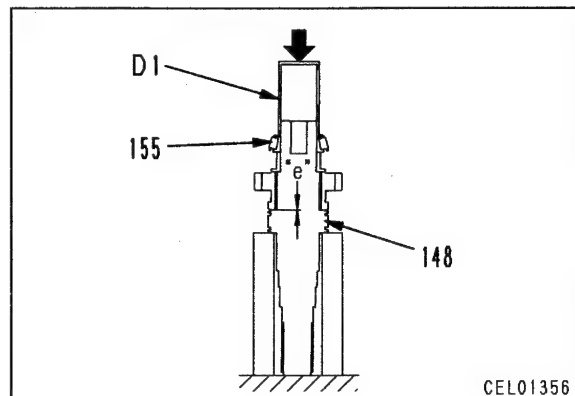
- iv) Fit ball (157) to shaft (148) and install spacer (156).



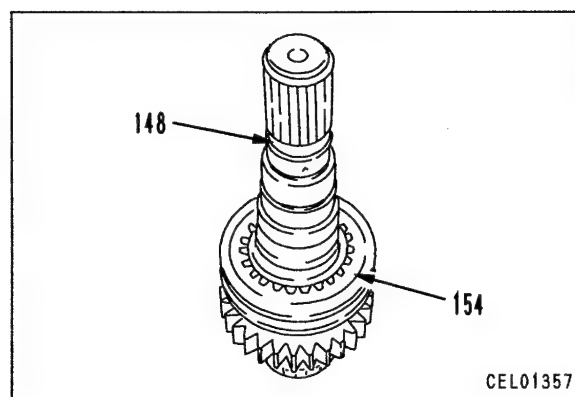
023S02

v) Using tool **D1**, press fit bearing (155) to shaft (148).


- ★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the spacer and between the end face of the spacer and the shaft.
- ★ After press fitting the bearing, check clearance "e" between the shaft and the gear.
- ★ Clearance "e": 0.4 – 0.65 mm

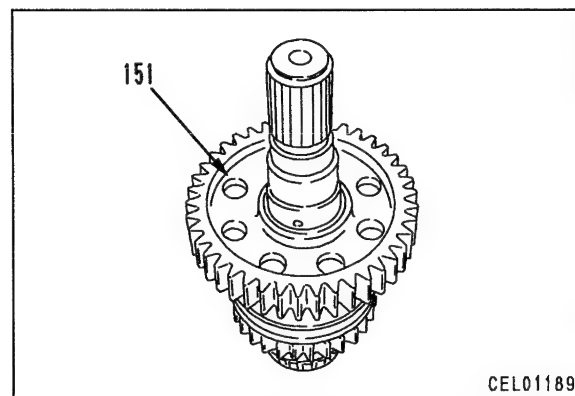


vi) Install Hi/Lo gear (154) to shaft (148).

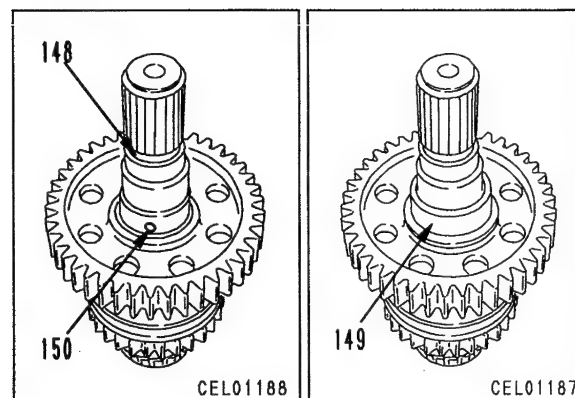


vii) Install Lo gear assembly (151) to shaft.

 Sliding surface of bushing:
Engine oil (EO10-CD)

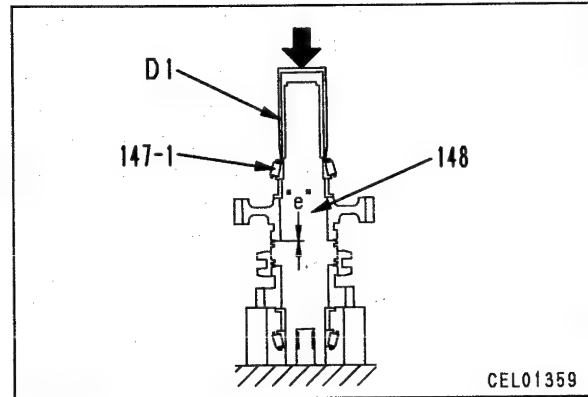


viii) Fit ball (150) to shaft (148) and install spacer (149).



- ix) Using tool **D1**, press fit bearing (147-1) to shaft (148).

- ★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the spacer and between the end face of the spacer and the shaft.
- ★ After press fitting the bearing, check clearance "e" between the shaft and the gear.
- ★ Clearance "e": 0.4 – 0.65 mm

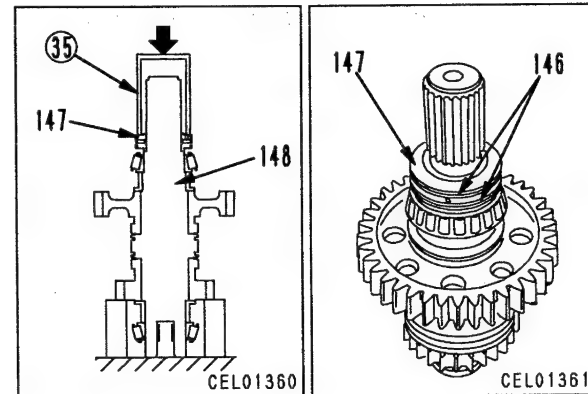


- x) Using push tool ③⑤, press fit spacer (147) to shaft (148).

- ★ Set with the surface with the drill hole facing up.

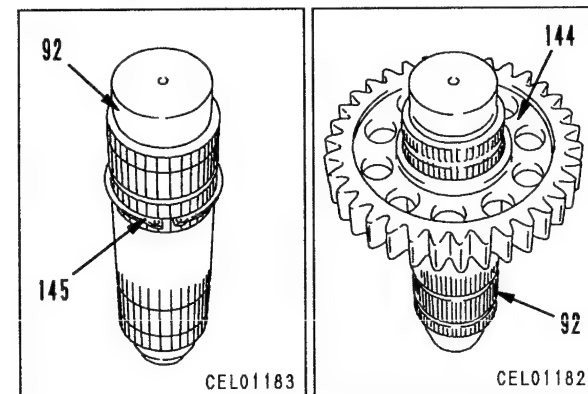
- xi) Install seal ring (146) to spacer (147).

- ★ Coat the outside circumference of the seal ring with grease (G2-LI) and take care not to install it off center.



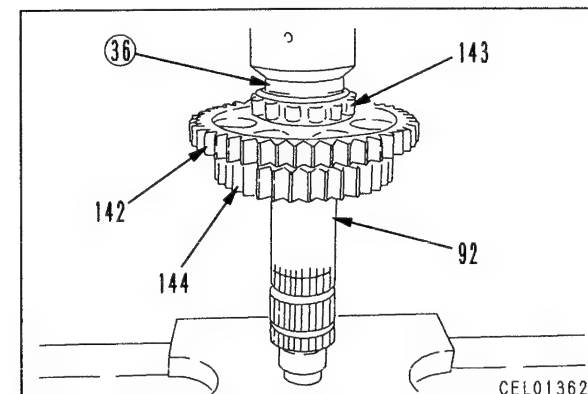
2) Assembly of Hi/Lo shaft assembly

- i) Fit snap ring (145) to shaft (92) and install Hi gear (144).



- ii) Install gear (142) to shaft (92), then using push tool (36), press fit bearing (143).

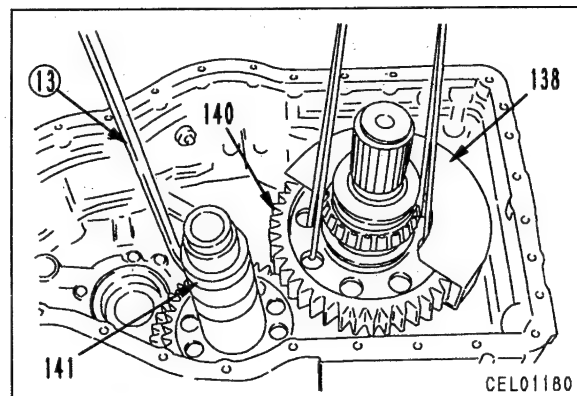
- ★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the shaft



023S02

- 3) Fit gear cover (138) to Hi/Lo output shaft assembly (140), gradually lower half way, assemble Hi/Lo shaft assembly (141), then install Hi/Lo output shaft assembly and Hi/Lo shaft assembly at same time.

★ When installing the shaft assembly, be extremely careful not to damage the bottom bearing.

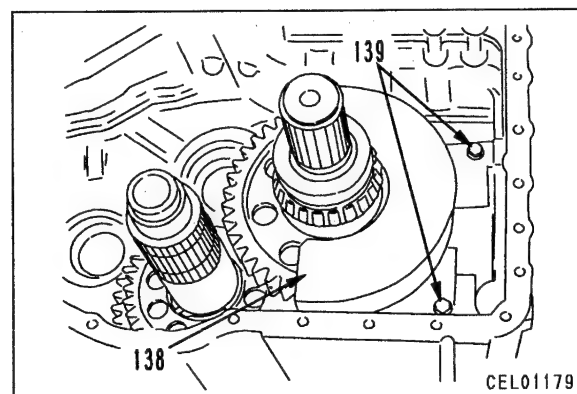


- 4) Tighten mounting bolts (139) of gear cover (138).



Mounting bolt :

Thread tightener (LT-2)



13. Hi/Lo fork, shaft

- 1) Set fork (135) to Hi/Lo gear, then fit O-ring (136) and assemble shaft (134).
- 2) Tighten screw (132), then fix it in position with wire.



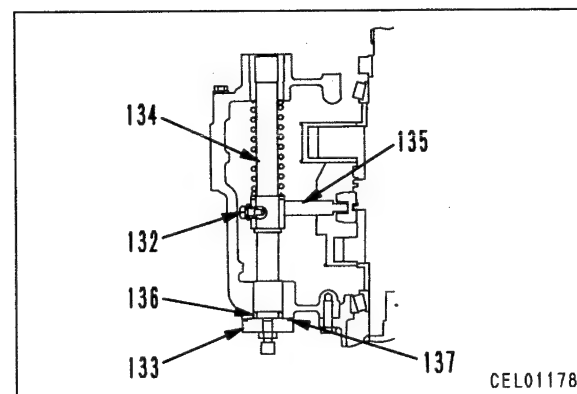
Screw : Thread tightener (LT-2)



kgm Screw :

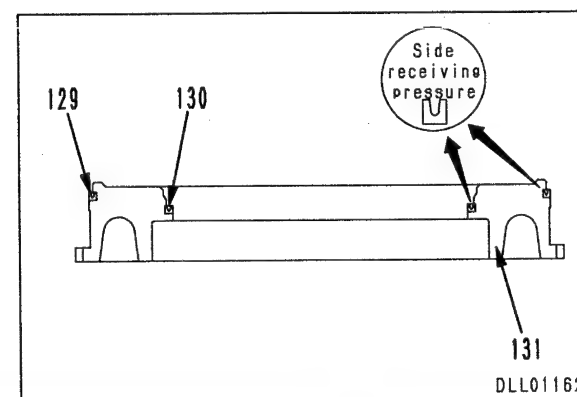
$46.55 \pm 2.45 \text{ Nm} \{4.75 \pm 0.25 \text{ kgm}\}$

- 3) Fit O-ring (137) and install flange (133).

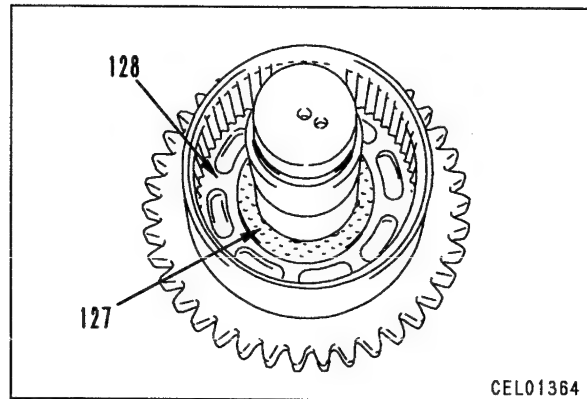


14. 1st, 2nd clutch assembly

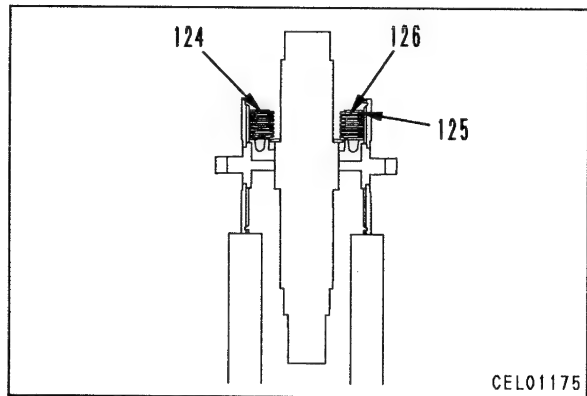
- 1) Assembly of 1st, 2nd clutch assembly
 - i) Assemble seal rings (129) and (130) to piston (131).
- ★ Be careful to assemble with the pressure-receiving side of the seal ring facing in the correct direction.



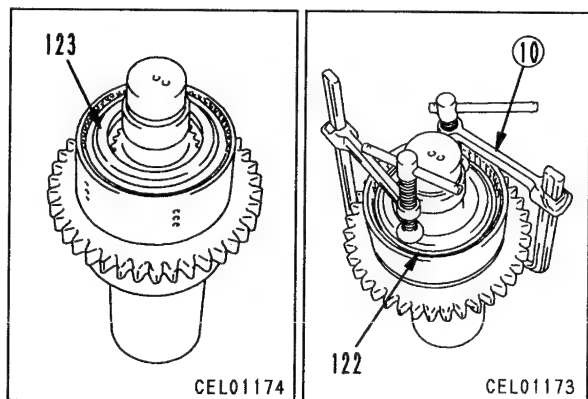
- ii) Set block to shaft and install piston assembly (128).
 - ★ When installing the piston assembly to the shaft, coat the outside circumference, inside circumference, and contact surface of the seal ring with transmission oil.
- iii) Install thrust washer (127).



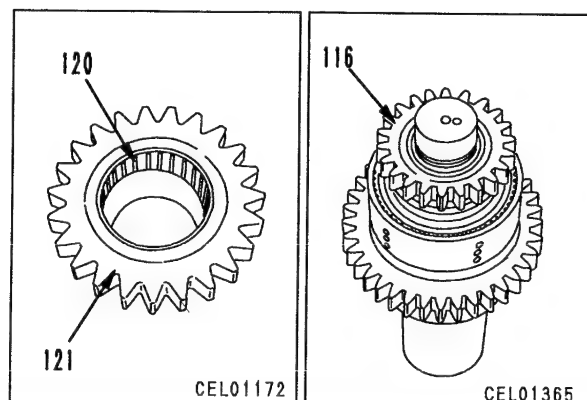
- iv) Assemble 8 plates (124), 7 springs (125), and 7 discs (126) in turn.
 - ★ Soak the discs in clean transmission oil for at least 2 minutes before assembling.
 - ★ Be careful that the spring and disc are not stacked on top of each other.



- v) Install end plate (123).
- vi) Push in end plate with bar handle ⑩ and install snap ring (122).
 - ★ Check that the snap ring is fitted securely in the groove.

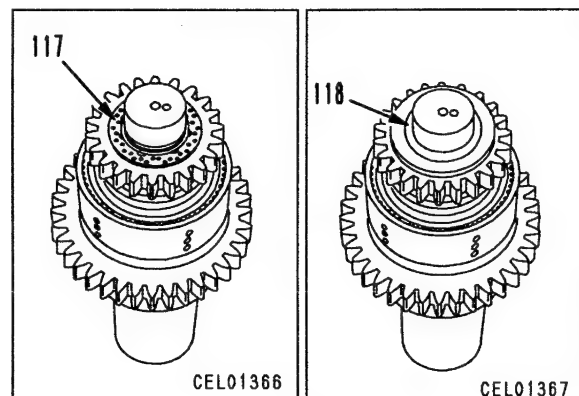


- vii) Assemble needle bearing (120) to 1st gear (121).
- viii) Align the teeth of the discs and install 1st gear assembly (116).
 - ★ If the teeth of the gear and discs cannot be aligned, rotate the gear lightly and install. Never use force to push them in.

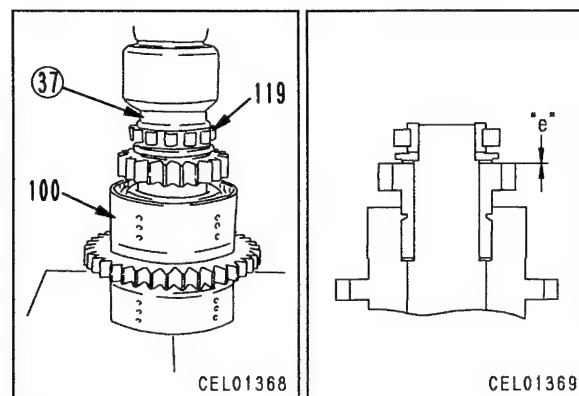


023S02

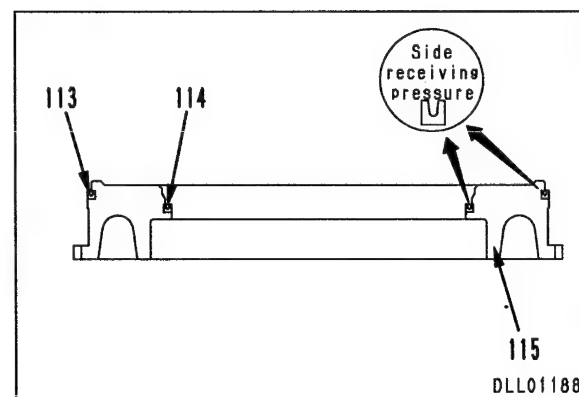
- ix) Install thrust washer (117).
- x) Install spacer (118).
- ★ Install the spacer with the large stepped diameter on the thrust washer side.



- xi) Using push tool (37), press fit bearing (119) to shaft (100).
- ★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the spacer and between the end face of the spacer and the shaft.
- ★ After press fitting the bearing, check clearance "e" between the thrust washer and the gear.
- ★ Clearance "e": 0.27 – 1.13 mm

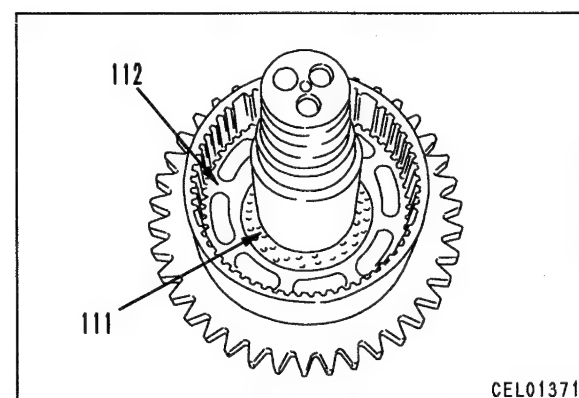


- xii) Assemble seal rings (113) and (114) to piston (115).
- ★ Be careful to assemble with the pressure-receiving side of the seal ring facing in the correct direction.



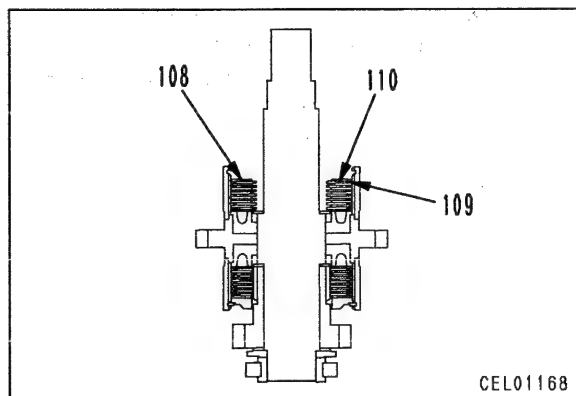
- xiii) Install piston assembly (112) to shaft.
- When installing the piston assembly to the shaft, coat the outer and inner circumferences and the mating surface of the seal ring with transmission oil.

- xiv) Install thrust washer (111).



xv) Assemble 8 plates (108), 7 springs (109), and 7 discs (110) in turn.

- ★ Soak the discs in clean transmission oil for at least 2 minutes before assembling.
- ★ Be careful that the spring and disc are not stacked on top of each other.

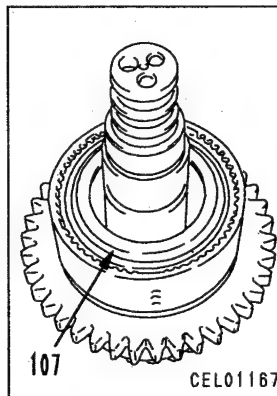


CEL01168

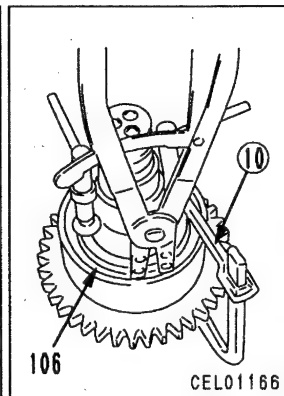
xvi) Install end plate (107).

xvii) Push in end plate with bar handle ⑩ and install snap ring (106).

- ★ Check that the snap ring is fitted securely in the groove.



CEL01167

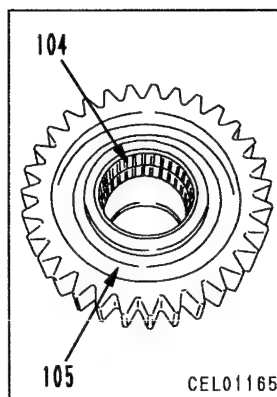


CEL01166

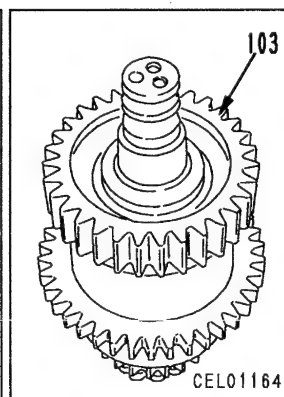
xviii) Assemble needle bearing (104) to 2nd gear (105).

xix) Align the teeth of the discs and install 2nd gear assembly (103).

- ★ If the teeth of the gear and discs cannot be aligned, rotate the gear lightly and install. Never use force to push them in.



CEL01165

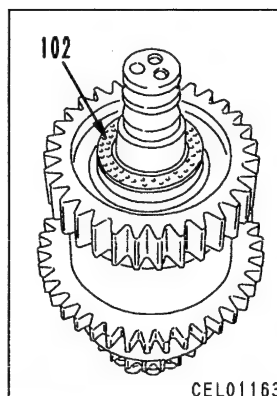


CEL01164

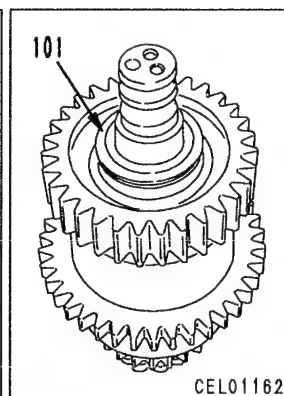
xx) Install thrust washer (102).

xxi) Install spacer (101).

- ★ Install the spacer with the completely flat surface on the thrust washer side.



CEL01163

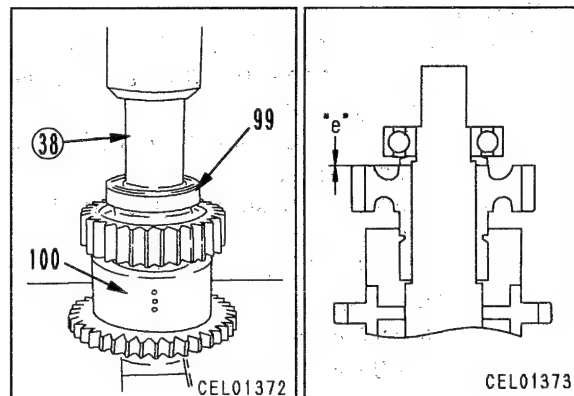


CEL01162

023S02

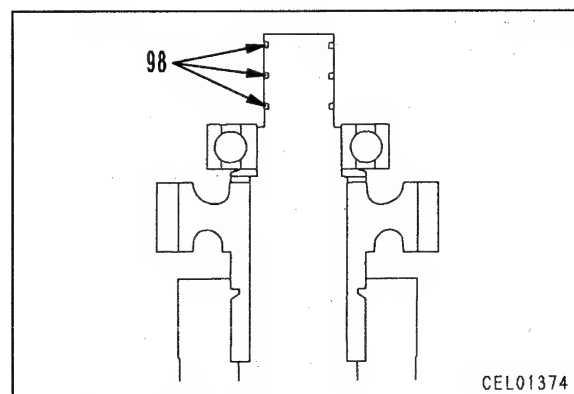
xxii) Using push tool ③, press fit bearing (99) to shaft (100).

- ★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the spacer and between the end face of the spacer and the shaft.
- ★ After press fitting the bearing, check clearance "e" between the thrust washer and the gear.
- ★ Clearance "e": 0.44 – 1.56 mm



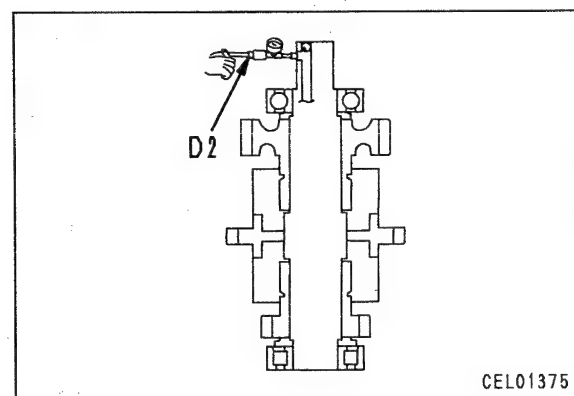
xxiii) Install seal rings (98) to shaft.

- ★ Coat the outside circumference of the seal ring with grease (G2-LI) and take care not to install it off center.



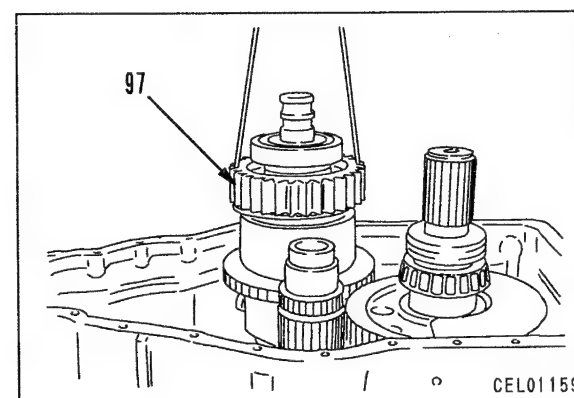
2) Using tool D2, blow air in from oil hole of shaft and check that each clutch works.

- ★ If the gear is held in position when air is blown in, the clutch is working normally.
- ★ Air pressure: 0.5 – 0.6 MPa {5 – 6 kg/cm²}



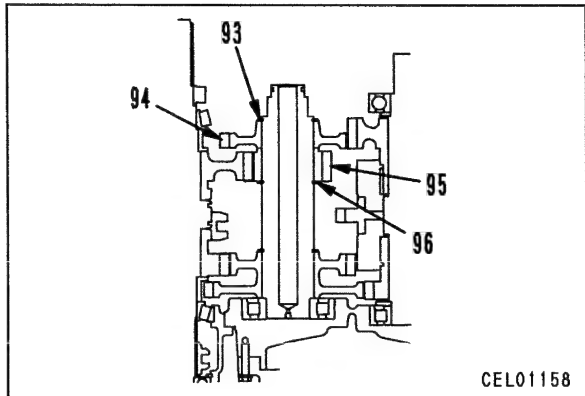
3) Raise 1st and 2nd clutch assembly (97) and install to middle case.

- ★ Remove slowly and be careful not to interfere with the other gears.

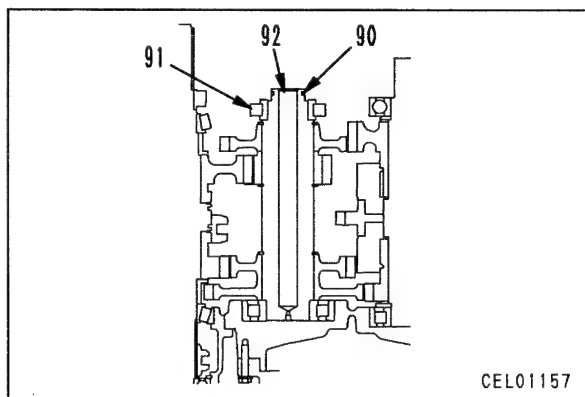


15. Snap ring

- 1) Install snap ring (96) to Hi/Lo shaft.
 - ★ Check that the snap ring is fitted securely in the groove.
- 2) Assemble Lo gear (95) and gear (94), and install snap ring (93).
 - ★ Check that the snap ring is fitted securely in the groove.
 - ★ Install the Lo gear with the stepped side facing up.
 - ★ Install the gear with the large stepped side facing up.

**16. Bearing**

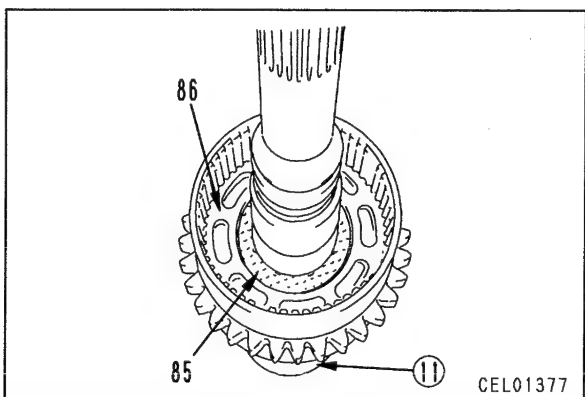
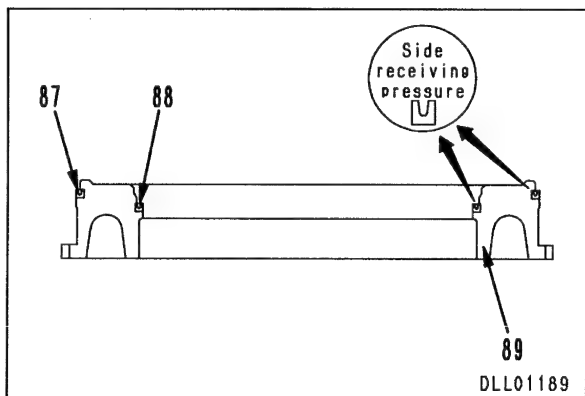
- Shrink fit bearing (91) and install to Hi/Lo shaft (92).
- ★ If the temperature of the bearing is raised too high, the hardness obtained by heat treatment will be reduced, so do not heat above 120°C.
 - ★ Check that there is no clearance between the end face of the shaft and the bearing.

**17. Seal ring**

- Install seal ring (90).
- ★ Coat the outside circumference of the seal ring with grease (G2-LI) and take care not to install it off center.

18. 3rd, REVERSE clutch assembly

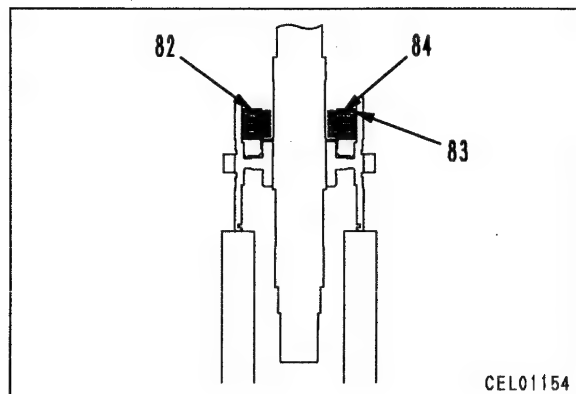
- 1) Assembly of 3rd and REVERSE clutch assembly
 - i) Assemble seal rings (87) and (88) to piston (89).
 - ★ Be careful to assemble with the pressure-receiving side of the seal ring facing in the correct direction.
 - ii) Set block (11) to shaft, and install piston assembly (86).
 - ★ When installing the piston assembly to the shaft, coat the outside circumference, inside circumference, and contact surface of the seal ring with transmission oil.
 - iii) Install thrust washer (85).



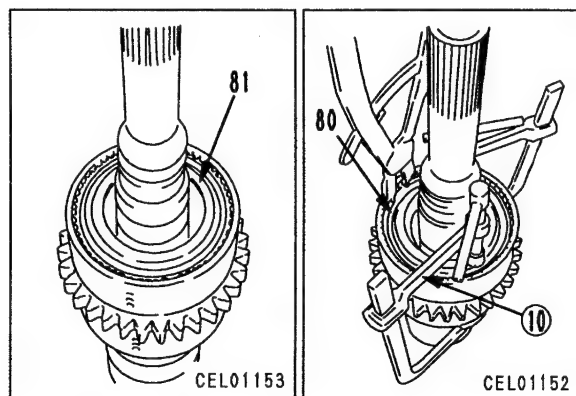
023S02

- iv) Assemble 8 plates (82), 7 springs (83), and 7 discs (84) in turn.

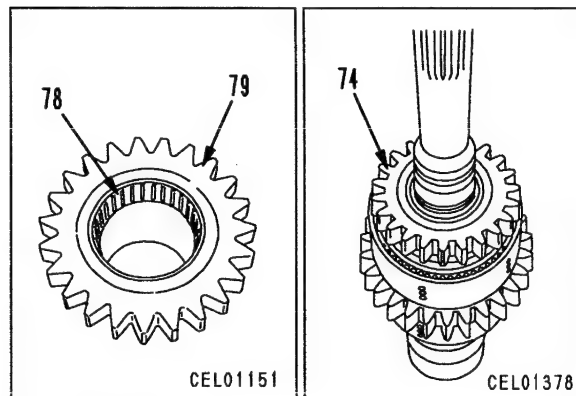
- ★ Soak the discs in clean transmission oil for at least 2 minutes before assembling.
- ★ Be careful that the spring and disc are not stacked on top of each other.



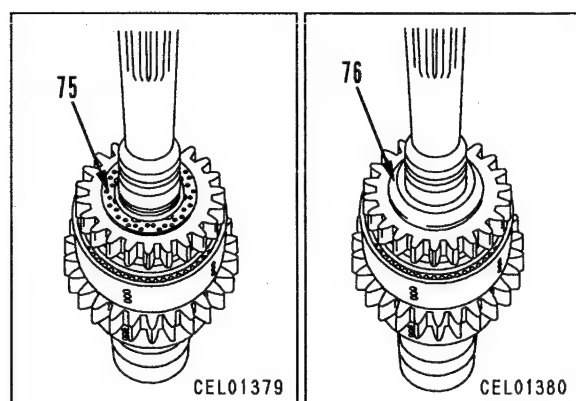
- v) Install end plate (81).
- vi) Push in end plate with bar handle ⑩ and install snap ring (80).
- ★ Check that the snap ring is fitted securely in the groove.



- vii) Assemble needle bearing (78) to REVERSE gear (79).
- viii) Align the teeth of the discs and install REVERSE gear assembly (74).
- ★ If the teeth of the gear and discs cannot be aligned, rotate the gear lightly and install. Never use force to push them in.



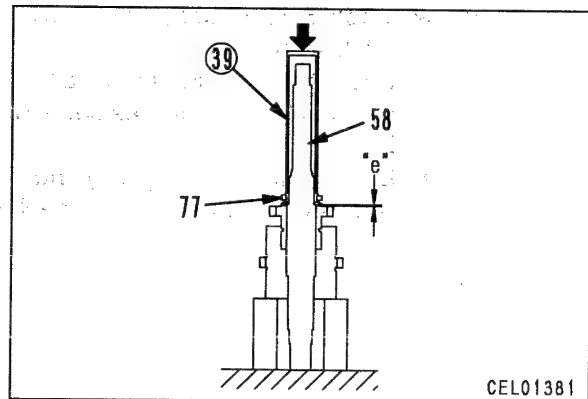
- ix) Install thrust washer (75).
- x) Install spacer (76).
- ★ Install the spacer with the completely flat surface on the thrust washer side.



023S02

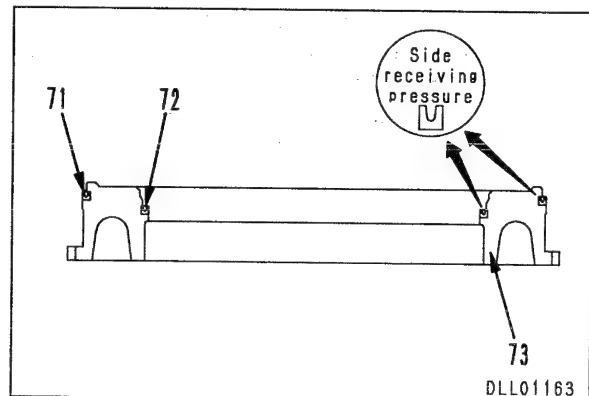
- xi) Using tool (39), press fit bearing (77) to shaft (58).

- ★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the spacer and between the end face of the spacer and the shaft.
- ★ After press fitting the bearing, check clearance "e" between the thrust washer and the gear.
- ★ Clearance "e": 0.07 – 1.33 mm



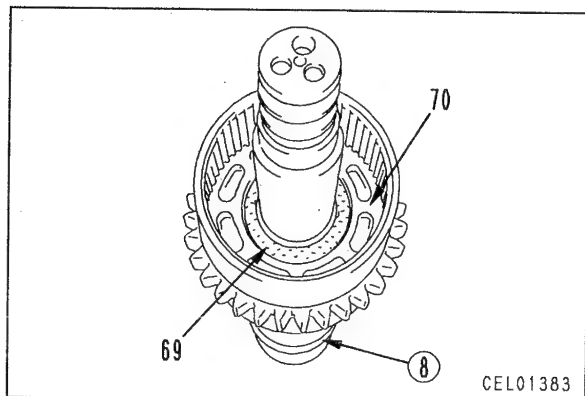
- xii) Assemble seal rings (71) and (72) to piston (73).

- ★ Be careful to assemble with the pressure-receiving side of the seal ring facing in the correct direction.



- xiii) Turn over REVERSE clutch assembly and set to block (8), then install piston assembly (70) to shaft.

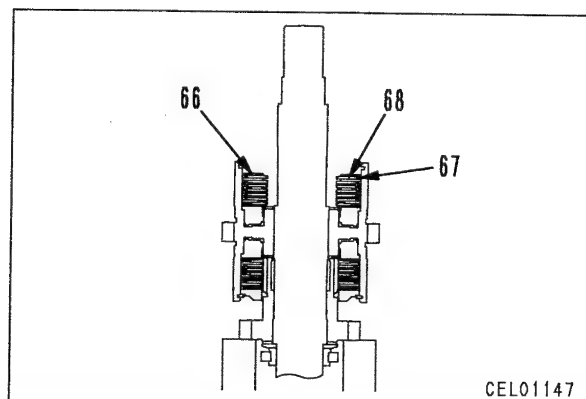
- ★ When installing the piston assembly to the shaft assembly, coat the outside circumference, inside circumference, and contact surface of the seal ring with transmission oil.



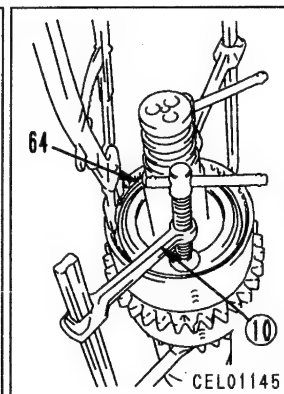
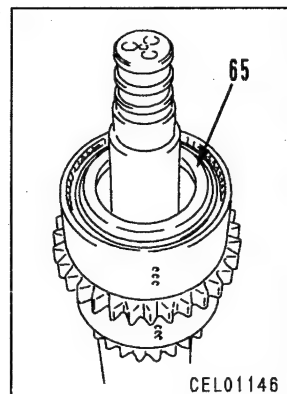
- xiv) Install thrust washer (69).

- xv) Assemble 8 plates (66), 7 springs (67), and 7 discs (68) in turn.

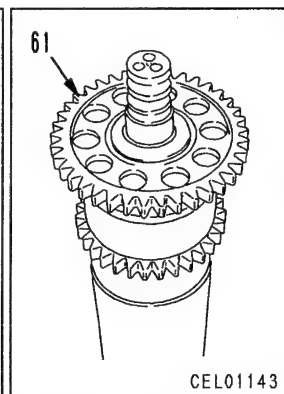
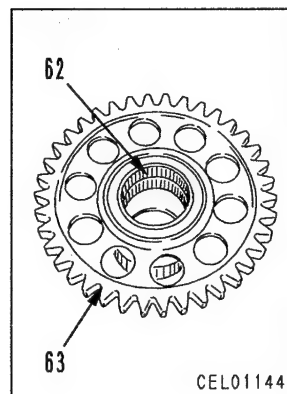
- ★ Soak the discs in clean transmission oil for at least 2 minutes before assembling.
- ★ Be careful that the spring and disc are not stacked on top of each other.



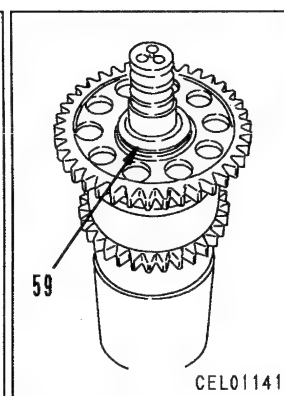
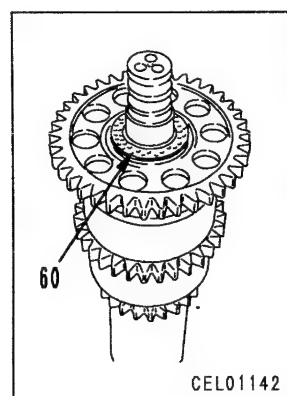
- xvi) Install end plate (65).
 xvii) Push in end plate with bar handle ⑩ and install snap ring (64).
 ★ Check that the snap ring is fitted securely in the groove.



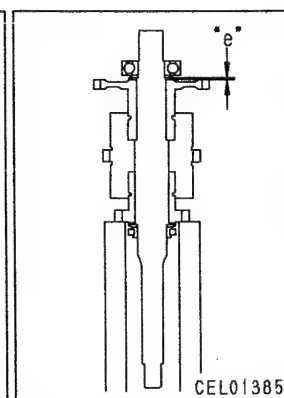
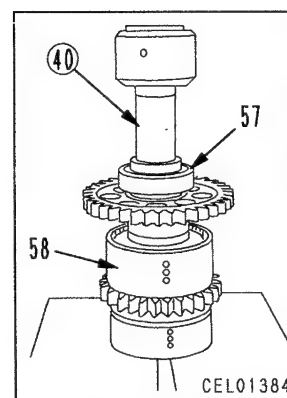
- xviii) Assemble needle bearing (62) to 3rd gear (63).
 xix) Align the teeth of the discs and install 3rd gear assembly (61).
 ★ If the teeth of the gear and discs cannot be aligned, rotate the gear lightly and install. Never use force to push them up.



- xx) Install thrust washer (60).
 xxi) Install spacer (59).
 ★ Install the spacer with the completely flat surface on the thrust washer side.

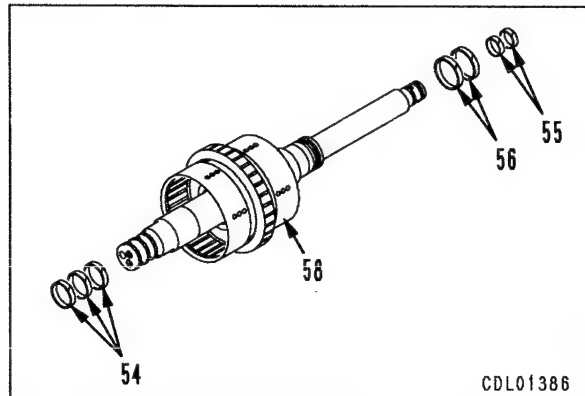


- xxii) Using push tool ④, press fit bearing (57) to shaft (58).
 ★ After press fitting the bearing, check that there is no clearance between the end face of the bearing and the spacer and between the end face of the spacer and the shaft.
 ★ After press fitting the bearing, check clearance "e" between the thrust washer and the gear.
 ★ Clearance "e": 0.1 – 1.3 mm



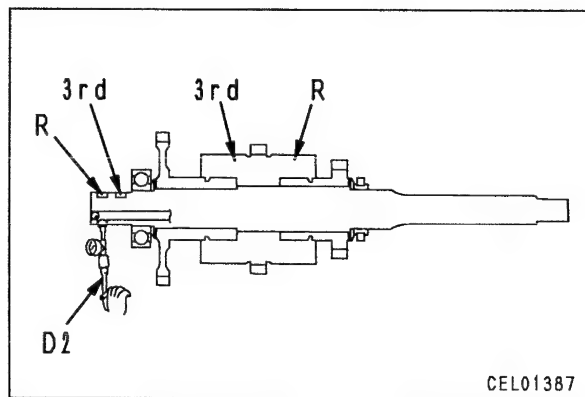
xxiii) Install seal rings (54), (55), and (56) to shaft.

- ★ Coat the outside circumference of the seal ring with grease (G2-LI) and take care not to install it off center.



2) Using tool **D2**, blow air in from oil hole of shaft and check that each clutch works.

- ★ If the gear is held in position when air is blown in, the clutch is working normally.
- ★ Air pressure: 0.5 – 0.6 MPa {5 – 6 kg/cm²}

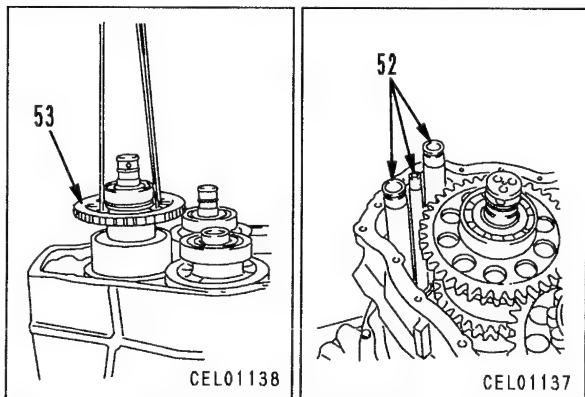


3) Raise 3rd and REVERSE clutch assembly (53) and install to middle case.

- ★ There is danger that the seal ring at the tip of the shaft may be damaged, so be careful not to interfere with the other gears, and remove slowly.

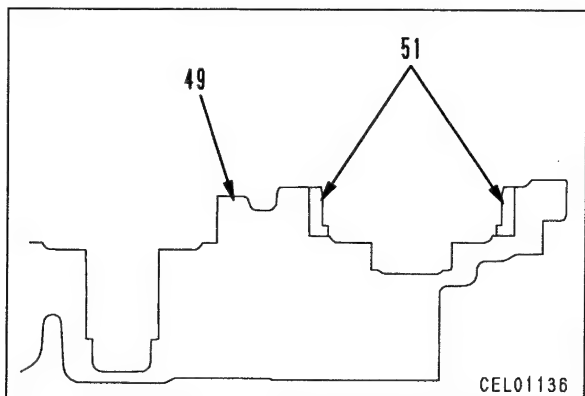
19. Tubes

Fit O-rings and install tubes (52).



20. Front cover

1) Install outer races (51) to front cover (49).



- 2) See diagram on right and coat middle case with gasket sealant.

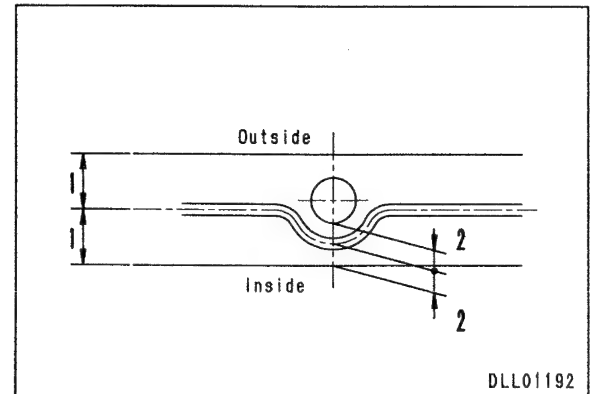


Mating surface of front cover :

Gasket sealant (Three Bond 1207B or equivalent)

- ★ Make sure that the gasket sealant does not ooze out inside the case, and be careful not to coat with too much gasket sealant.

* Check that there are no scratches or damage to the front cover.



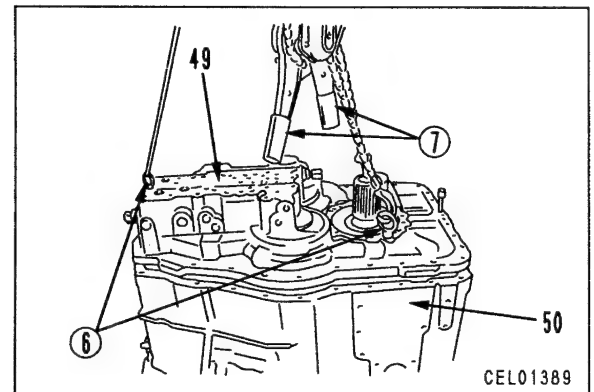
- 3) Using eyebolts (6), raise front cover (49) and set to middle case (50), then tighten mounting bolts.

- ★ Adjust with lever block (7) to keep the clearance uniform between the front cover and middle case when installing.
- ★ Be careful not to damage the seal ring of each shaft when installing.



Mounting bolt :

$66.15 \pm 7.35 \text{ Nm}$ ($6.75 \pm 0.75 \text{ kgm}$)



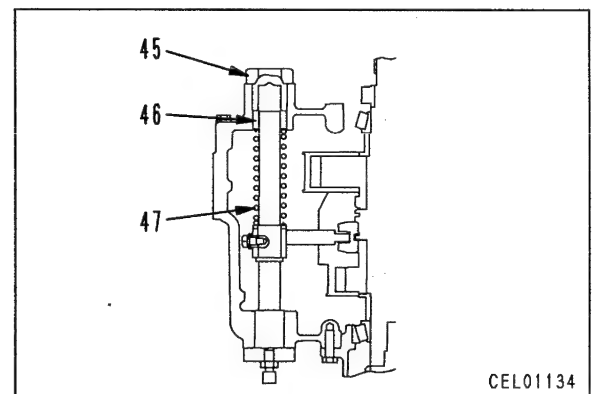
21. Hi/Lo spring

Assemble Hi/Lo spring (47) and spacer (46), then fit O-ring and tighten plug (45).



Plug :

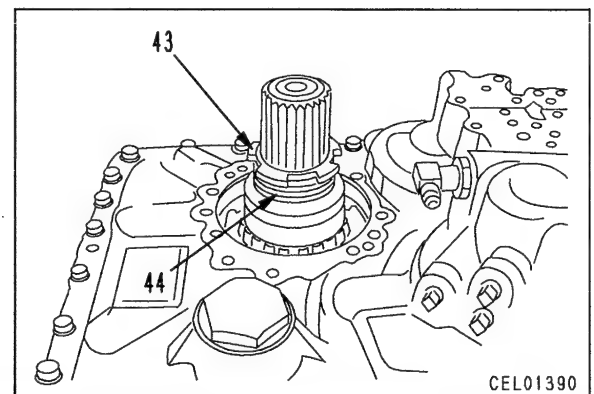
$320.95 \pm 46.55 \text{ Nm}$ ($32.75 \pm 4.75 \text{ kgm}$)



22. Plate, worm

Assemble worm (44) and plate (43) to shaft.

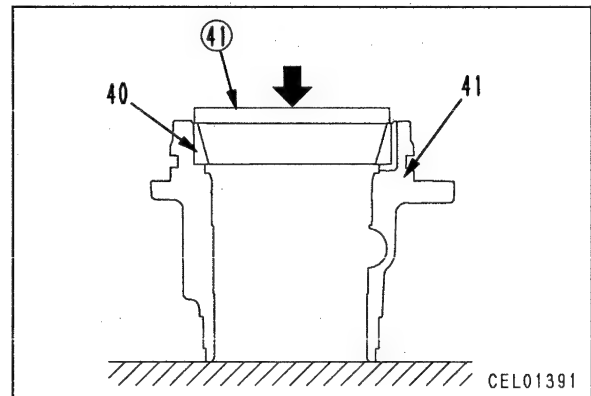
- ★ Assemble the worm with the stepped side at the bottom.



23. Cage assembly**1) Assembly of cage assembly**

- i) Using push tool (41), press fit outer race (40) to cage (41).


★ After press fitting the outer race, check that there is no clearance between the end face of the cage and the outer race.

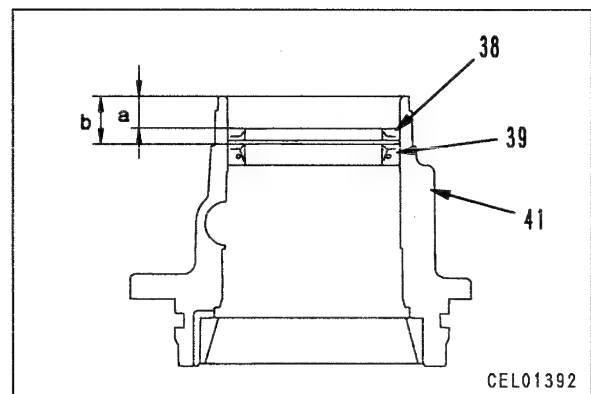


- ii) Using push tool, press fit oil seal (39) and dust seal (38) to rear case (41) to positions a and b.

★ Press fitting dimension a:
 $28.0 \pm 0.2 \text{ mm}$

Press fitting dimension b:
 $19.0 \pm 0.2 \text{ mm}$

 Seal lip : **Grease (G2-LI)**

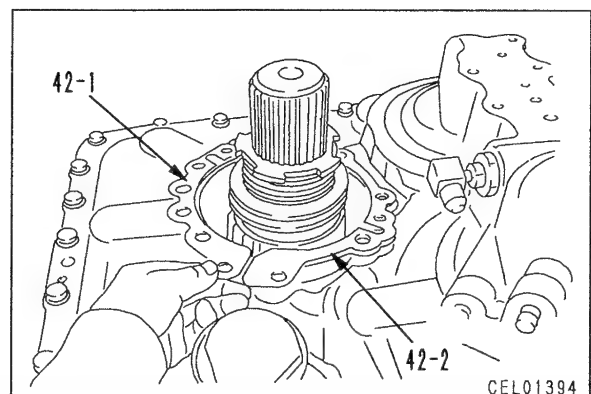
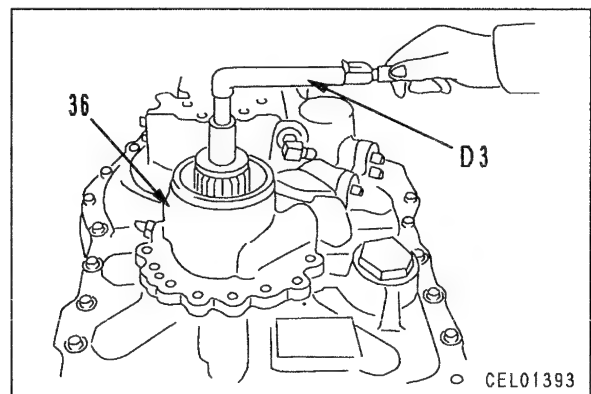
**2) Adjusting preload of taper roller bearing**

- i) Set cage assembly (36) to output shaft assembly without fitting O-ring.
 ii) Tighten coupling mounting bolts to shaft, then using tool **D3**, measure rotating torque.

★ Coat the bearing well with transmission oil.

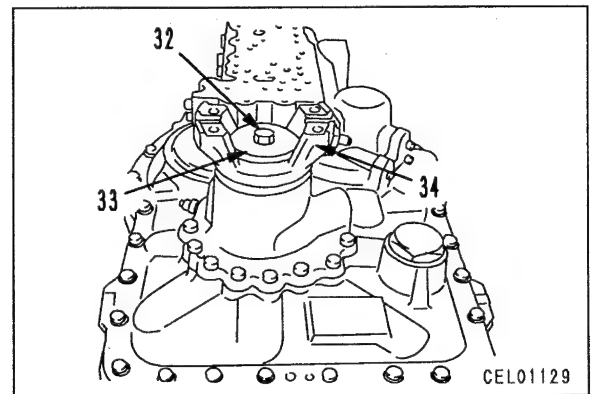
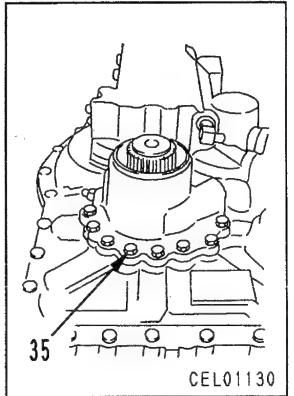
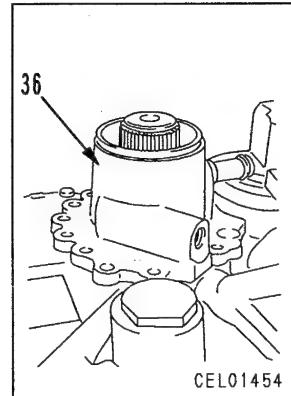
★ Check that the rotating torque is within a range of $6.86 - 7.84 \text{ Nm}$ $\{0.7 - 0.8 \text{ kg/cm}^2\}$.

- iii) Remove cage assembly and set shims (42-1) and (42-2) (removed during disassembly) in position.



023S02

- iv) Fit O-ring and install cage assembly (36), then tighten mounting bolts (35).
 - ★ To settle the bearing, rotate the shaft while tightening. After tightening, tap the end face of the shaft several times with a plastic hammer to settle again.
 - ★ Coat the bearing well with oil.
- v) Measure rotating torque in same way as in Step ii).
 - ★ When measuring the rotating torque, do not measure at the beginning of the rotation. Measure the torque during rotation.
 - ★ Rotating torque:
 - Max. $6.86 - 7.84 + 0.98 \text{ Nm}$
 - {Max. $0.7 - 0.8 + 0.1 \text{ kgm}$ }
 - ★ If the rotating torque is not within the standard range, change the shim thickness and adjust again.
 - ★ When the rotating torque is within standard value, check that the end play is "0".




24. Coupling

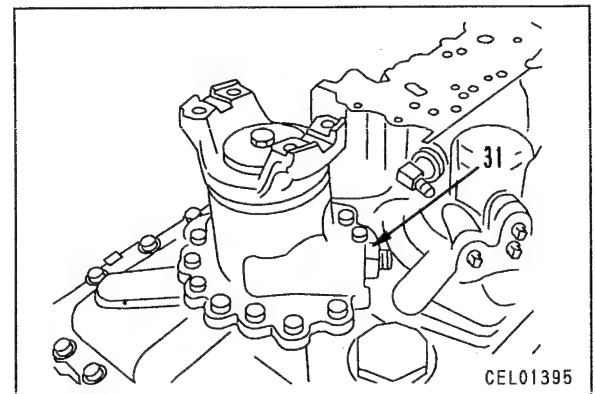
Install coupling (34) to shaft, then fit O-ring holder (34) and tighten mounting bolt (32).

 Mounting bolt : $276.85 \pm 31.85 \text{ Nm}$ $\{28.25 \pm 3.25 \text{ kgm}\}$

25. Output detection pinion

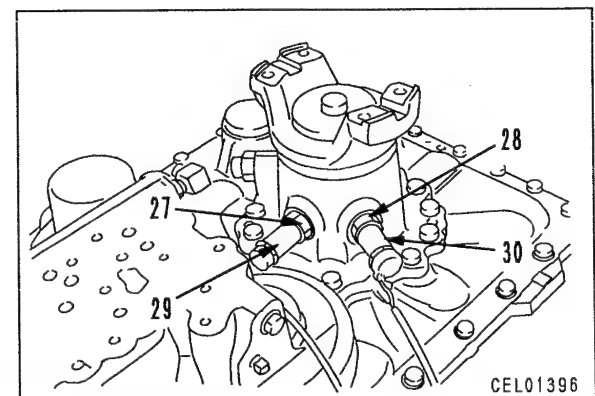
Coat pinion with engine oil (EO-10CD), and assemble to cage, then fit O-ring and tighten sleeve (31).

 Sleeve : $68.6 \pm 9.8 \text{ Nm}$ $\{7.0 \pm 1.0 \text{ kgm}\}$



26. Output shaft speed sensors

- Install output shaft sensors (29) and (30) to cage as follows.
- 1) Screw in sensors (29) and (30) until they contact outermost surface of plate (43).
 - ★ Before installing, check with sensors (29) and (30) that the plate is at the outermost circumference in relation to the mounting surface. (If it is not at the outermost circumference, turn the coupling to set it to the outermost position.)
 - ★ When screwing in with a wrench, stop just before contacting the gear and tighten finally by hand until it contacts lightly.



- 2) After sensors (29) and (30) contact worm, turn back 1/2 – 3/4 turns and fix in position with locknuts (27) and (28).

★ When fixing in position with the locknut, hold the nut at one end with a wrench while tightening.



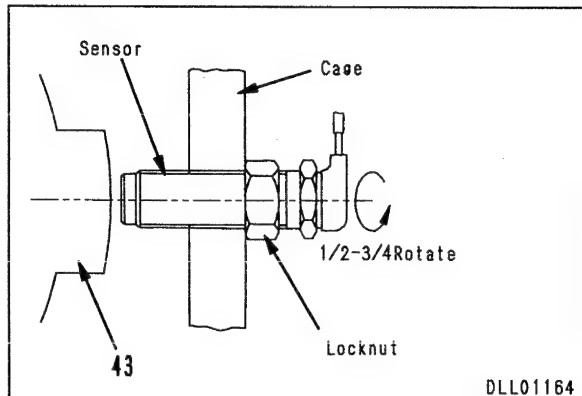
Sensor thread portion :

Gasket sealant (LG-5)



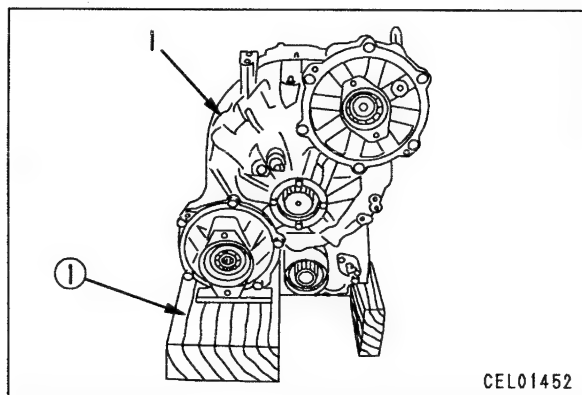
Sensor locknut :

$58.8 \pm 9.8 \text{ Nm } \{6.0 \pm 1.0 \text{ kgm}\}$



27. Turning over transmission assembly

Turn over transmission assembly (1), and set on block ① securely.

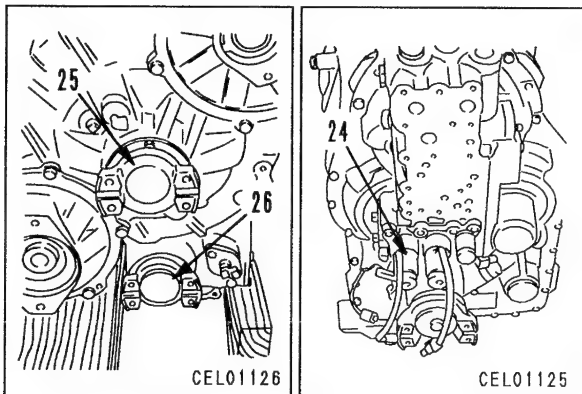


28. Couplings

Install couplings (25) and (26).

29. Hi/Lo and 2WD/4WD valve assembly

Fit O-ring and install Hi/Lo and 2WD/4WD valve assembly (24) to front cover.



30. Transmission control valve assembly

Using eyebolts ②, raise transmission control valve assembly (22), then fit gasket, set to front cover, and tighten 13 mounting bolts (23).



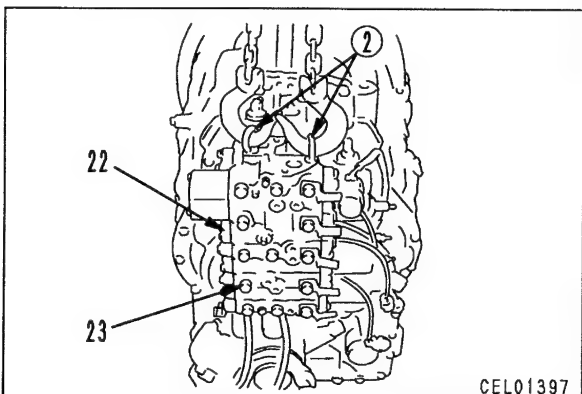
Mounting bolt thread portion :

Thread tightener (LT-2)



Mounting bolt :

$34.3 \pm 4.9 \text{ Nm } \{3.5 \pm 0.5 \text{ kgm}\}$




31. Piping

- 1) Install breather hose (21).

 Tee : **Gasket sealant (LG-5)**

- 2) Install Hi/Lo tube (20).

 Sleeve nut :
 $49.0 \pm 19.6 \text{ Nm } \{5.0 \pm 2.0 \text{ kgm}\}$


- 3) Install tube (19).

 Sleeve nut :
 $78.4 \pm 19.6 \text{ Nm } \{8.0 \pm 2.0 \text{ kgm}\}$

- 4) Fit PTO tube (18) and install engine tube (17).

 Sleeve nut :
 $49.0 \pm 19.6 \text{ Nm } \{5.0 \pm 2.0 \text{ kgm}\}$

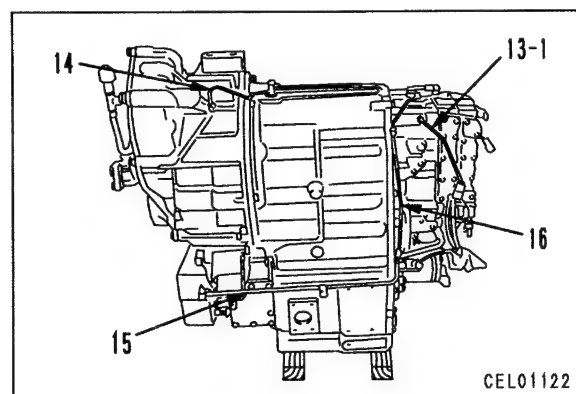
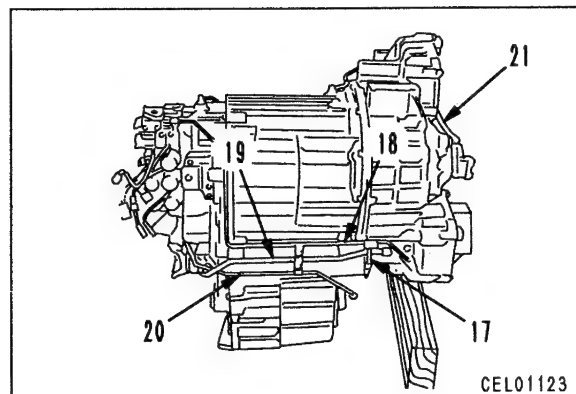
- 5) Install tube (16).

 Sleeve nut :
 $24.5 \pm 9.8 \text{ Nm } \{2.5 \pm 1.0 \text{ kgm}\}$

- 6) Install tube (15).


 Sleeve nut :
 $49.0 \pm 19.6 \text{ Nm } \{5.0 \pm 2.0 \text{ kgm}\}$

- 7) Install lubrication tube (14).

**32. Oil temperature sensor**

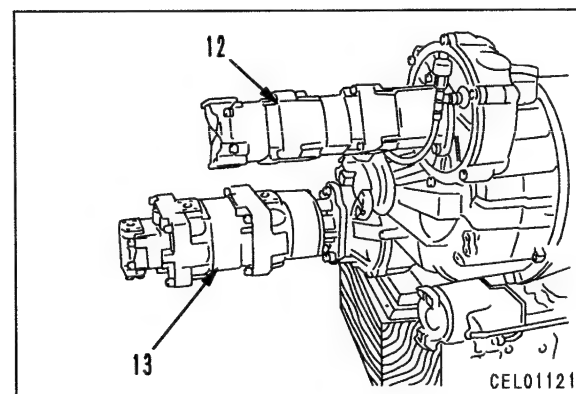
Install oil temperature sensor (13-1).

 Oil temperature sensor :
Gasket sealant (LG-5)

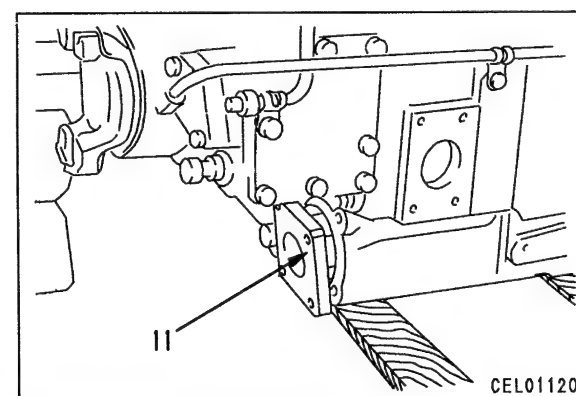
 Oil temperature sensor :
 $39.2 \pm 9.8 \text{ Nm } \{4.0 \pm 1.0 \text{ kgm}\}$

33. Pump assembly

Fit O-ring, then raise winch, boom, and PPC pump assembly (13), and transmission, steering (outrigger), and swing pump assembly (12) and install.

**34. Strainer assembly**

Fit O-ring and assemble strainer assembly (11) to case.



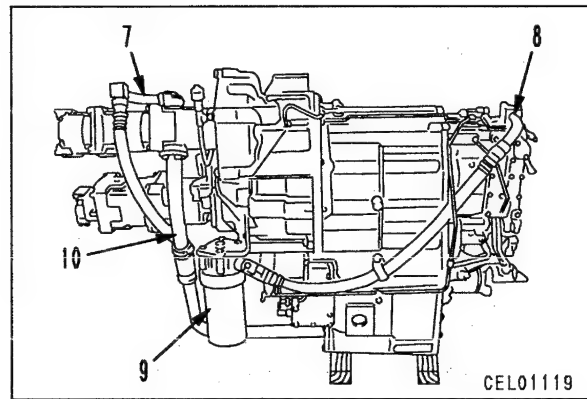
023S02

35. Suction tube

Fit O-ring and install suction tube (10).

36. Transmission filter assembly

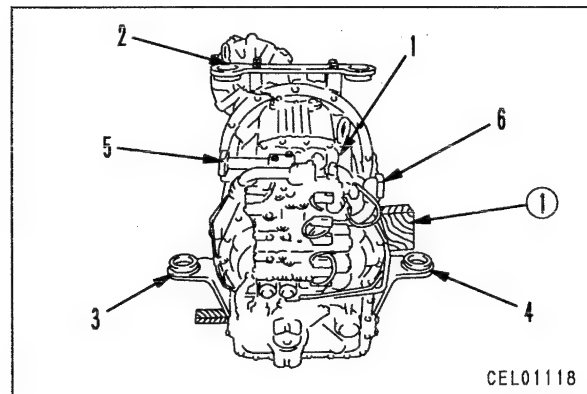
Fit transmission filter assembly (9) to rear case, then fit O-rings and connect tubes (7) and (8).

**37. Tubes**

Fit O-rings and install tubes (5) and (6).

38. Supports

Install supports (2), (3), and (4).

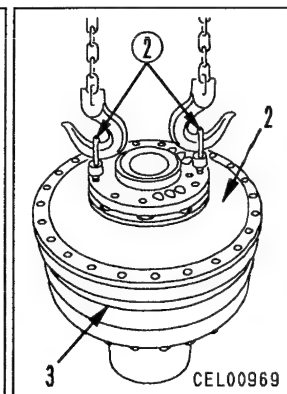
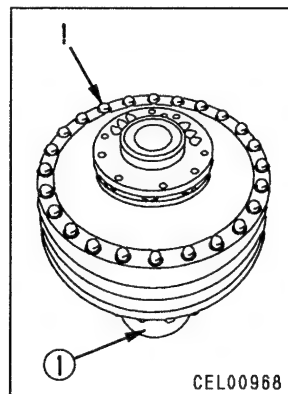


023S02

DISASSEMBLY OF TORQUE CONVERTER ASSEMBLY

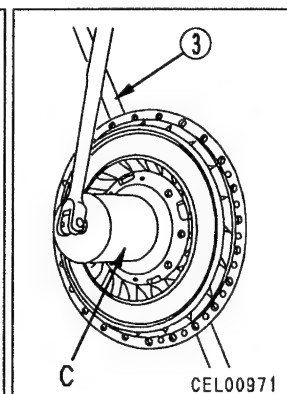
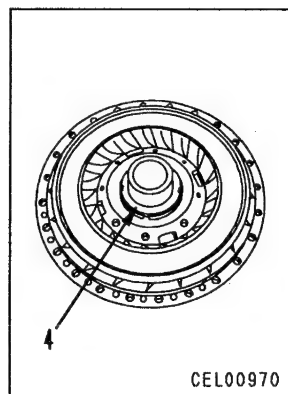
1. Stator shaft, pump assembly

- 1) Set torque converter assembly to block ①, and remove mounting bolts (1).
- 2) Using eyebolts (2), raise stator shaft and pump assembly (2), then remove from turbine and case assembly (3).

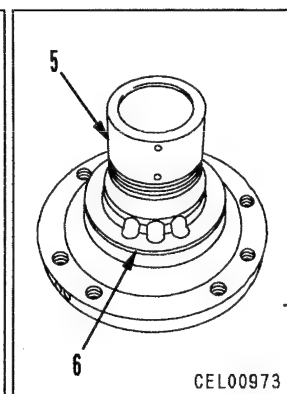
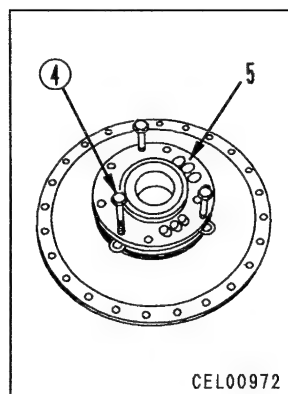


3) Disassembly of stator shaft, pump assembly

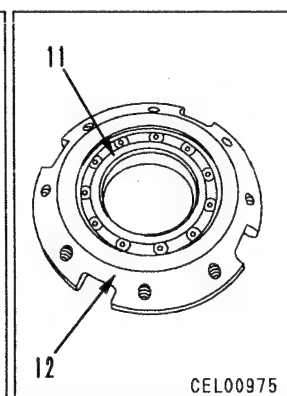
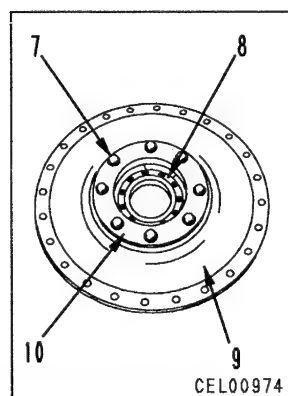
- i) Using tool C, remove nut (4).
 - ★ Screw a bolt into the stator shaft, hold with bar ③ to prevent it from turning, and loosen the nut.



- ii) Using forcing screws ④, pull out stator shaft (5).
- iii) Remove seal ring (6) from stator shaft (5).

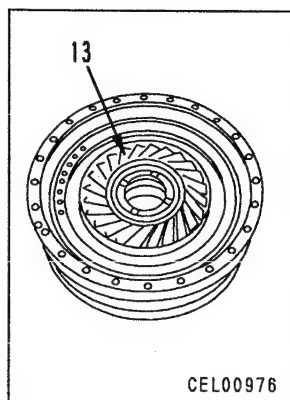


- iv) Remove mounting bolts (7), then remove guide and bearing assembly (8) from pump (9).
- v) Remove retainer (10) from pump (9).
- vi) Remove bearing (11) from guide (12).

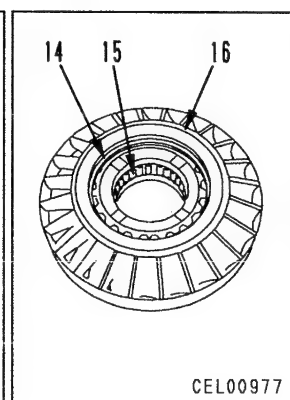


2. Stator assembly

- 1) Remove stator assembly (13),
- 2) Disassembly of stator assembly
 - i) Remove snap ring (14), then remove race and freewheel assembly (15) from stator (16).

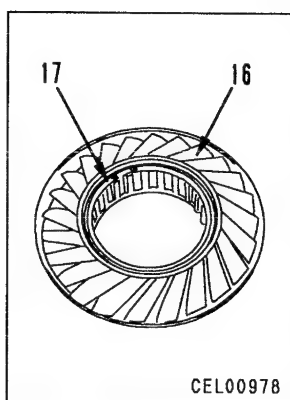


CEL00976

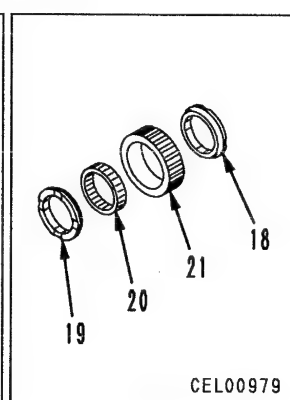


CEL00977

- ii) Remove snap ring (17) from stator (16).
- iii) Remove bushings (18) and (19), then remove freewheel (20) from race (21).



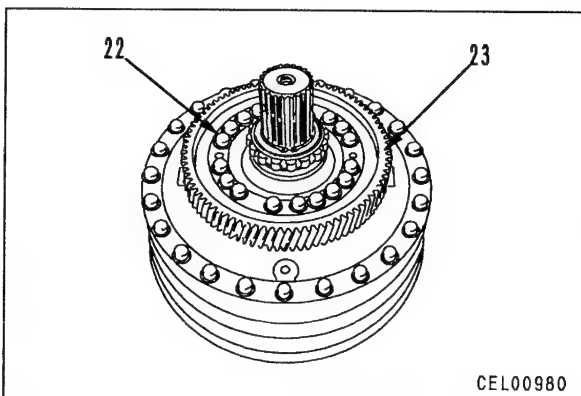
CEL00978



CEL00979

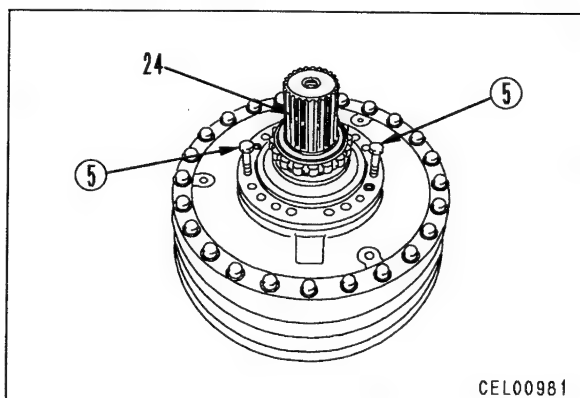
3. Disassembly of turbine, case assembly

- 1) Remove mounting bolts (22), then remove gear (23).



CEL00980

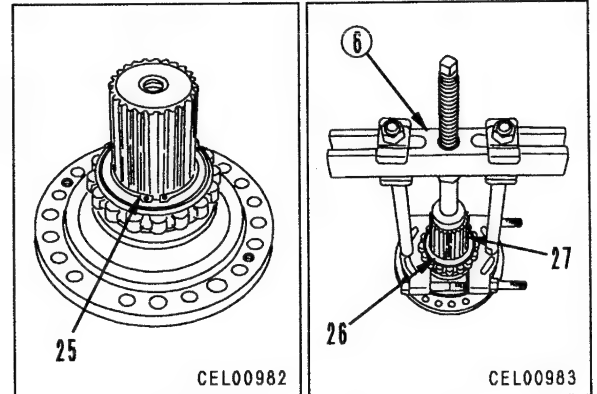
- 2) Using forcing screws (5), remove shaft and bearing assembly (24).



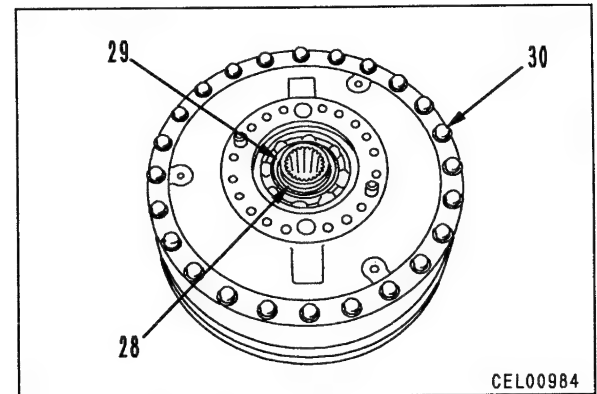
CEL00981

023S02

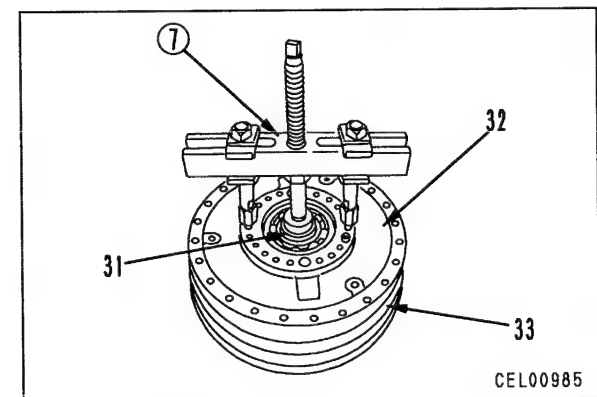
- 3) Disassembly of shaft, bearing assembly
 i) Remove snap ring (25).
 ii) Using puller (6), pull out bearing (26) from shaft (27).



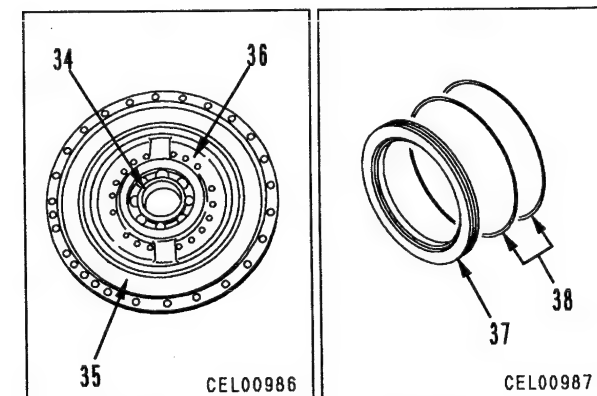
- 4) Remove snap ring (28), then remove spacer (29).
 5) Remove complete housing mounting bolts (30).



- 6) Using puller (7), pull out complete turbine (31), then remove complete housing assembly (32) from drive case (33).

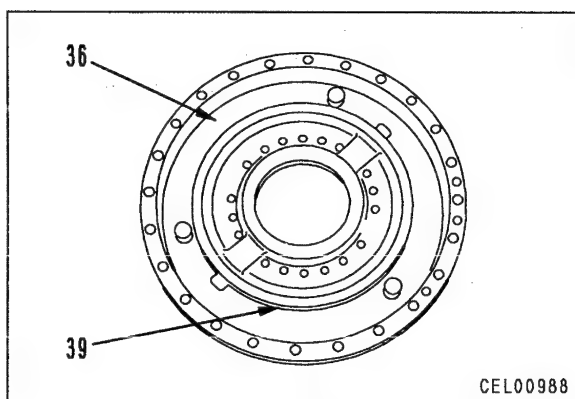


- 7) Disassembly of complete housing assembly
 i) Remove bearing (34) and piston assembly (35) from complete housing (36).
 ii) Remove seal ring (38) from piston (37).

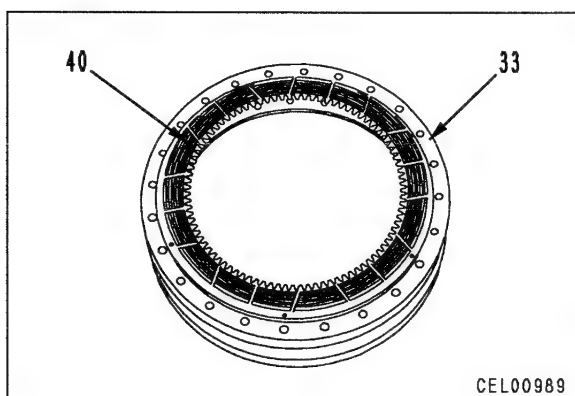


023S02

- 8) Remove seal ring (39) from complete housing (36).



- 9) Remove disc (40) from drive case (33).



023S02

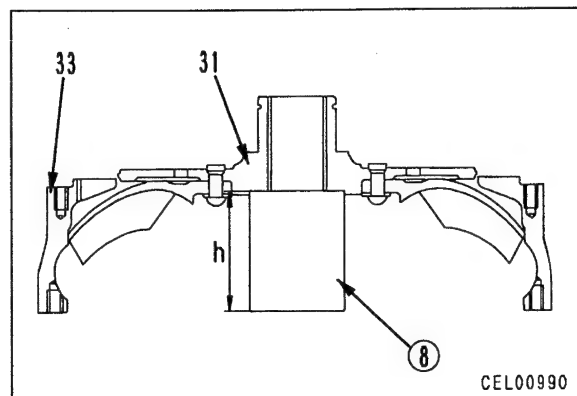
ASSEMBLY OF TORQUE CONVERTER ASSEMBLY

- ★ Clean all parts, and check for dirt or damage before assembling.
- ★ Check that the snap ring is fitted securely in the groove.

1. Turbine, case

Set complete turbine (31) on block ⑧ and fit drive case (33).

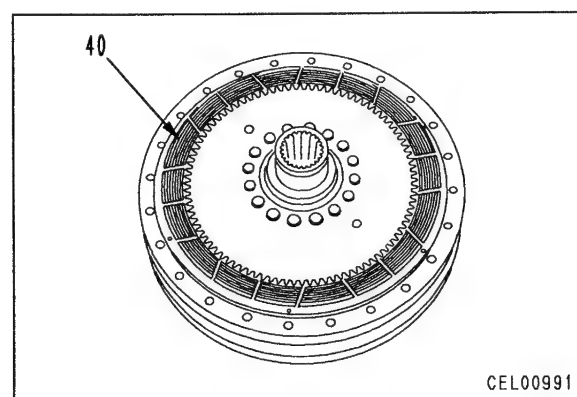
- ★ Block height *h*: Approx. 80 mm



2. Disc

Install disc (40).

- ★ Coat the sliding surface of the disc with engine oil and install.



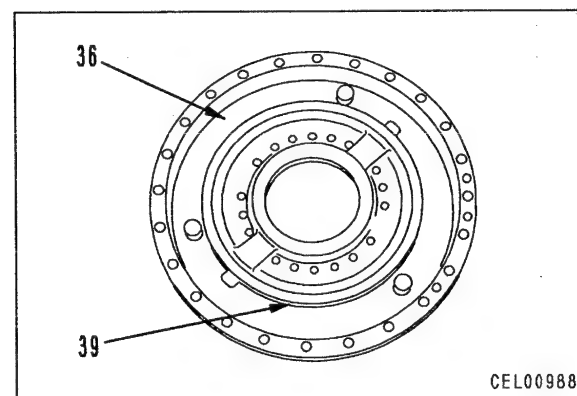
3. Complete housing assembly

1 Assembly of complete housing assembly

- i) Install seal ring (39) to complete housing (36).



Outer circumference of seal ring :
Grease (G2-LI)

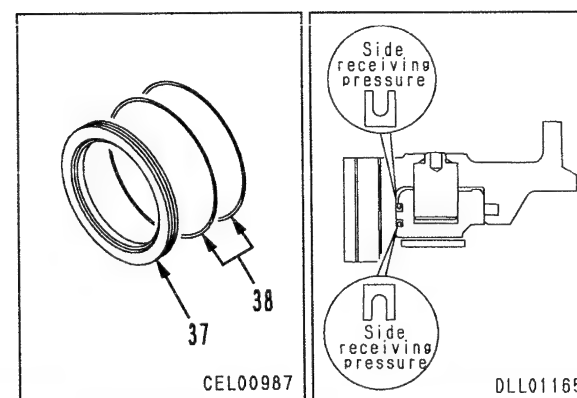


- ii) Install seal ring (38) to piston (37).

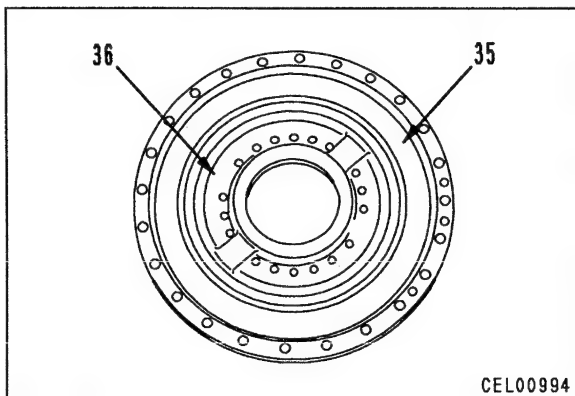
- ★ Be careful to assemble with the pressure-receiving side of the seal ring facing in the correct direction.



Outer circumference of seal ring :
Grease (G2-LI)



- iii) Install piston assembly (35) to complete housing (36).



- 2) Using eyebolts (9), raise complete housing assembly (32), and set to drive case (33).

- 3) Tighten mounting bolts (30).



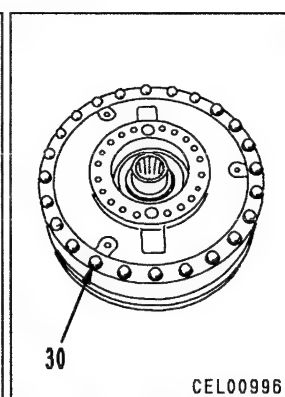
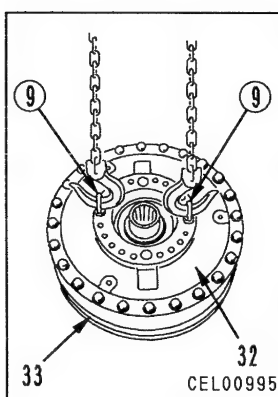
Mounting bolt :

Thread tightener (LT-2)



Mounting bolt :

$66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }



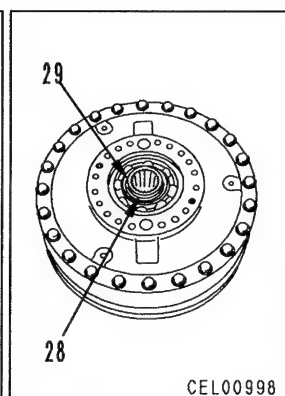
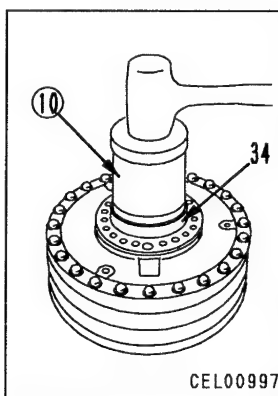
4. Bearing

Using push tool (10), press fit bearing (34).

★ After press fitting the bearing, drop 6cc of engine oil on it, and rotate it 10 times.

5. Spacer, snap ring

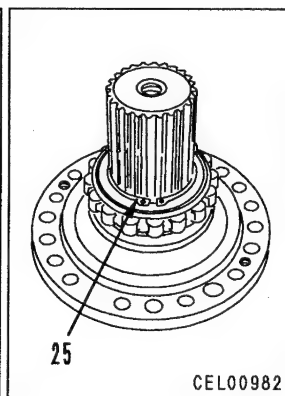
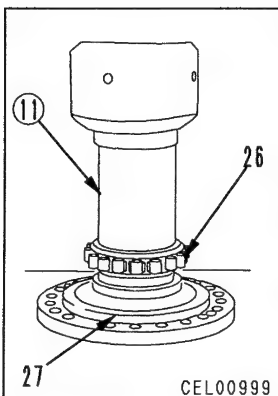
Assemble spacer (29) and install snap ring (28).



6. Shaft, bearing assembly

- 1) Assembly of bearing, shaft assembly

- Using push tool (11), press fit bearing (26) to shaft (27).
- Install snap ring (25).




023S02

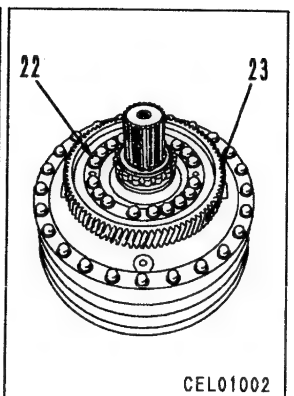
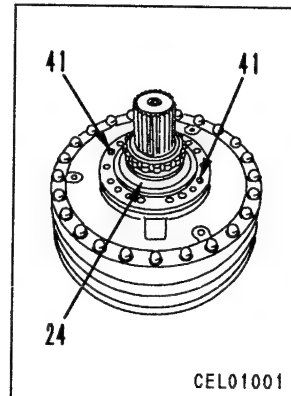
- 2) Knock dowel pins (41) to complete housing, then install shaft and bearing assembly (24) to housing.

7. Gear

Set gear (23) to shaft and tighten mounting bolts (22).

 Mounting bolt : **Thread tightener (LT-2)**

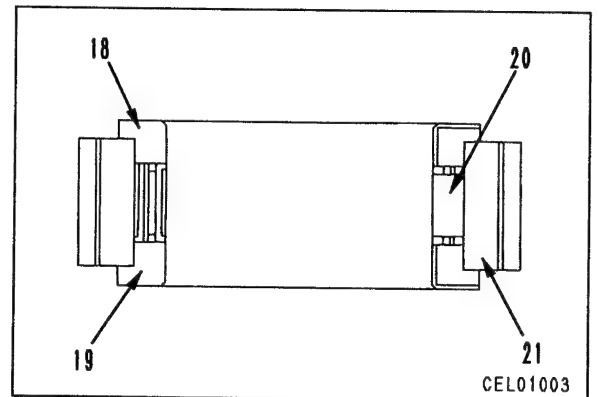
 Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }



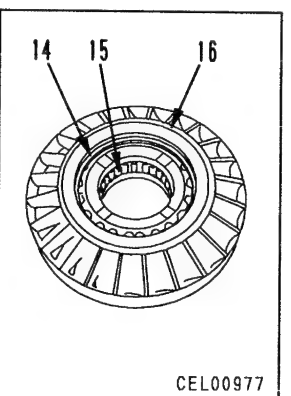
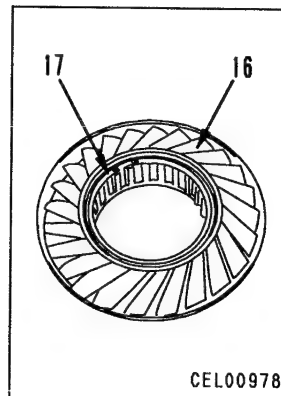
8. Stator assembly

1) Assembly of stator assembly

- i) Assemble freewheel (20) to race (21), then expand fit bushings (18) and (19).
 - ★ Coat the sliding surface of the bushing and freewheel with engine oil.
 - ★ Be careful not to damage the sprag of the freewheel.



- ii) Install snap ring (17) to stator (16).
- iii) Fit race and freewheel assembly (15) to stator (16), and install snap ring (14).




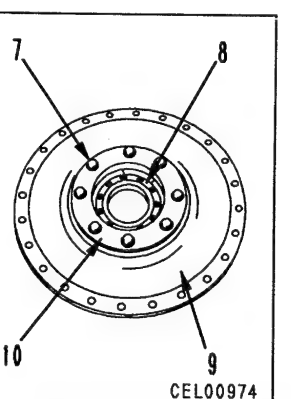
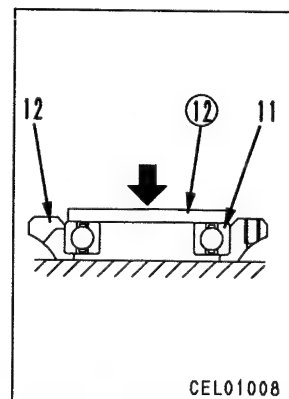
9. Stator shaft, pump assembly

1) Stator shaft, pump assembly


- i) Using push tool ⑫, press fit bearing (11) to guide (12).
 - ★ After press fitting the bearing, drop 6 cc of engine oil on it, and rotate it 10 times.
- ii) Install retainer (10) to pump (9), then set pump (9) to guide and bearing assembly (8), and tighten mounting bolts (7).

 Mounting bolt : **Thread tightener (LT-2)**

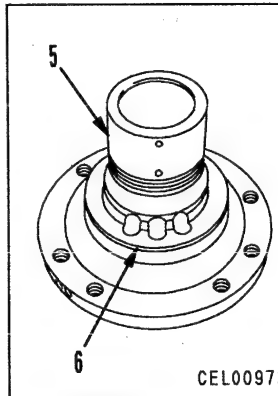
 Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }



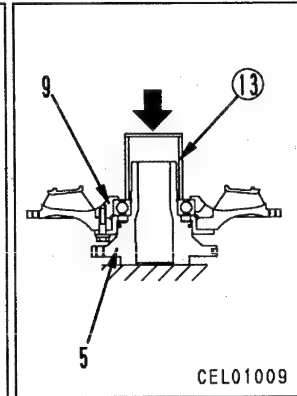
- iii) Install seal ring (6) to stator shaft (5).

 Outer circumference of seal ring :
Grease (G2-LI)

- iv) Using push tool ⑬, push inner race end of bearing, and install pump assembly (9) to stator shaft (5).



CEL00973



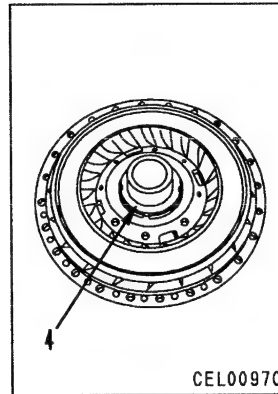
CEL01009

- v) Using tool C, tighten nut (4).

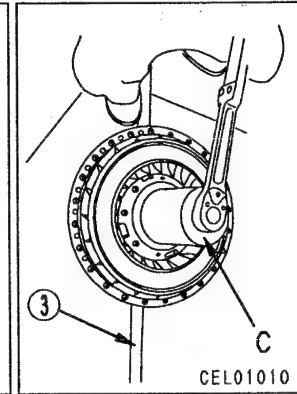
- ★ Screw a bolt into the stator shaft, hold with bar (3) to prevent it from turning, and tighten the nut.

 Nut : **Thread tightener (LT-2)**

 Nut :
 $61.7 \pm 14.7 \text{ Nm}$ ($16.5 \pm 1.5 \text{ kgm}$)



CEL00970



CEL01010

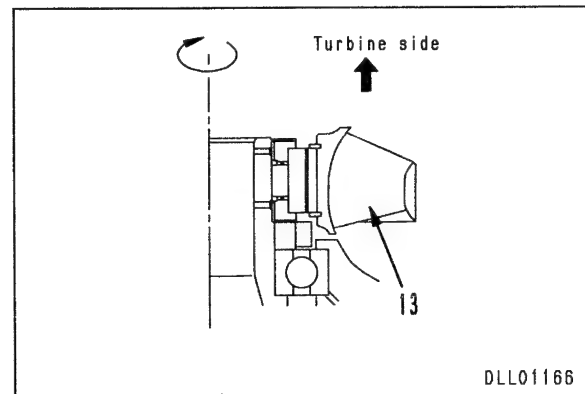
- vi) Rotate stator assembly (13) to right (clockwise) to install.

- ★ Check the direction of rotation of the stator as seen from the turbine end (input end).

Clockwise: Free

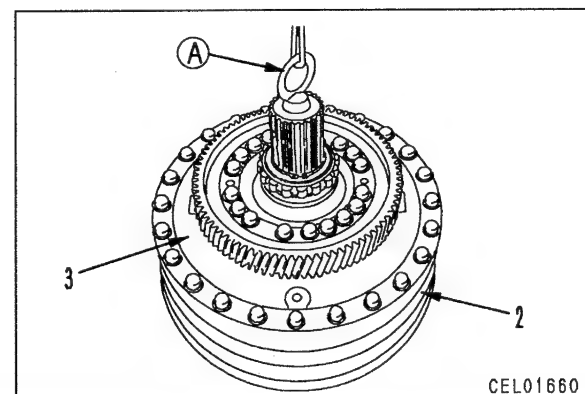
Counterclockwise: Locked

- ★ If the direction of rotation of the stator is different from the above, reverse the race and freewheel, assemble the stator, then check the direction of rotation again.



DLL01166

- 2) Using eyebolt ①, put turbine case assembly (3) on stator shaft and pump assembly (2), and tighten 2 mounting bolts (1) temporarily.



CEL01660

023S02

- 3) Turn over and set to block ①, then tighten mounting bolts (1).



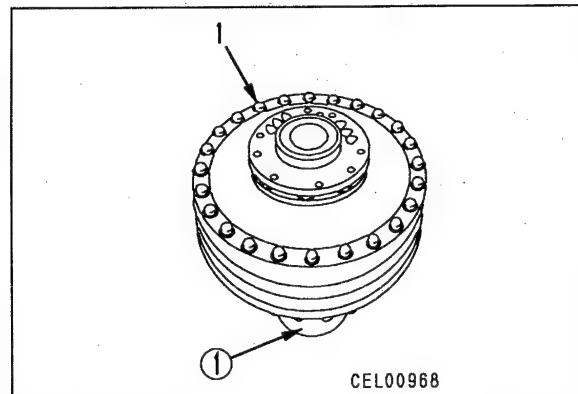
Mounting bolt :

Thread tightener (LT-2)



kgm Mounting bolt :

$53.9 \pm 4.9 \text{ Nm}$ { $5.5 \pm 0.5 \text{ kgm}$ }

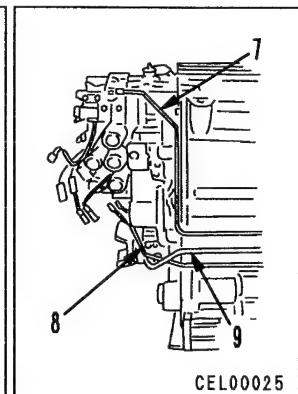
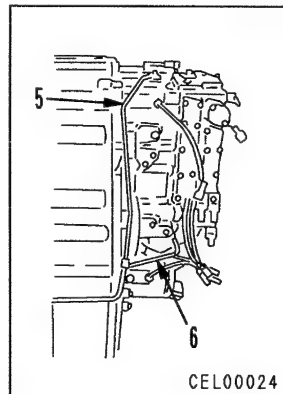
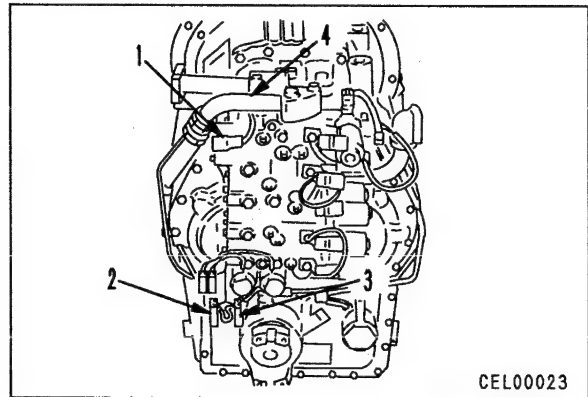


REMOVAL OF TRANSMISSION CONTROL VALVE ASSEMBLY

1. Remove transmission assembly.
For details, see REMOVAL OF TRANSMISSION ASSEMBLY.
2. Remove wiring connectors (1), (2), and (3) from bracket.
3. Disconnect tubes (4), (5), (6), (7), (8), and (9).
4. Using eyebolts ①, lift off transmission control valve (10).
★ The bolts marked ※ are service bolts, so do not remove them.



Transmission control valve assembly :
40 kg



INSTALLATION OF TRANSMISSION CONTROL VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

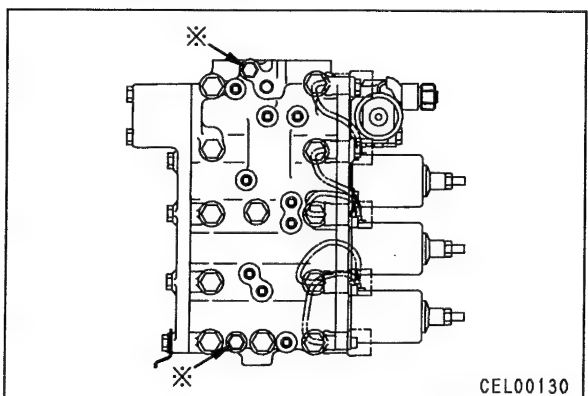
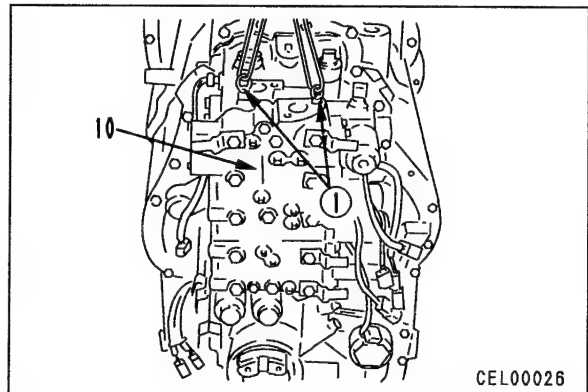


Transmission control valve assembly mounting bolt : **Thread tightener (LT-2)**



Transmission control valve assembly mounting bolt :

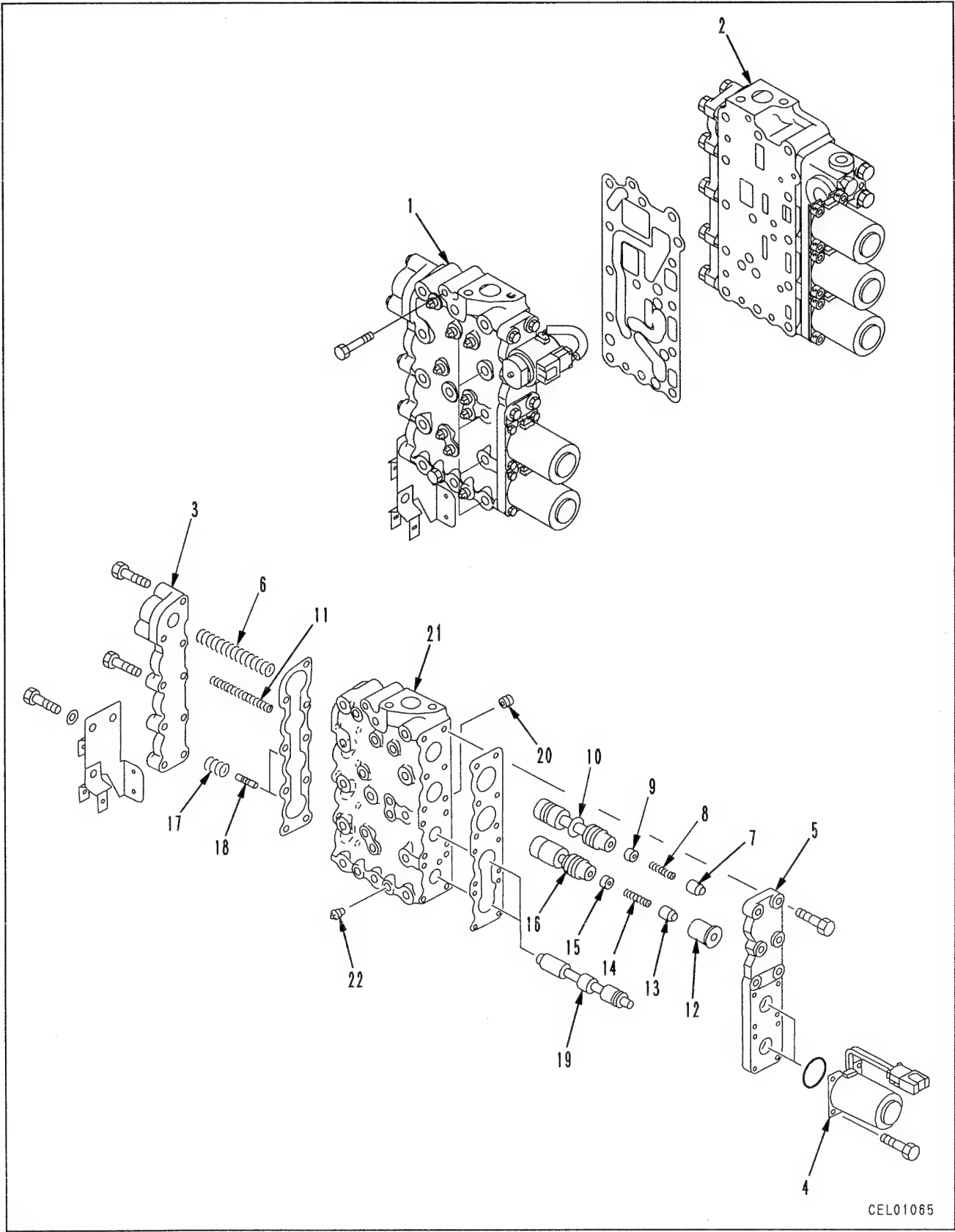
$34.3 \pm 4.9 \text{ Nm}$ { $3.5 \pm 0.5 \text{ kgm}$ }



023S02

DISASSEMBLY OF TRANSMISSION CONTROL VALVE
ASSEMBLY

UPPER VALVE ASSEMBLY



023S02

1. Disconnection of valves

Disconnect upper valve assembly (1) and lower valve assembly (2).

2. Cover

Remove cover (3).

- ★ The total installed load for the springs is 872 N {89 kg}, so use forcing screws and extend the springs to a point where there is no installed load, then remove.
- ★ Dimension to point where installed load becomes 0: Approx. 28.9 mm

3. 1st, 3rd solenoid valve

Remove solenoid valve (4).

4. Cover

Remove cover (5).

5. Priority valve

- 1) Remove spring (6).
- 2) Remove piston (7), spring (8), and valve (9).
- 3) Remove spool (10).

6. Main valve

- 1) Remove spring (11).
- 2) Remove spacer (12).
- 3) Remove piston (13), spring (14), and valve (15).
- 4) Remove spool (16).

7. 1st, 3rd valve

- 1) Remove spring (17), then remove piston (18).
- 2) Remove spool (19).

8. Orifice

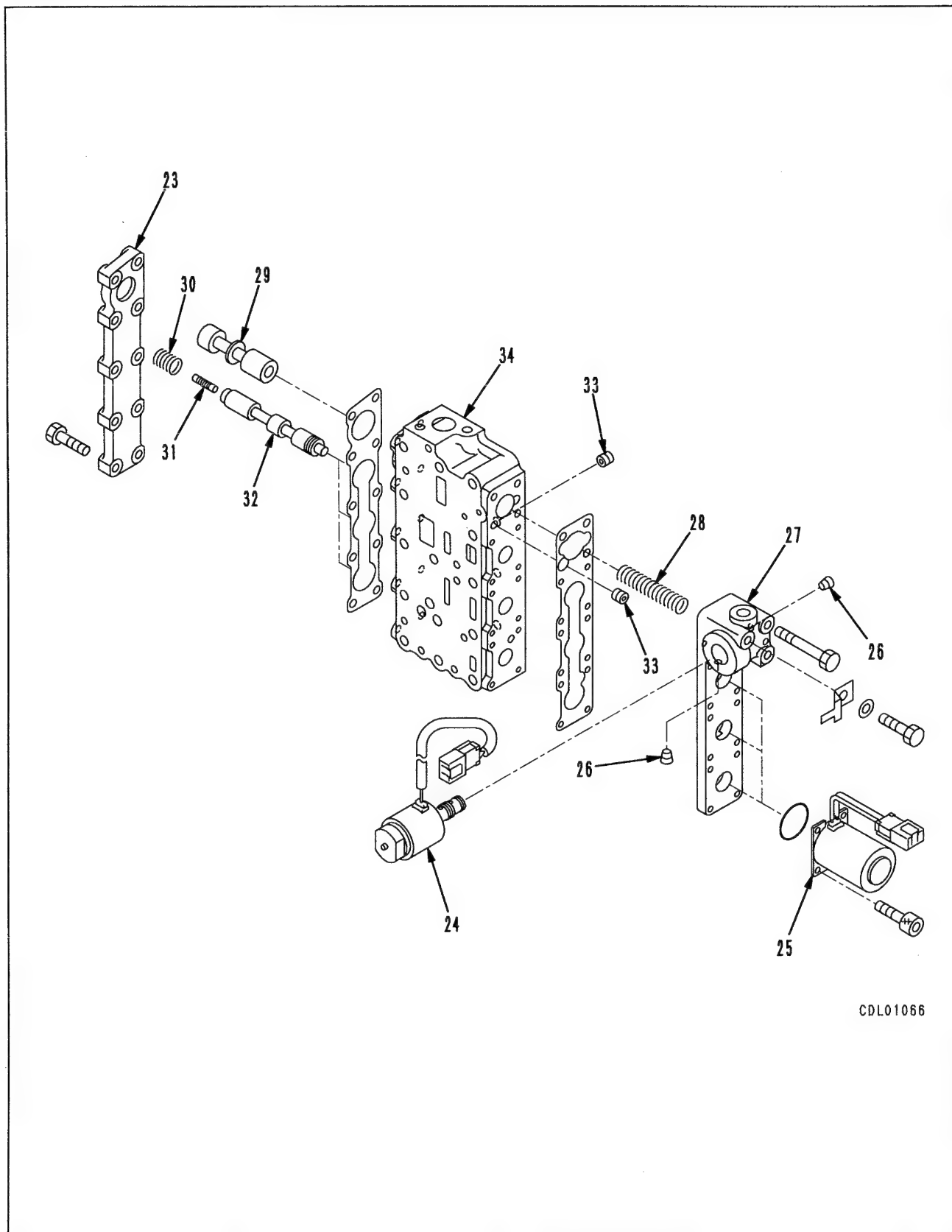
Remove orifice (20) from upper body (21).

9. Plug

Remove plug (22) from body (21).

023S02

LOWER VALVE ASSEMBLY



023S02

11. Cover

Remove cover (23).

12. PTO solenoid valve

Remove solenoid valve (24).

13. 2nd, REVERSE, lock-up solenoid valve

Remove solenoid valve (25).

14. Plug

Remove plug (26) from cover (27).

15. Cover

Remove cover (27).

16. PTO valve

1) Remove spring (28).

2) Remove spool (29).

17. 2nd, REVERSE, lock-up, PTO valve

1) Remove spring (30), then remove piston (31).

2) Remove spool (32).

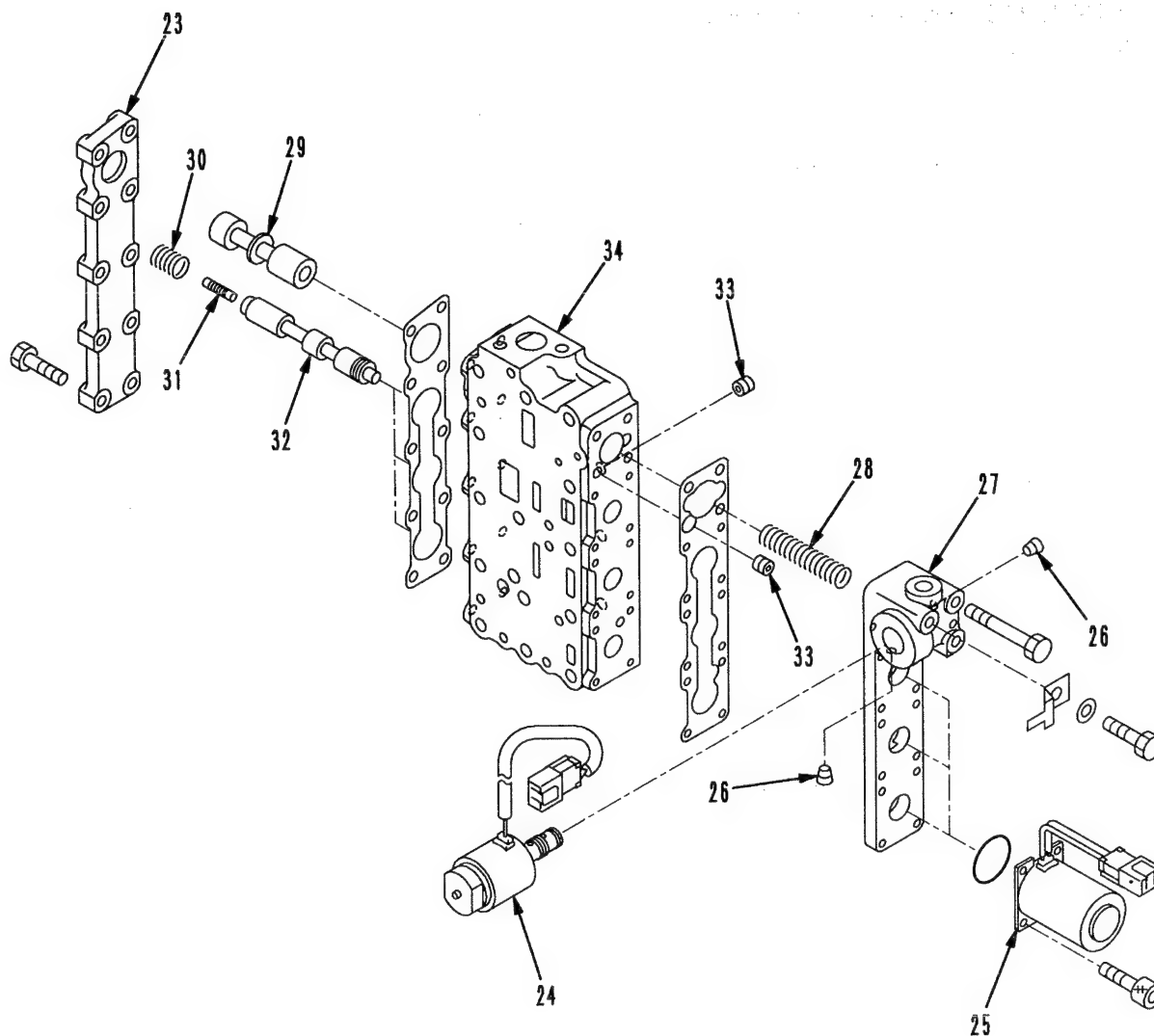
18. Orifice

Remove orifice (33) from lower body (34).

023S02

ASSEMBLY OF TRANSMISSION CONTROL VALVE ASSEMBLY

LOWER VALVE ASSEMBLY



CDL01066

023S02

1. Orifice

Install orifice (33) to lower body (34).



Orifice : **Gasket sealant (LG-1)**



Orifice :

$4.41 \pm 1.47 \text{ Nm}$ ($0.45 \pm 0.15 \text{ kgm}$)

2. 2nd, REVERSE, lock-up, PTO valve

1) Fit piston (31) to spool (32) and assemble.

2) Assemble spring (30).

3. PTO valve

1) Assemble spool (29).

2) Assemble spring (28).

4. Cover

Fit gasket and install cover (27).

★ Tighten together with the connector bracket.

5. Plug

Install plug (26) to cover (27).



Plug : **Gasket sealant (LG-1)**



Plug :

$8.82 \pm 2.94 \text{ Nm}$ ($0.9 \pm 0.3 \text{ kgm}$)

6. 2nd, REVERSE, lock-up solenoid valve

Fit O-ring and install solenoid valve (25).

7. PTO solenoid valve

Fit O-ring and install solenoid valve (24).



Solenoid valve :

$22.05 \pm 2.45 \text{ Nm}$ ($2.25 \pm 0.25 \text{ kgm}$)



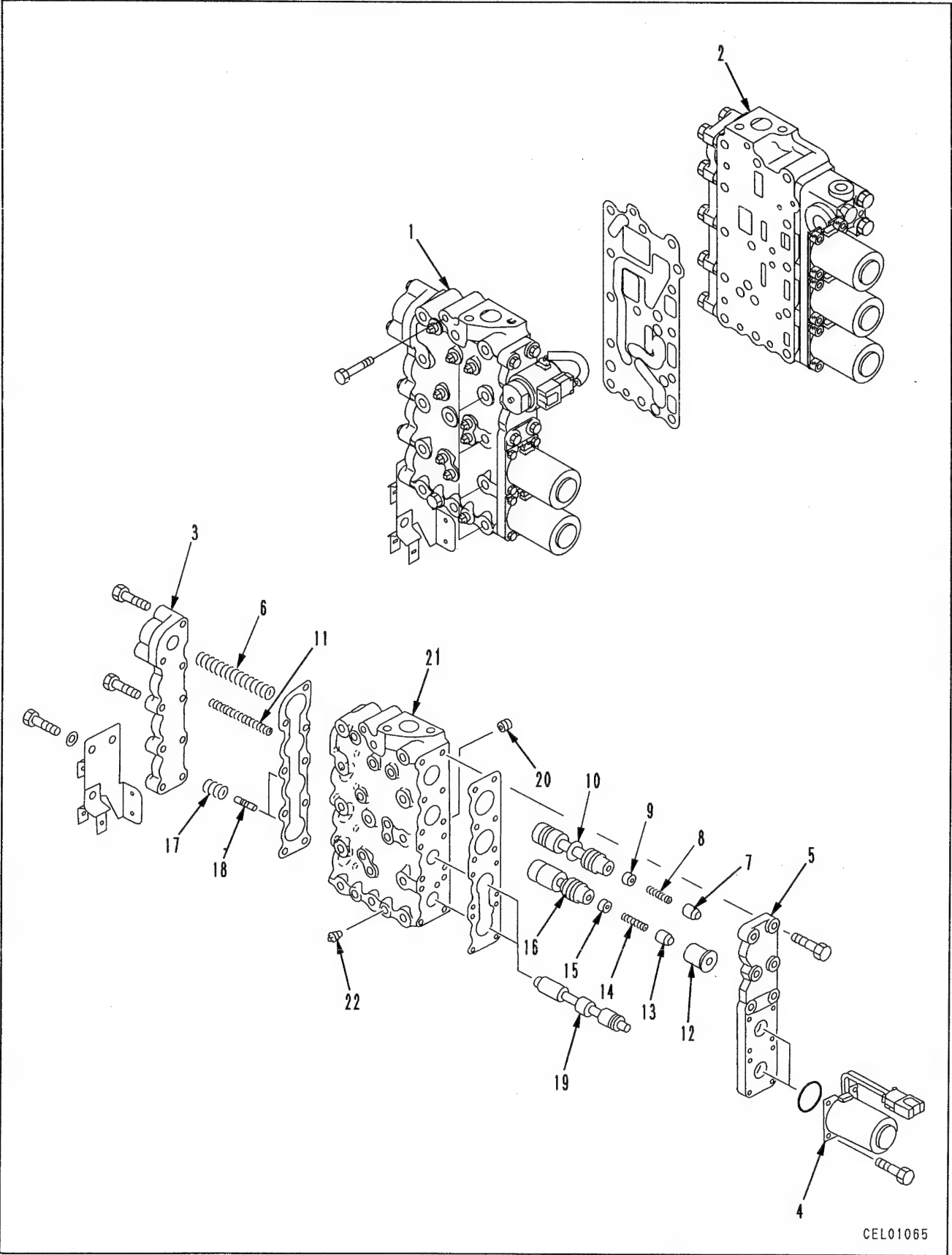
Solenoid nut :

$8.33 \pm 1.47 \text{ Nm}$ ($0.85 \pm 0.15 \text{ kgm}$)

8. Cover

Fit gasket and install cover (23).


UPPER VALVE ASSEMBLY



023S02

1. Plug

Install plug (22) to body (21).

 Plug : $14.7 \pm 4.9 \text{ Nm}$ $\{1.5 \pm 0.5 \text{ kgm}\}$

2. Orifice

Install orifice (20) to upper body (21).

 Orifice : **Gasket sealant (LG-1)**

 Orifice :
 $4.41 \pm 1.47 \text{ Nm}$ $\{0.45 \pm 0.15 \text{ kgm}\}$

3. 1st, 3rd valve

- 1) Assemble piston (18) to spool (19).
- 2) Assemble spool (19) to upper body (21).
- 3) Assemble spring (17).

4. Main valve


- 1) Fit valve (15) to spool (16) and assemble.
- 2) Assemble spool (14) and piston (13).
- 3) Assemble spacer (12).
- 4) Assemble spring (11).

5. Priority valve

- 1) Fit valve (9) to spool (10) and assemble.
- 2) Assemble spring (8) and piston (7).
- 3) Assemble spring (6).

6. Cover

Fit gasket and install cover (5).

 Mounting bolt :
 $30.87 \pm 3.43 \text{ Nm}$ $\{3.15 \pm 0.35 \text{ kgm}\}$

7. 1st, 3rd solenoid valve


Fit O-ring and install solenoid valve (4).

kgm Mounting bolt :
 $13.23 \pm 1.47 \text{ Nm}$ $\{1.315 \pm 0.15 \text{ kgm}\}$

8. Cover

Install cover (3).

- ★ Tighten together with the connector bracket.
- ★ The total installed load for the springs is 872.2 N {89 kg}, so use forcing screws and tighten to a point where the mounting bolts can be screwed in securely, then install the cover.

 Mounting bolt :
 $30.87 \pm 3.43 \text{ Nm}$ $\{3.15 \pm 0.35 \text{ kgm}\}$

9. Connection of valve

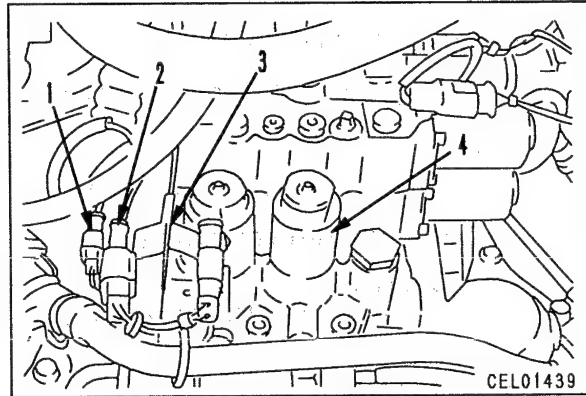
Fit gasket and connect lower valve assembly (2) and upper valve assembly (1).

 Mounting bolt :
 $30.87 \pm 3.43 \text{ Nm}$ $\{3.15 \pm 0.35 \text{ kgm}\}$

REMOVAL OF HI/LO, 2WD/4WD SELECTOR SOLENOID VALVE ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connectors (L101) (1) and (L99) (2).
2. Remove wiring connector bracket (3).
★ Move it towards the outside of the machine.
3. Remove Hi/Lo and 2WD/4WD selector solenoid valve assembly (4).



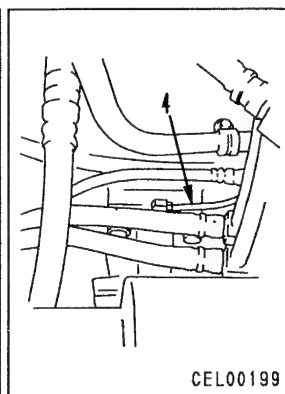
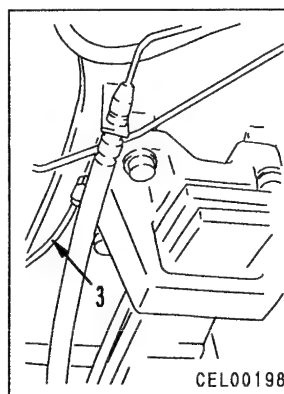
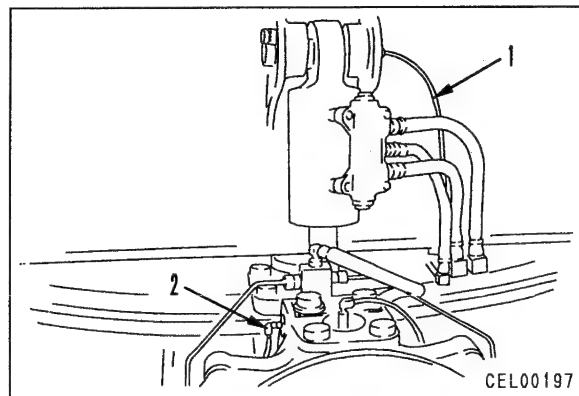
INSTALLATION OF HI/LO, 2WD/4WD SELECTOR SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

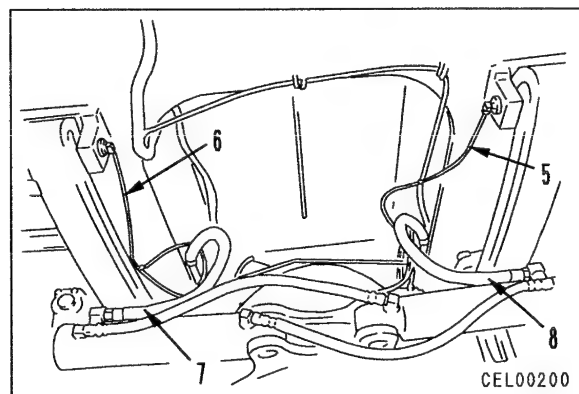
REMOVAL OF FRONT AXLE ASSEMBLY

- ⚠ Extend the outriggers fully, set blocks (height: approx. 350 mm) under the outriggers, raise the machine fully, then swing the revolving frame 90°.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

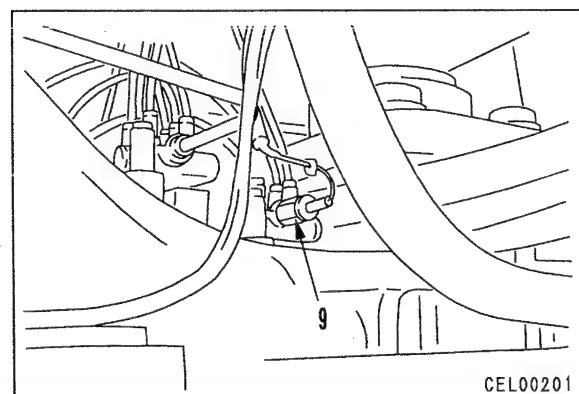
1. Remove wheel assembly.
For details, see REMOVAL OF WHEEL ASSEMBLY.
2. Disconnect grease hoses (1) and (2) from suspension lock cylinder pin, grease hoses (3) and (4) from leaf spring bracket, and grease hoses (5) and (6) from leaf spring pin.
★ After disconnecting the hoses, fit tags to distinguish them.



3. Disconnect hoses (7) and (8) from steering cylinder.



4. Disconnect wiring connector (L88) (9).



023S02

5. Disconnect grease hose (10) and brake hose (11).

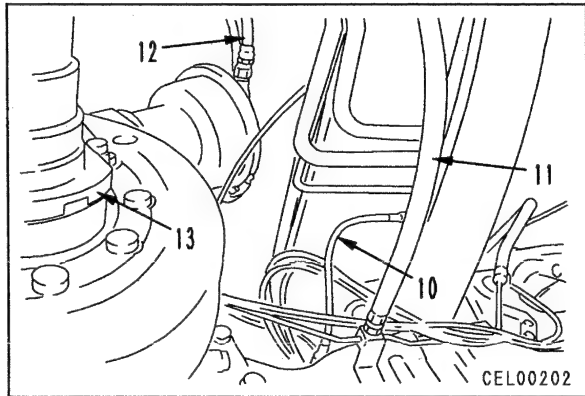
※ 1

6. Disconnect air hose (12) from parking brake chamber.

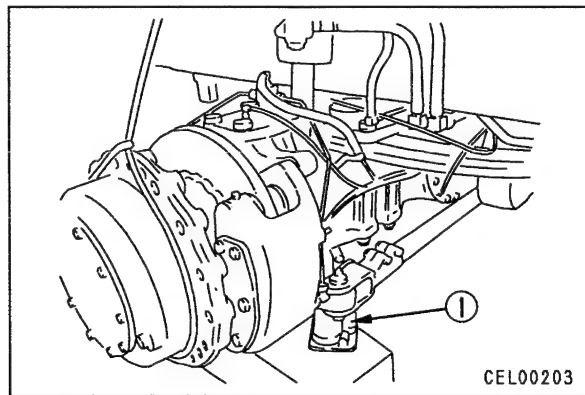
※ 2

7. Disconnect front drive shaft (13) at axle end.

※ 3

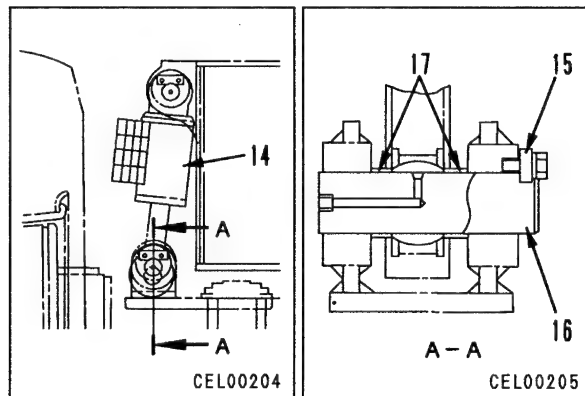


8. Sling left and right front axles, then support bottom of left and right knuckle with jack (1).



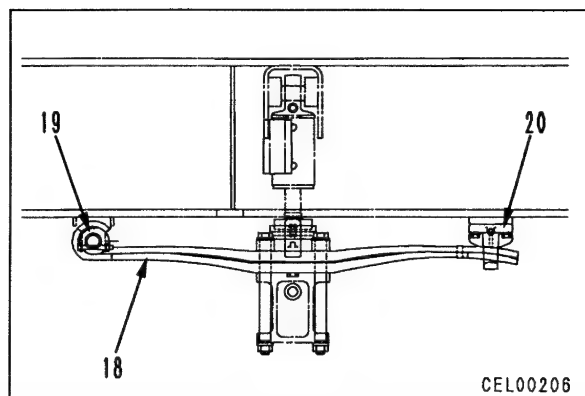
9. Remove lock plate (15), pin (16), and spacers (17) from bottom of suspension lock cylinder (14). ※ 4

★ Remove the grease nipple from the pin.



10. Remove pin (19) from front leaf spring (18), and bracket (20) from rear leaf spring. ※ 5

★ Remove the grease nipple from the pin.



023S02

11. Sling one end of front axle assembly (20), support other end with garage jack (2), then operate jack and crane, and remove front axle assembly from under chassis towards crane.



Front axle assembly : 1300 kg

INSTALLATION OF FRONT AXLE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ Wheel brake hose sleeve nut :
 $24.5 \pm 4.9 \text{ Nm}$ { $2.5 \pm 0.5 \text{ kgm}$ }

※ 2

- ★ Sleeve nut of parking brake chamber air hose: $49 \pm 19.6 \text{ Nm}$ { $5 \pm 2 \text{ kgm}$ }

※ 3

- Drive shaft mounting bolt :
 $110.25 \pm 12.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }

※ 4

※ 5

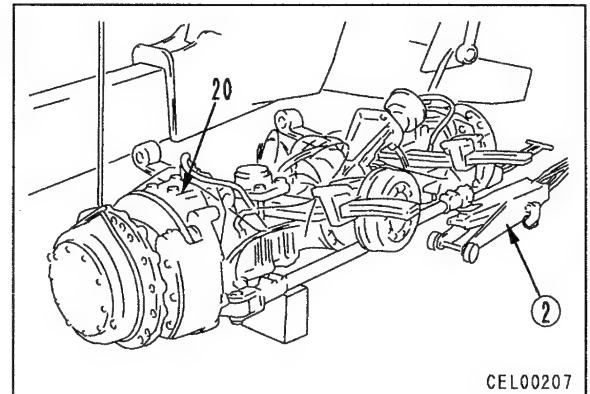


When aligning the position of the pin hole, never insert your fingers in the pin hole.



Pin portion : Grease (G2-LI)

- Refilling with oil**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- Bleeding air**
Bleed the air from the brake line.
For details, see TESTING AND ADJUSTING, Bleeding air.



CEL00207

REMOVAL OF REAR AXLE ASSEMBLY

- ⚠ Extend the outriggers fully, set blocks (height: approx. 350 mm) under the outriggers, raise the machine fully, then swing the revolving frame 90°.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove wheel assembly.
For details, see REMOVAL OF WHEEL ASSEMBLY.

2. Disconnect wiring connectors (L11) (1) and (J16)(2).

3. Disconnect grease hoses (1) and (2) from rear axle suspension lock cylinder pin, grease hose (3) from leaf spring pin, and grease hose (4) and basic hose (5) from leaf spring bracket.

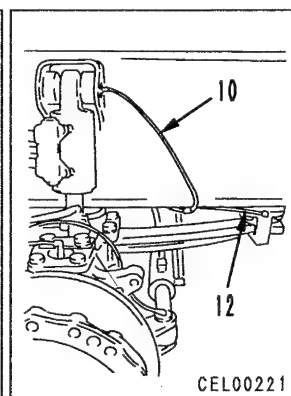
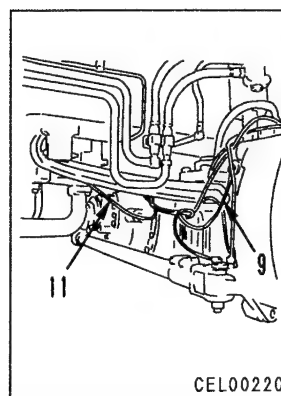
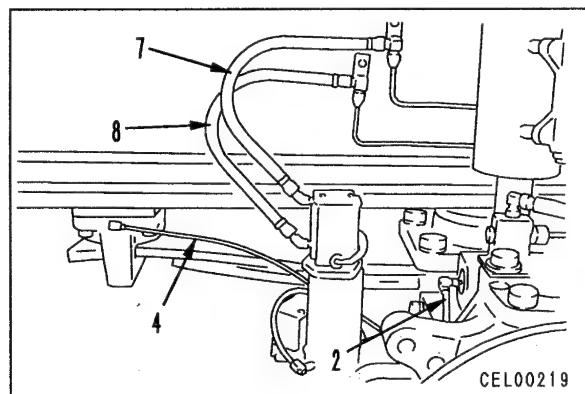
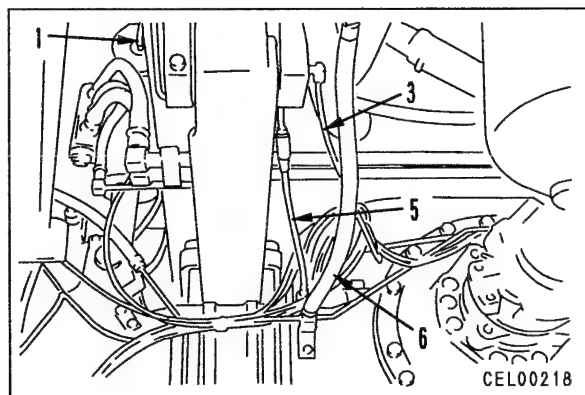
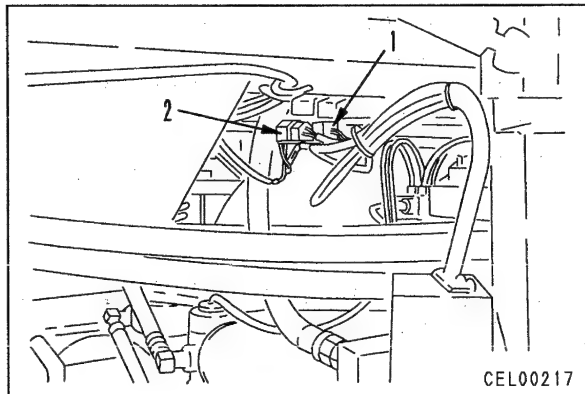
★ After disconnecting the hoses, fit tags to distinguish them.

4. Disconnect brake hose (6).



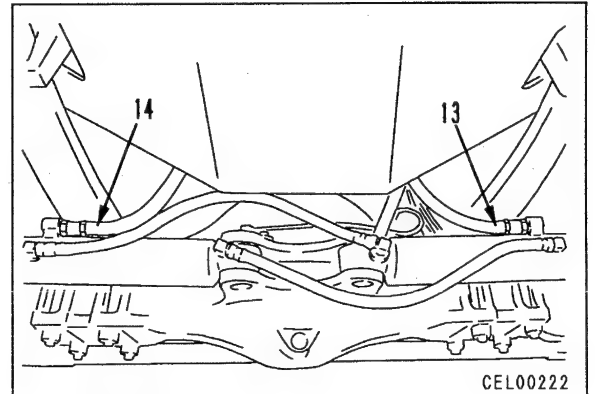
5. Disconnect air hoses (7) and (8) from rear steering lock cylinder.

6. Disconnect grease hoses (9) and (10) from suspension lock cylinder pin, grease hose (11) from leaf spring pin, and grease hoses (12) from leaf spring bracket at left end of rear axle.



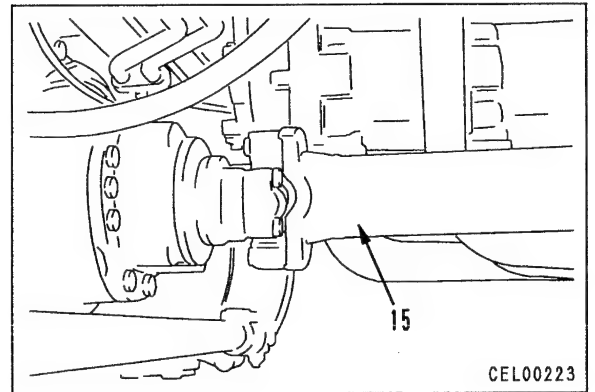
023S02

7. Disconnect hoses (13) and (14) from steering cylinder.

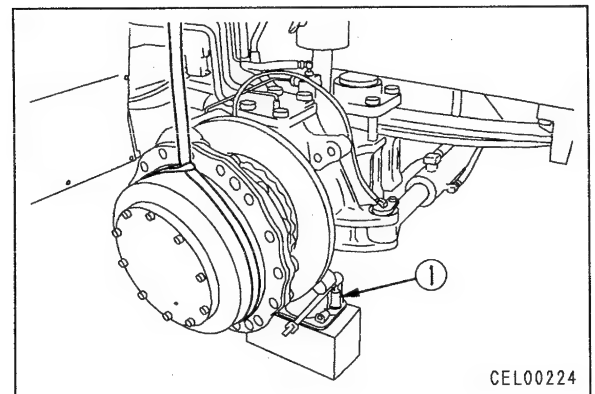


8. Disconnect rear drive shaft (15) at axle end.

※ 2



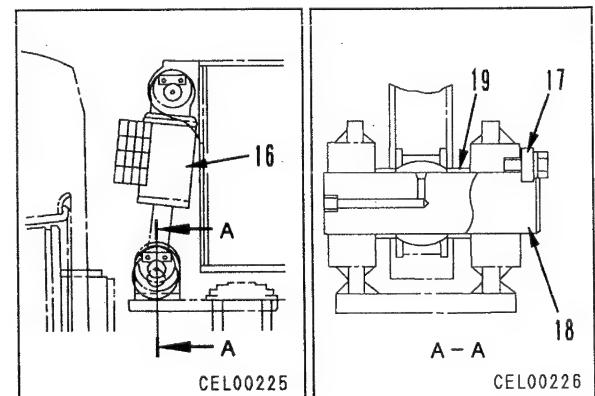
9. Sling left and right ends of rear axle, then support bottom of left and right knuckles with jack (1).



10. Remove lock plate (17), pin (18), and spacer (19) from bottom of suspension lock cylinder (16).

※ 3

★ Remove the grease nipple from the pin.



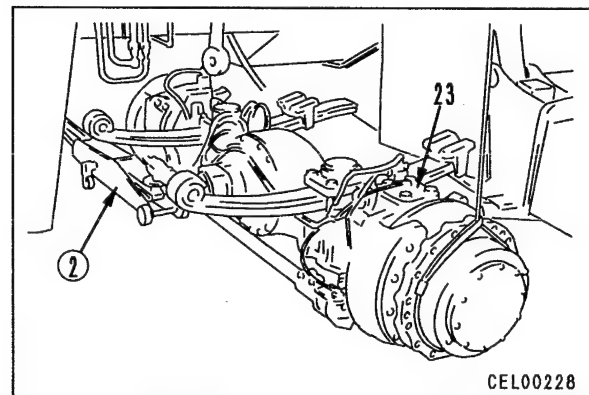
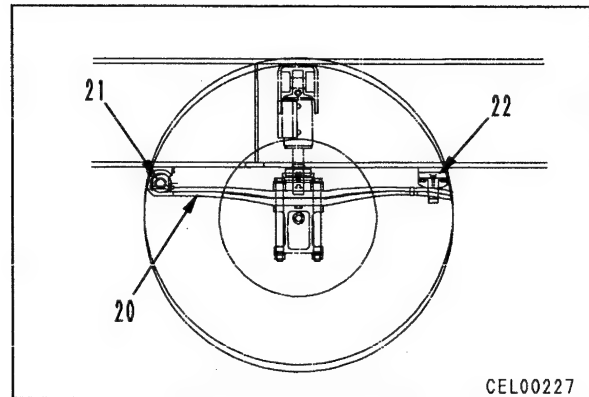
023S02

11. Remove pin (21) from front leaf spring (20), and bracket (22) from rear leaf spring. [*4]
★ Remove the grease nipple from the pin.

12. Sling one end of rear axle assembly (23), support other end with garage jack ②, then operate jack and crane, and remove rear axle assembly from under chassis towards crane.



Rear axle assembly : 1200 kg



INSTALLATION OF REAR AXLE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ Wheel brake hose sleeve nut :
 $24.5 \pm 4.9 \text{ Nm}$ { $2.5 \pm 0.5 \text{ kgm}$ }

※ 2

- Drive shaft mounting bolt :
 $110.25 \pm 12.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }

※ 3 ※ 4

- ⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin portion : **Grease (G2-LI)**

- Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- Bleeding air**
Bleed the air from the brake line.
For details, see TESTING AND ADJUSTING, Bleeding air from brake line.

023S02

DISASSEMBLY OF AXLE ASSEMBLY

1. Set axle assembly on block (1).
2. **Draining oil**
Remove drain plug and drain oil from final drive case and differential case.

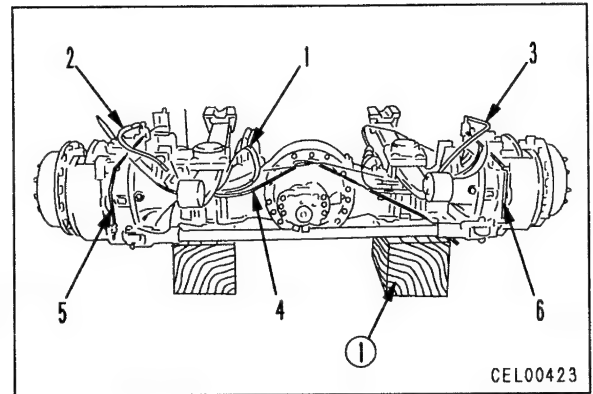


Differential case : **Approx. 32 ℓ**

Final drive case :
Approx. 7 ℓ (left and right)

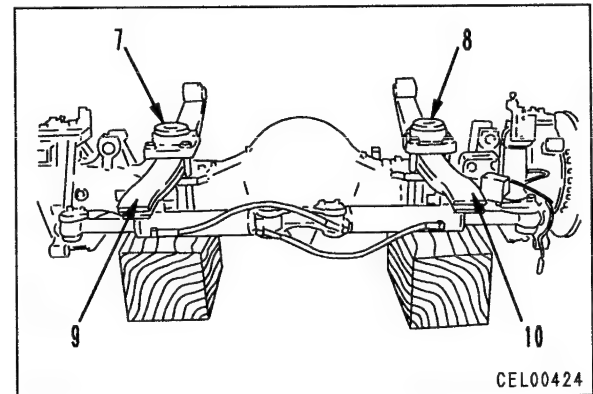
3. Grease hoses, brake tubes

- 1) Remove grease hose ① together with bracket and distributor from axle housing.
★ After disconnecting the hoses, fit tags to distinguish them.
- 2) Disconnect brake hoses (2) and (3), and remove tube (4) together with bracket from axle housing.
- 3) Remove brake tubes (5) and (6).



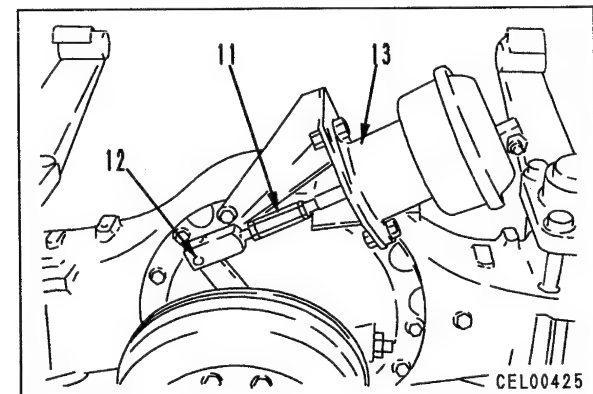
4. Spring assembly

- 1) Remove mounting bolts, then remove plates (7) and (8).
- 2) Remove spring assemblies (9) and (10).



5. Parking brake chamber assembly (front axle only)

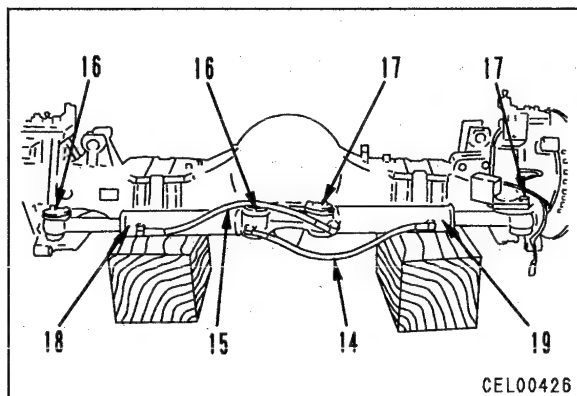
- 1) Rotate rod (11) between chamber and brake lever and release brake.
- 2) Remove pin (12), then remove parking brake chamber assembly (13) together with bracket.



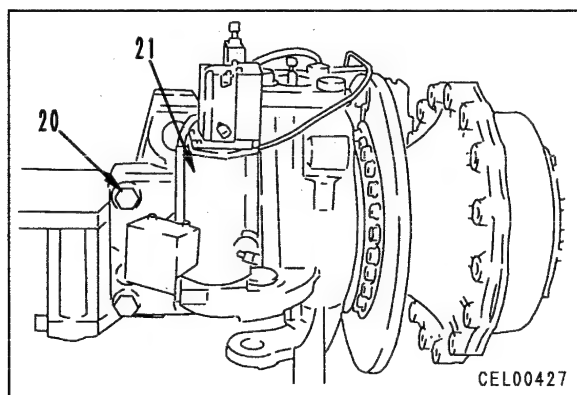
023S02

6. Steering cylinder assembly

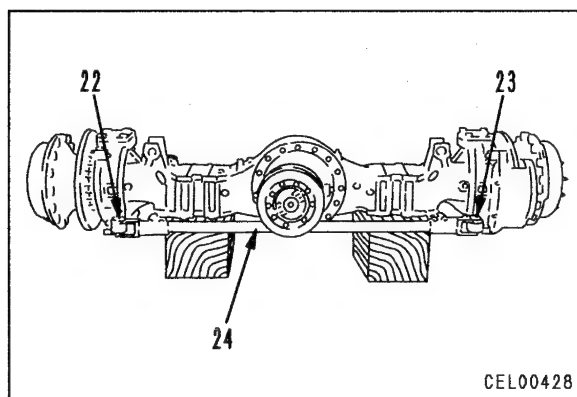
Disconnect hoses (14) and (15) at cylinder bottom end, and remove connecting pins (16) and (17), then remove steering cylinder assemblies (18) and (19).

**7. Rear steering lock cylinder assembly (rear axle only)**

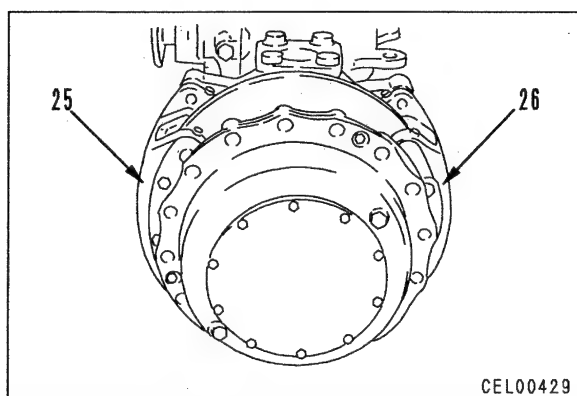
Remove 4 mounting bolts (20), then remove rear steering lock cylinder assembly (21) together with bracket.

**8. Tie rod**

Remove connecting pins (22) and (23), then remove tie rod (24).

**9. Wheel brake caliper assembly**

Sling wheel brake caliper assemblies (25) and (26), then remove mounting bolts, and lift off.



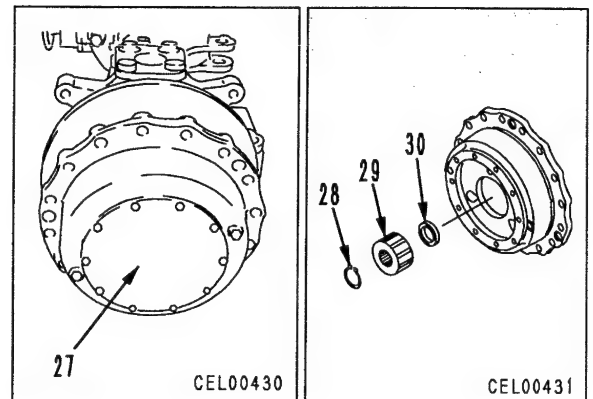
023S02

10. Cover

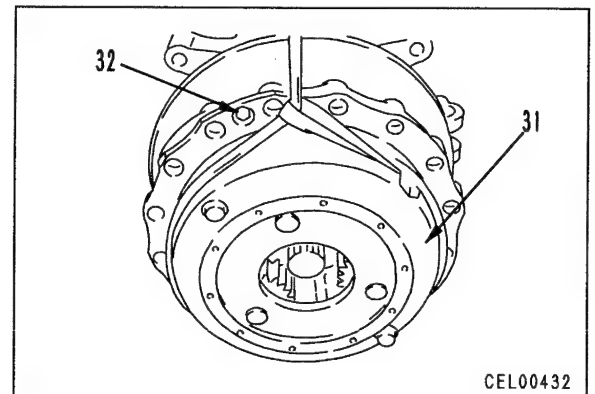
Remove cover (27).

11. Snap ring, sun gear, spacer

Remove snap ring (28), then remove sun gear (29) and spacer (30).

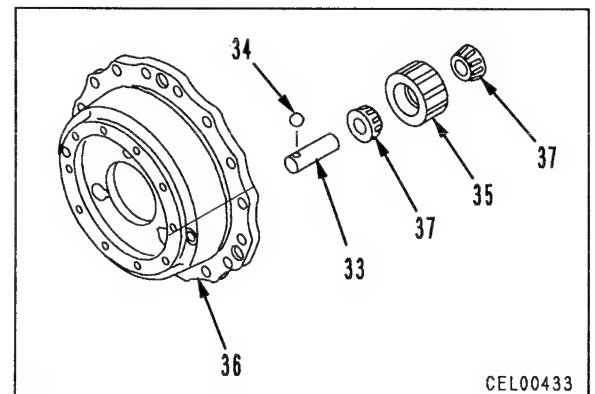
**12. Carrier assembly**

Sling carrier assembly (31), then remove 3 mounting bolts (32), and lift off.



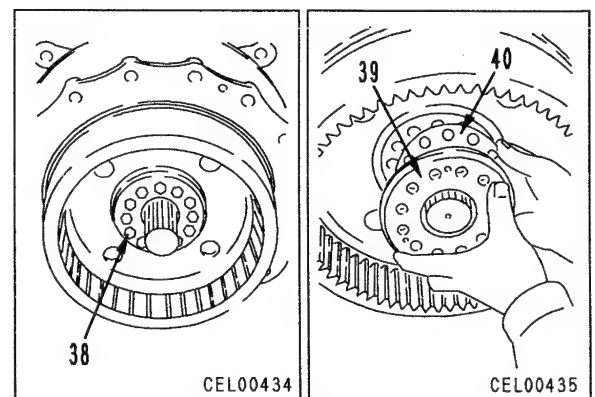
- Disassembly of carrier assembly**

- 1) Pull shaft (33) out partially, remove ball (34), then remove shaft.
 - ★ Keep the ball in a safe place and be careful not to lose it.
- 2) Remove gear (35) from carrier (36), then remove bearing (37).

**13. Retainer, shim**

Remove retainer mounting bolts (38), then remove retainer (39) and shim (40).

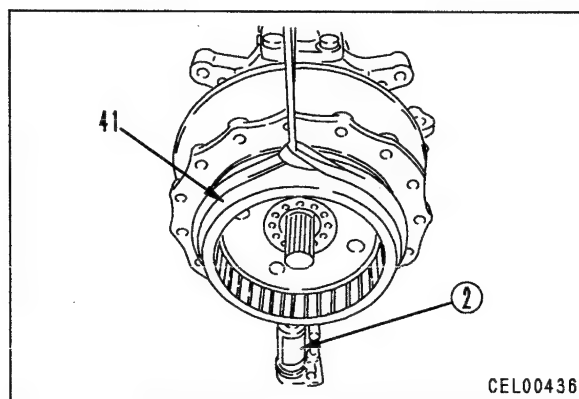
- ★ Check the number and thickness of the shims, and keep in a safe place.



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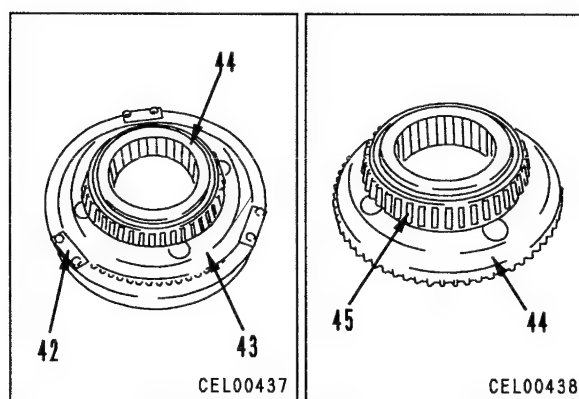
14. Ring gear, hub assembly

Support bottom of wheel hub with jack ②, then lift off ring gear and hub assembly (41).

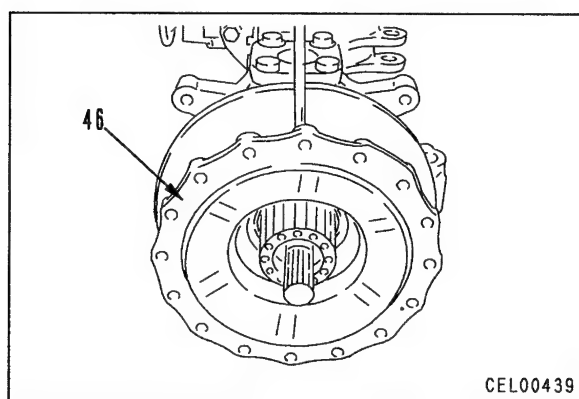


- Disassembly of ring gear, hub assembly**

- 1) Remove plate (42), then remove hub (44) from ring gear (43).
- 2) Remove bearing (45) from hub (44).

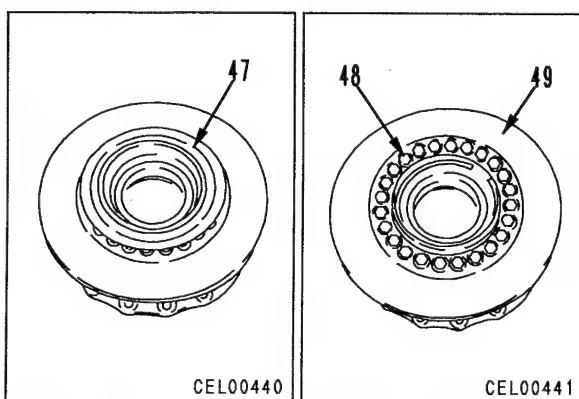
**15. Wheel hub, disc plate assembly**

Lift off wheel hub and disc plate assembly (46).



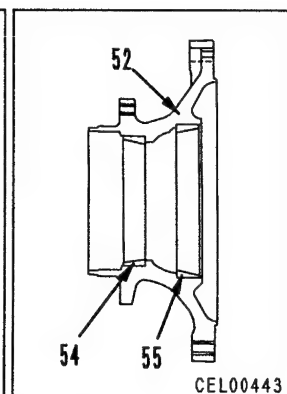
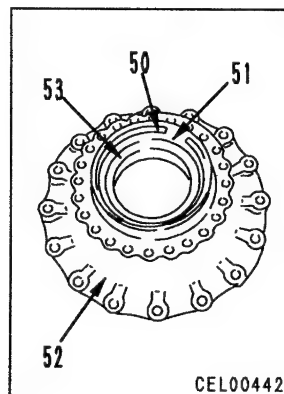
- Disassembly of wheel hub, disc plate assembly**

- 1) Remove protector (47).
- 2) Remove mounting bolts (48), then remove disc plate (49).



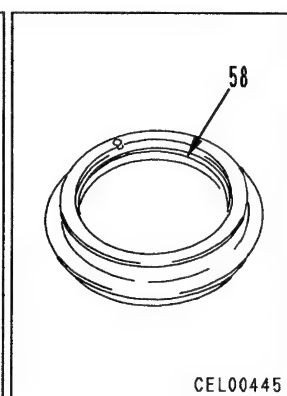
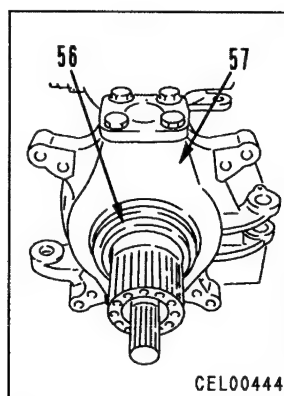
023S02

- 3) Remove snap ring (50).
- 4) Remove oil seal (51) from hub (52).
- 5) Remove bearing (53).
- 6) Remove outer races (54) and (55) from hub (52).



16. Retainer

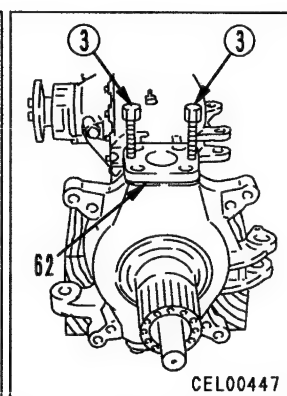
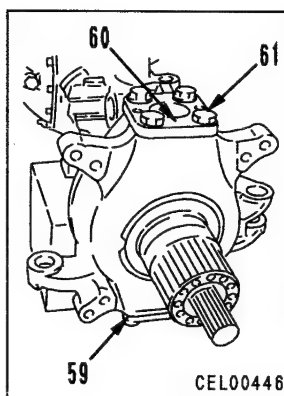
- 1) Remove retainer (56) from knuckle (57).
- 2) Remove O-ring (58) from retainer.



17. Cap

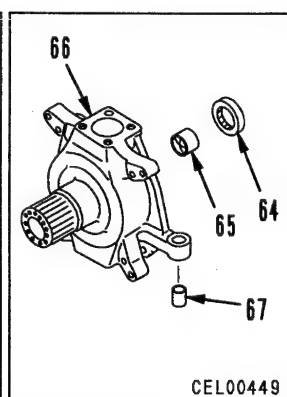
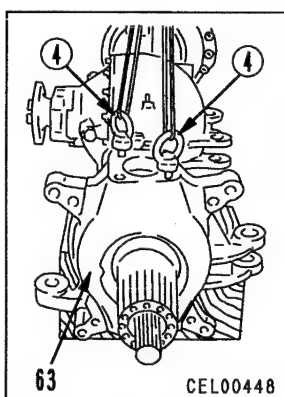
Remove mounting bolts (61) of lower cap (50) and upper cap (60), then using forcing screws ③, remove cap and shim (62).

- ★ Check the number and thickness of the shims, and keep in a safe place.



18. Knuckle assembly

- 1) Using eyebolts ④, remove knuckle assembly (63).
- 2) Remove oil seal (64) and bushing (65) from knuckle (66).
- 3) Remove bushing (67) from knuckle (66).

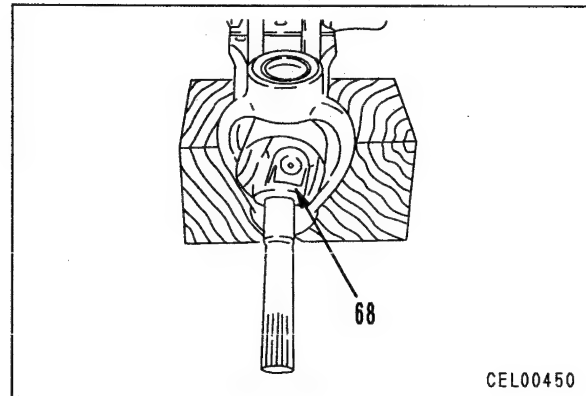


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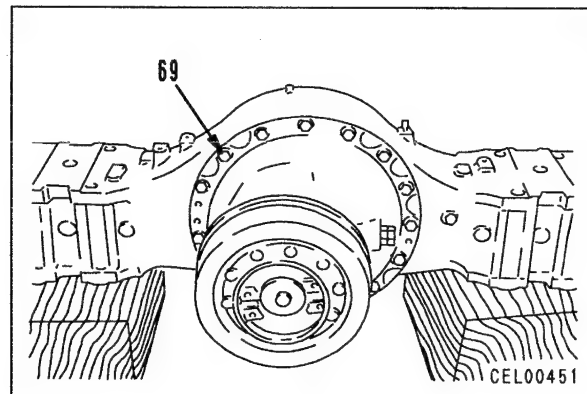
19. Torque shaft

Remove torque shaft (68).

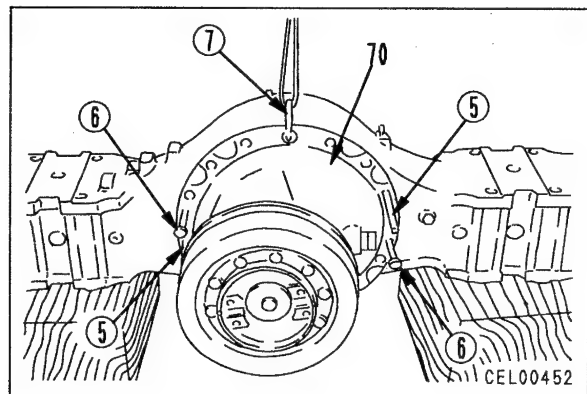
- 20. Repeat Steps in Item 9 – 19 to disassemble opposite side.**

**21. Differential assembly**

- 1) Leave 2 mounting bolts in position and remove remaining mounting bolts (69) of differential assembly.



- 2) Set guide bolt (5) in position, then use forcing screws (6) to pull out to position where shackle (7) can be installed.
- 3) Fit shackle (7), then lift off differential assembly (70).

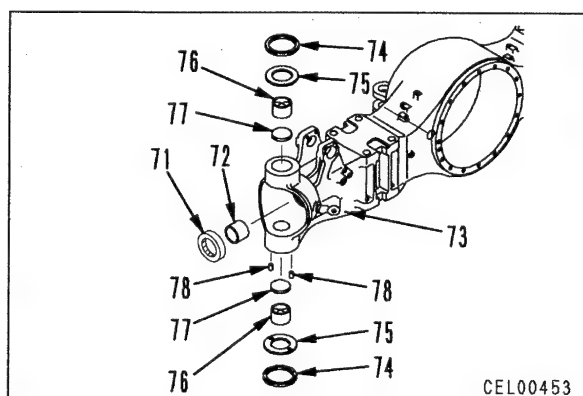
**22. Oil seal, bushing**

Remove oil seal (71) and bushing (72) from axle housing (73).

23. Seal, thrust washer, bushing, retainer

Remove seal (74), thrust washer (75), bushing (76), and retainer (77) from axle housing (73).

- 24. Remove pin (78).**




023S02


ASSEMBLY OF AXLE ASSEMBLY

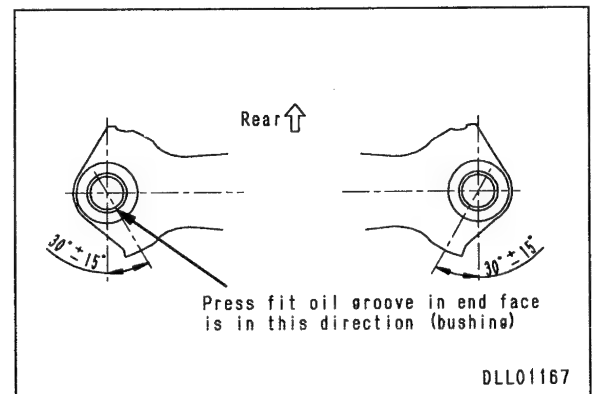
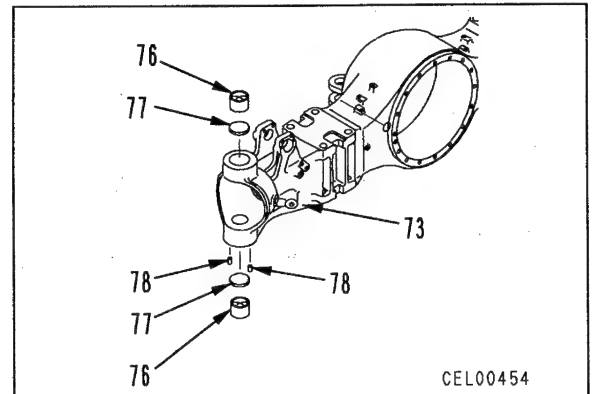
1. Remove, bushing, thrust washer, seal

- 1) Assemble retainer (77), then using push tool, press fit bushing (76) to axle housing (73).
 - ★ Press fit the bushing so that the oil groove in the end face of the bushing is in the direction shown in the diagram on the right.
 - ★ Press fit the bushing to a point where it pushes the retainer in fully.


 Inside face of bushing: **Molybdenum disulphide lubricant (LM-G)**

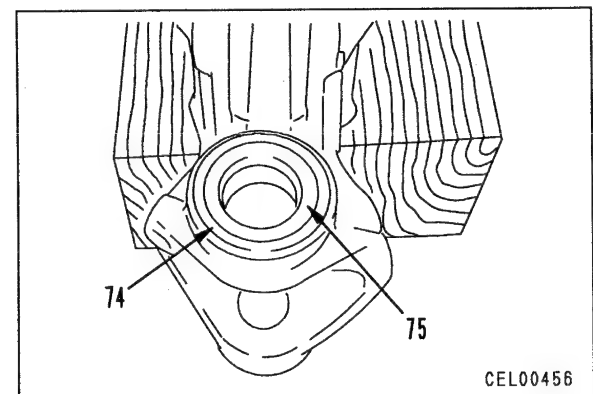
- 2) Knock pin (78) into axle housing.
 - ★ Set the large chamfered end at the housing end and knock the pin in completely.

 Pin (housing end) :
Thread tightener (LT-2)




- 3) Install thrust washer (75) and seal (74).

 Thrust washer, seal: **Molybdenum disulphide lubricant (LM-G)**





2. Bushing, oil seal

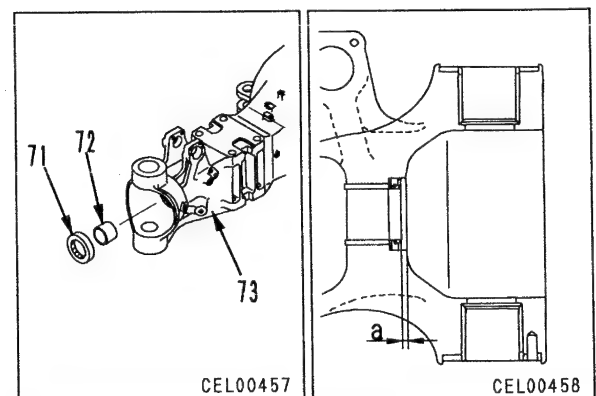
- 1) Using push tool, press fit bushing (72) to axle housing (73).
 - ★ Check that the vertical misalignment at the bushing press-fitting portion is less than 0.1 mm.

 Inside surface of bushing : **Oil (AX075)**

- 2) Using push tool, press fit oil seal (71) to axle housing (73) so that it is dimension a.
 - ★ Dimension a : 5.5 ± 0.2 mm

 Oil seal press-fitting portion :
Thread tightener (Seal end 242)


 Lip of oil seal : **Grease (G2-LI)**

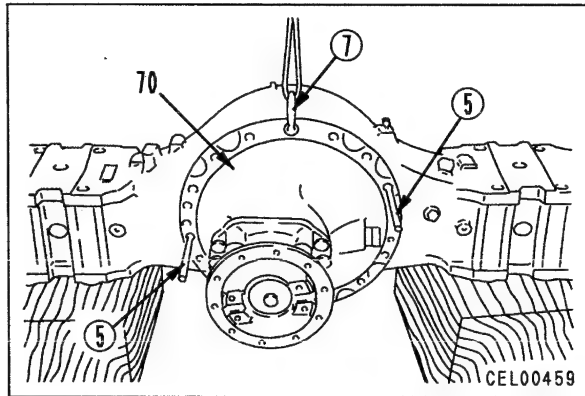


3. Differential assembly

Screw guide bolt ⑤ in housing, then using eye-bolt ⑦, raise differential assembly (70), and install to axle housing.

- ★ When installing the differential assembly, be extremely careful not to damage the O-ring.

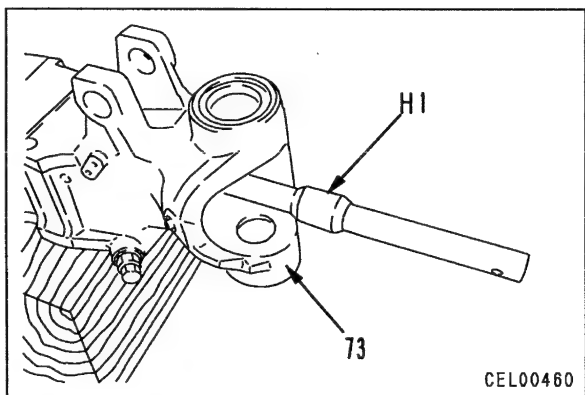
 **kgm** Mounting bolt :
176.4 ± 19.6 Nm {18 ± 2.0 kgm}



4. Adjusting king pin shim

- 1) Install tool H1 to axle housing (73).

- ★ Be extremely careful not to damage the oil seal inside the housing when installing.



- 2) Using push tool, press fit bushing (65) to knuckle (66).

- ★ Check that the vertical misalignment at the bushing press-fitting portion is less than 0.1 mm.

- 3) Using eyebolts ④, raise knuckle assembly (63) and set to axle housing.

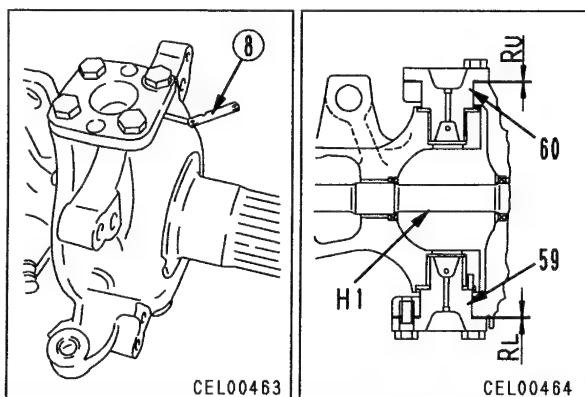
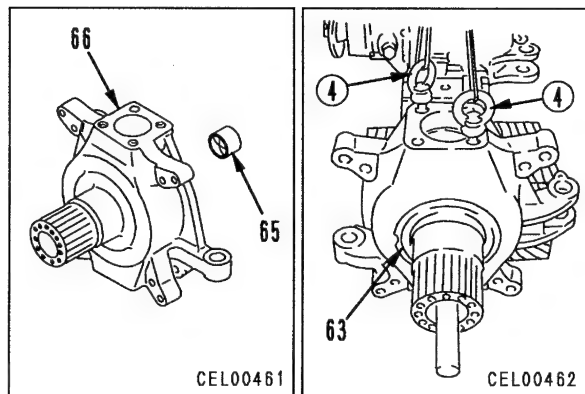
- 4) Install upper cap (60) and lower cap (59), then measure clearance between knuckle seat surface and cap flange surface with clearance gauge ⑧, and decide shim thickness. (Top: Y, bottom: Z)

Total shim thickness (R) $R=Y+Z+0.05$

Lower shim thickness (RL) $RL=Z-0.3$

Upper shim thickness (RU) $RU=R-RL$

- 5) After deciding shim thickness, remove cap, knuckle assembly, and tool H1.

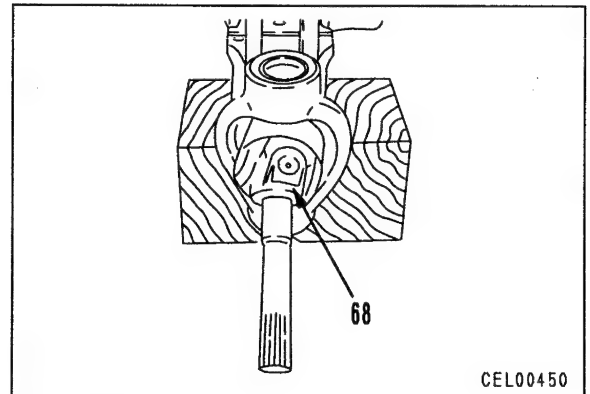


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5. Torque shaft


Install torque shaft (68).


- ★ Be extremely careful not to damage the oil seal inside the housing when installing.

**6. Knuckle assembly**


- Using push tool, press fit oil seal (64) to knuckle (66) so that it is dimension b.

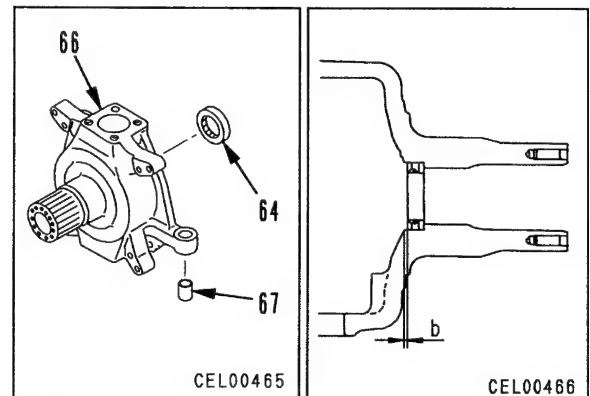
- ★ Dimension **b** : 5.5 ± 0.2 mm

 Oil seal press-fitting portion :
Liquid adhesive (Loctite 648)

 Lip of oil seal : **Grease (G2-LI)**

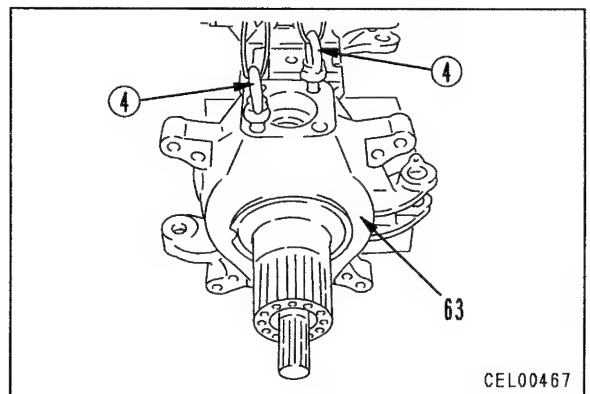
- Using push tool, press fit bushing (67) to knuckle (66).

 Inside surface of bushing: **Molybdenum disulphide lubricant (LM-G)**




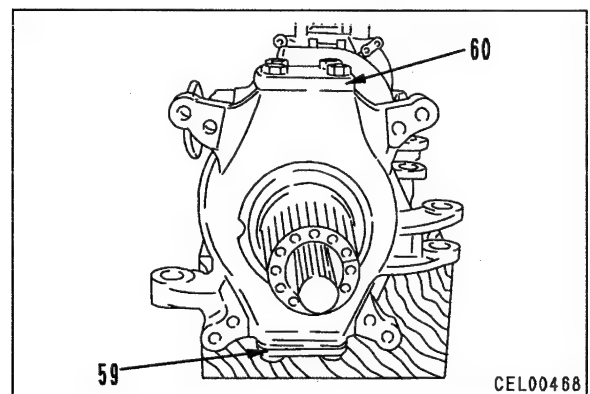
- Using eyebolts ④, raise knuckle assembly (63) and set to axle housing.

- ★ Be extremely careful not to damage the oil seal inside the knuckle when installing.

**7. Cap**

Fit shim selected in Step 4, then install upper cap (60) and lower cap (59).


 Mounting bolt :
 926.1 ± 102.9 Nm (94.5 ± 10.5 kgm)

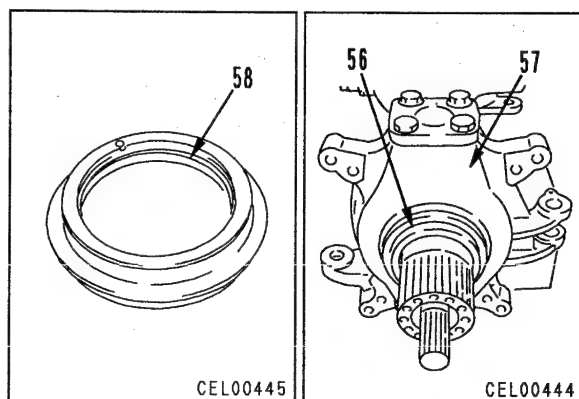


023S02

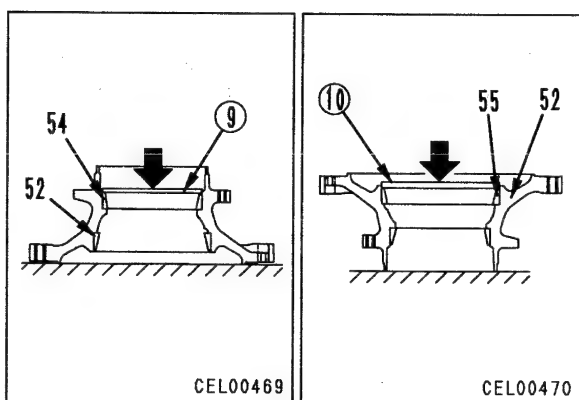
8. Retainer

Fit O-ring (58) to retainer (56), then install to knuckle (57).

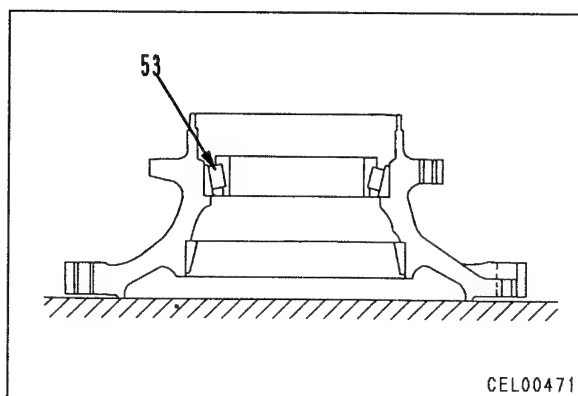
 O-ring and contact surface of O-ring:
Grease (G2-LI)

**9. Wheel hub, disc plate assembly**

- 1) Using push tool ⑨, press fit outer race (54) to hub (52).
- 2) Using push tool ⑩, press fit outer race (55) to hub (52).





- 3) Assemble bearing (53).

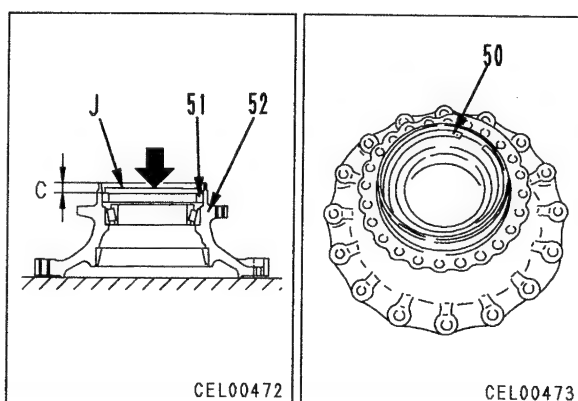


- 4) Using tool J, press fit oil seal (51) to hub (52) so that it is dimension C.

★ Dimension c : 28.4 ± 0.2 mm



 Oil seal press-fitting portion :
Liquid adhesive (Seal end 242)
 Lip of oil seal: **Oil (AX075)**

- 5) Install snap ring (50).

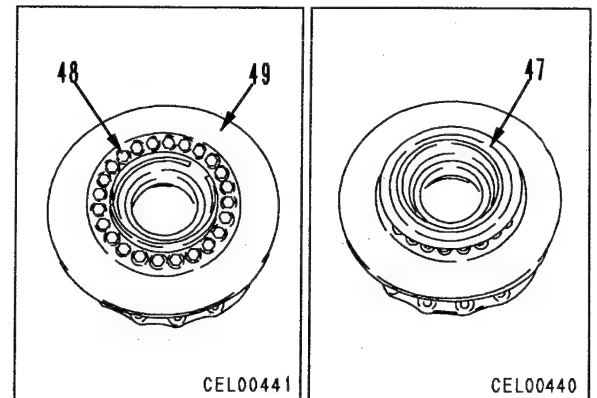


023S02

- 6) Set disc plate (49) to hub, and tighten bolts (48).

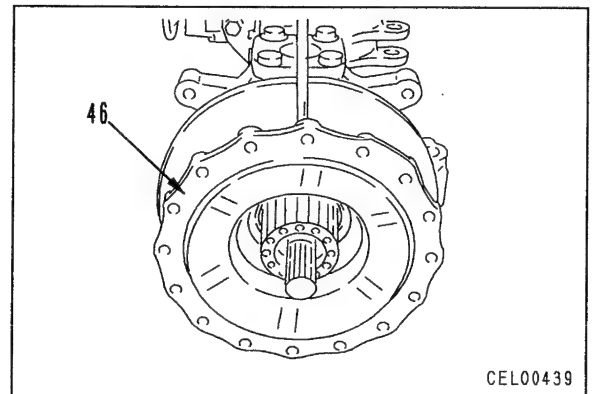
 Mounting bolt : **Thread tightener (LT-2)**
 ★  Mounting bolt : **$276.85 \pm 31.85 \text{ Nm}$ { $28.15 \pm 3.25 \text{ kgm}$ }**

- 7) Install protector (47).



- 8) Raise wheel hub and disc plate assembly (46) to knuckle shaft.

- ★ Be extremely careful not to damage the oil seal inside the hub.
- ★ Support the bottom of the wheel hub with a jack.





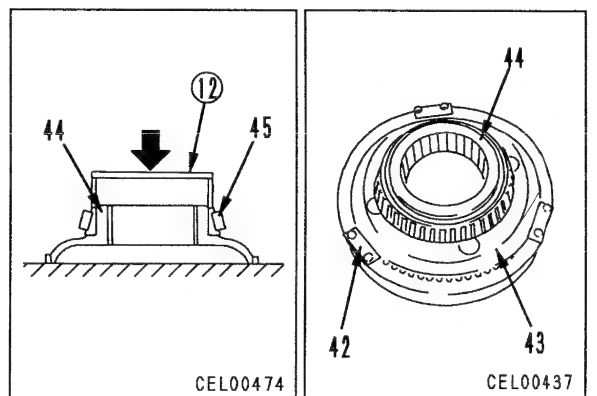
10. Ring gear, hub assembly

- Assembly of ring gear, hub assembly
- 1) Using push tool (12), press fit bearing (45) to hub (44).

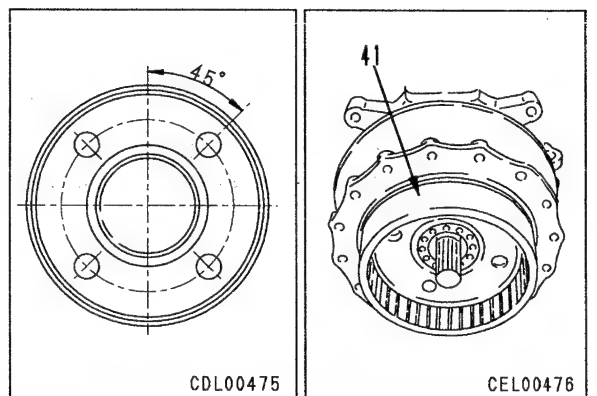
- 2) Set hub (44) to ring gear (43), and install plate (42).

- ★ Install the plate with the larger bolt holes on the inside.

 Mounting bolt : **Thread tightener (LT-2)**
 ★  Mounting bolt : **$30.87 \pm 3.43 \text{ Nm}$ { $3.15 \pm 0.35 \text{ kgm}$ }**

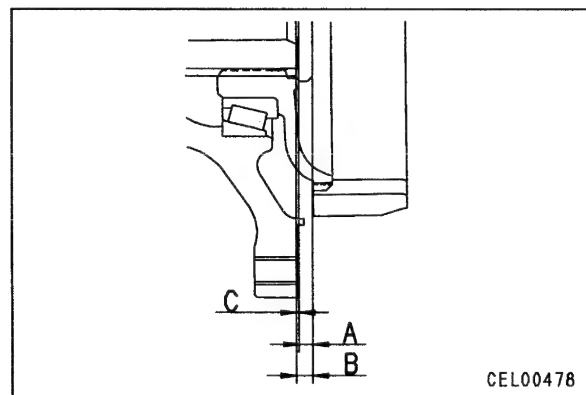
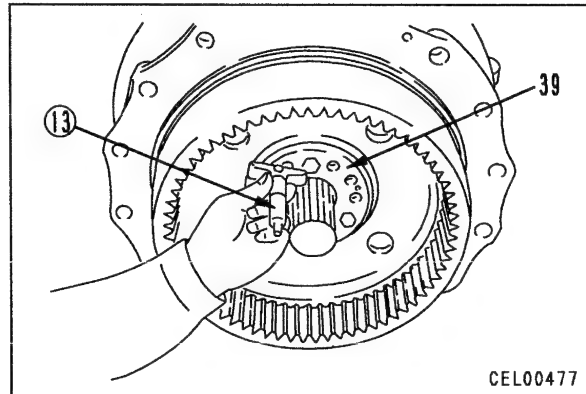


- 3) Set in position shown in diagram on right, then lift and install ring gear and hub assembly (41).





11. Retainer, shim

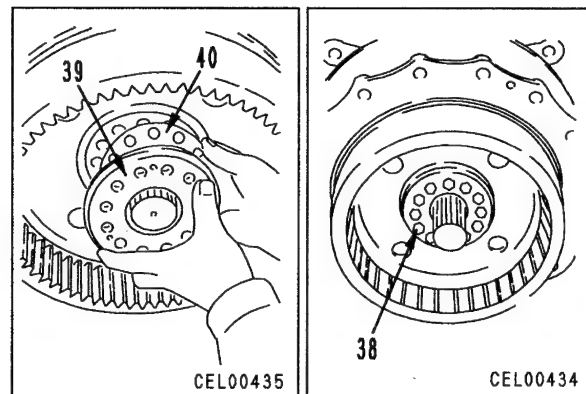
- 1) Adjusting wheel bearing preload
 - i) Without inserting shim, tighten retainer (39) with mounting bolts to 29.4 Nm {3 kg/cm²}.
 - ii) Rotate wheel hub 2 - 3 turns, then tighten mounting bolts to 29.4 Nm {3 kg/cm²}. Repeat until 3 bolts are tightened stably to 29.4 Nm {3 kg/cm²}.
 - iii) Using depth micrometer (13), measure dimension **B** from retainer to end face of axle at 3 places and take average.
 - iv) Remove retainer (39), measure thickness **A** of retainer, then take difference **C** in measured values (**C=B-A**) and add 0.10 - 0.15 mm to obtain shim thickness.



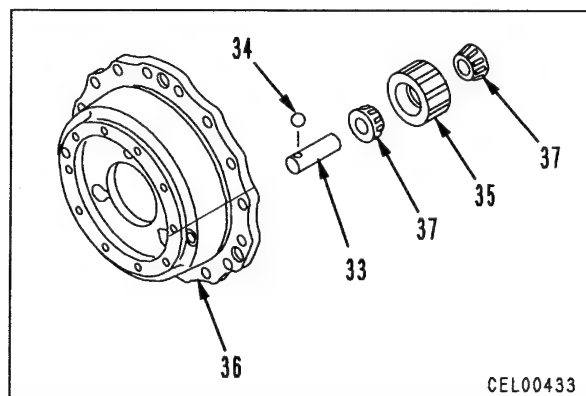
- 2) Fit shim (40) and tighten mounting bolts (38) of retainer (39) to specified torque.

 Mounting bolt : **Thread tightener (LT-2)**
 Mounting bolt : **110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}**

- 3) Check rotating force of wheel hub at wheel mounting bolt.
 - ★ Rotating force : 14.7 - 58.8 N {1.5 - 6.0 kg}


**12. Carrier assembly**


- Assembly of carrier assembly
- 1) Assemble bearing (37) to gear (35), then set to carrier (36).
 - 2) Fit ball (34) and press fit shaft (33).
 - ★ Check that the gear rotates smoothly.

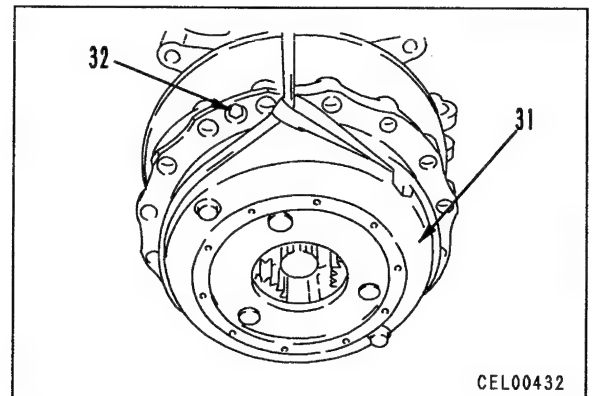


023S02

13. Fit O-ring, raise carrier assembly (31) and set to hub, then tighten 3 mounting bolts (32).

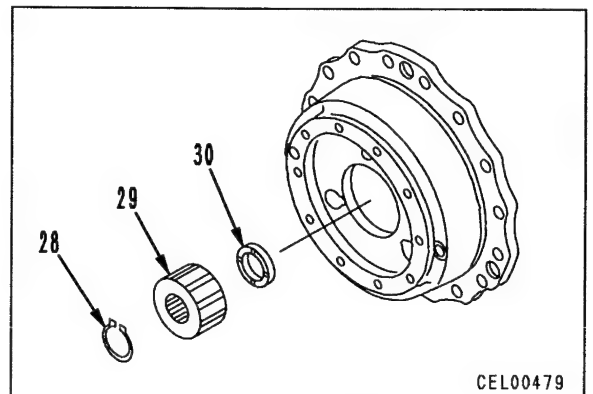
 O-ring and contact surface of O-ring:
Grease (G2-LI)

 **kgm** Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }



14. Spacer, sun gear, snap ring

Assemble spacer (30) and sun gear (29), then install snap ring (28).



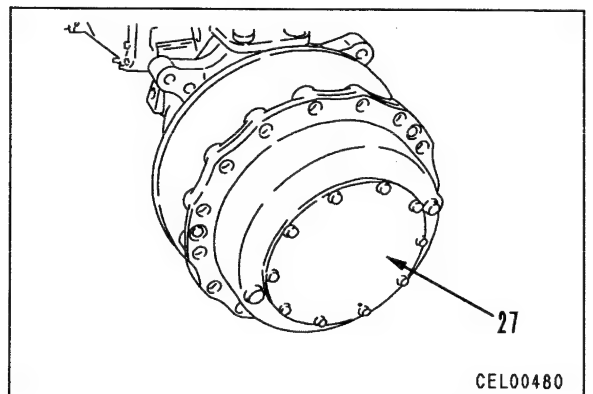
15. Cover

Fit O-ring and install cover (27).

 O-ring and contact surface of O-ring:
Grease (G2-LI)


 Mounting bolt : Thread tightener (LT-2)

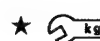
 **kgm** Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }

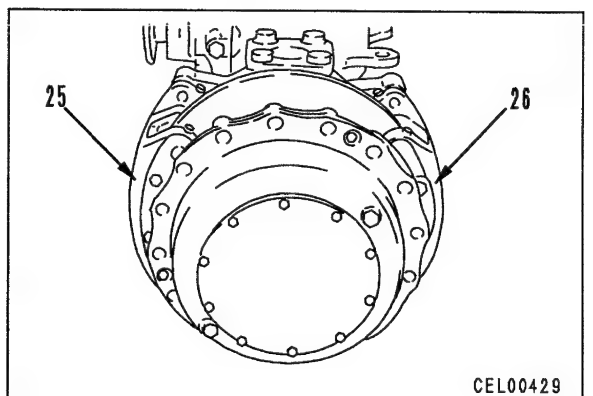


16. Wheel brake caliper assembly

Raise wheel brake caliper assemblies (25) and (26) and set to disc plate, then tighten mounting bolts.

 Mounting bolt :
Thread tightener (LT-2)

★  **kgm** Mounting bolt :
 $548.8 \pm 58.8 \text{ Nm}$ { $56 \pm 6.0 \text{ kgm}$ }



17. Repeat Steps 4 – 16 to assemble opposite side.

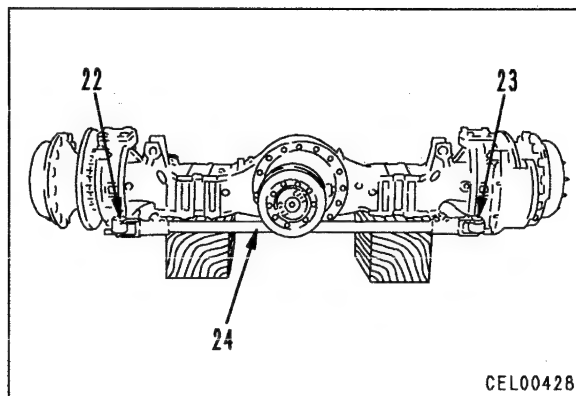
023S02

18. Tie rod

Set tie rod (24) to knuckle, and install connecting pins (23) and (22).

 **Nut : $171.5 \pm 24.5 \text{ Nm}$ ($17.5 \pm 2.5 \text{ kgm}$)**

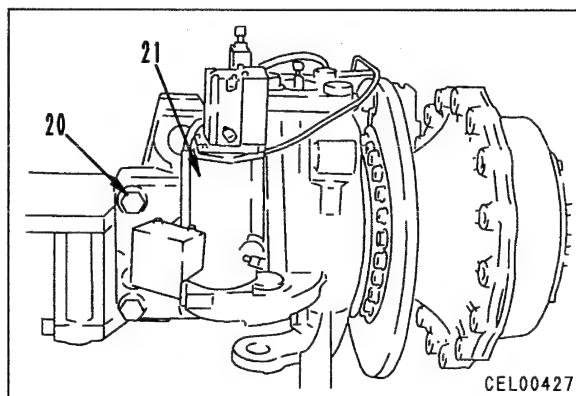
- ★ After installing axle assembly to chassis, adjust steering stopper bolt. For details, see TESTING AND ADJUSTING, Adjusting minimum turning radius of steering.
- Adjust the toe-in. For details, see TESTING AND ADJUSTING, Testing and adjusting toe-in.



CEL00428

19. Rear steering lock cylinder assembly (rear axle only)

Set rear steering lock cylinder assembly (21) together with bracket to axle housing, then tighten mounting bolts (20).

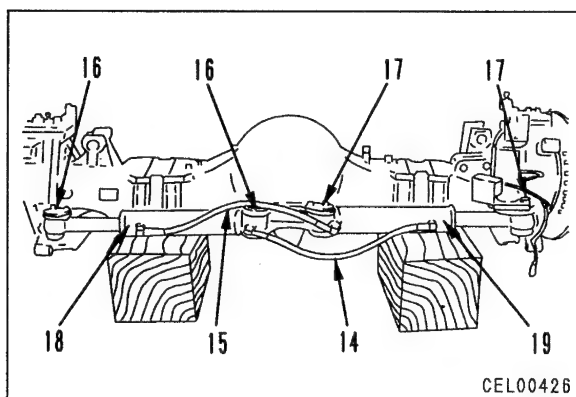


CEL00427

20. Steering cylinder assembly

Set steering cylinder assemblies (18) and (19) to axle housing, then install connecting pins (16) and (17) and connect hoses (14) and (15).


- ★ Install the hoses without twisting or interference.



CEL00426

21. Parking brake chamber assembly (front axle only)


- 1) Install parking brake chamber assembly (13) together with bracket.

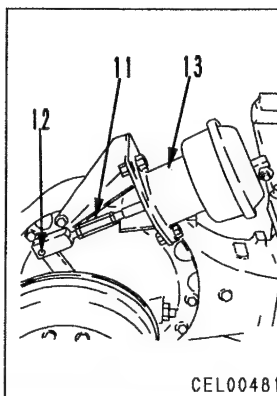
 **Mounting bolt : $176.4 \pm 19.6 \text{ Nm}$ ($18 \pm 2.0 \text{ kgm}$)**

- 2) Install pin (12), then rotate rod (11) to adjust to dimension d.

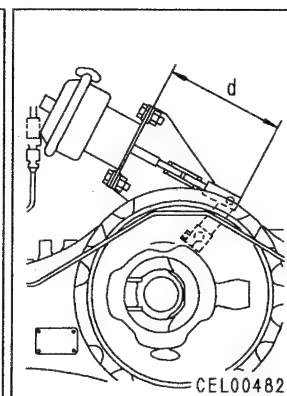
★ Dimension d: $110 \pm 3.0 \text{ mm}$

★ Bend the cotter pin securely.

 **Locknut : $51.45 \pm 7.35 \text{ Nm}$ ($5.25 \pm 0.75 \text{ kgm}$)**



CEL00481



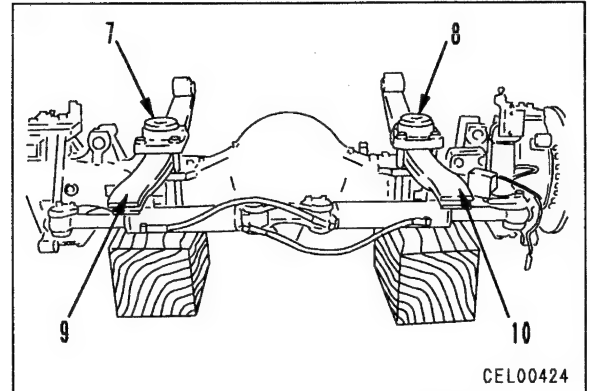
CEL00482


023S02

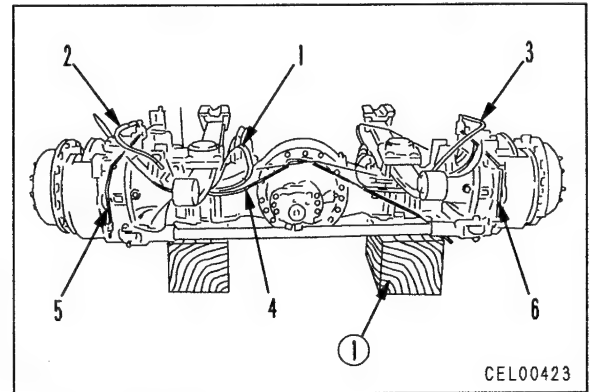
22. Spring assemblies

- 1) Set spring assemblies (9) and (10) to axle housing.
 - 2) Fit plates (8) and (7) and tighten mounting bolts temporarily.
- ★ After installing the axle assembly to the machine, tighten fully to the specified tightening torque.

 Nut : $627.2 \pm 58.8 \text{ Nm}$ $\{64 \pm 6.0 \text{ kgm}\}$

**23. Grease hose, brake tube**

- 1) Install brake tubes (6) and (5).
- ★  Tube nut : $19.6 \pm 3.92 \text{ Nm}$ $\{2.0 \pm 0.4 \text{ kgm}\}$
- 2) Install tube (4) together with bracket to axle housing, then connect brake hoses (3) and (2).
- ★ Install the hoses without twisting or interference.
- 3) Install grease hose (1) together with bracket and distributor to axle housing.
- ★ Check that there is a clearance of at least 10 mm between the brake tubes and hoses and the other parts.

**• Refilling with oil**

- 1) Add engine oil through oil filler to differential case.



Differential case : 32 ℓ

- 2) Set drain plug at horizontal position, then add oil through oil filler to final drive case.

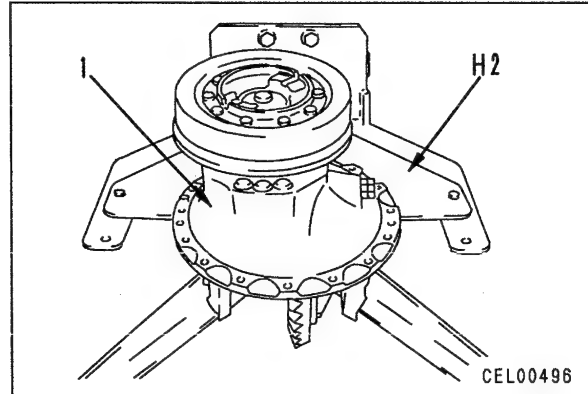


Final drive case : 3.5 ℓ (each)

DISASSEMBLY OF DIFFERENTIAL ASSEMBLY (FRONT, REAR)

1. Differential assembly

Set differential assembly (1) to tool H2.



2. Adjustment bolt

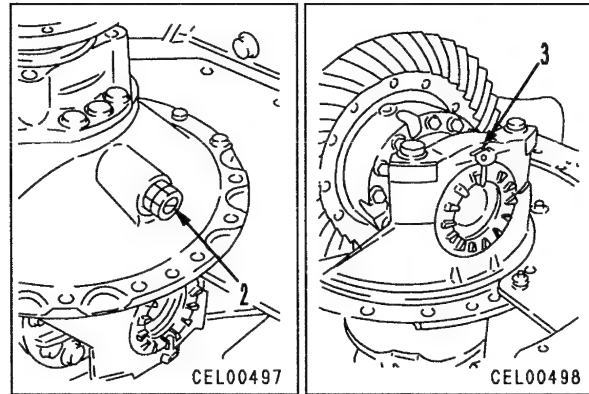
Loosen locknut and remove adjustment bolt (2).

3. Caps

- ★ Before removing the caps, measure the backlash.
- ★ Make match marks on the caps to distinguish between left and right.

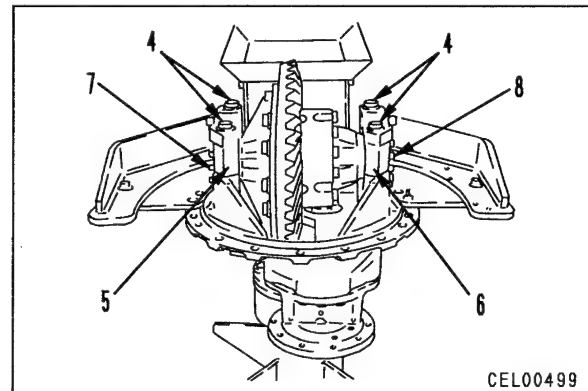
1) Remove left and right cotter pins (3).

2) Remove mounting bolts (4), then remove left and right caps (5) and (6).



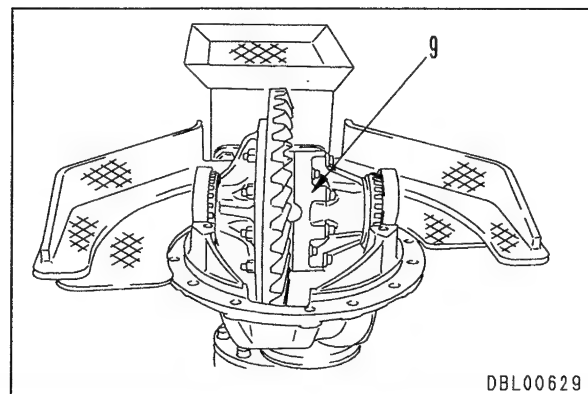
4. Adjustment rings

Remove left and right adjustment rings (7) and (8).



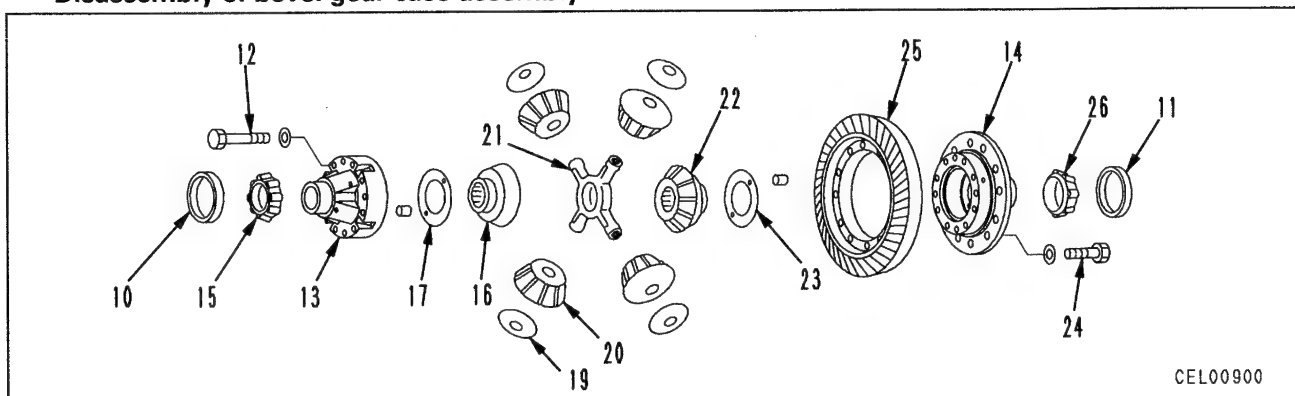
5. Bevel gear, case assembly

Using bar, lift off bevel gear and case assembly (9).



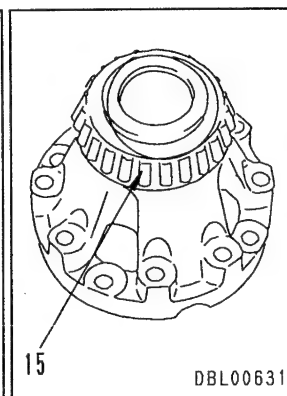
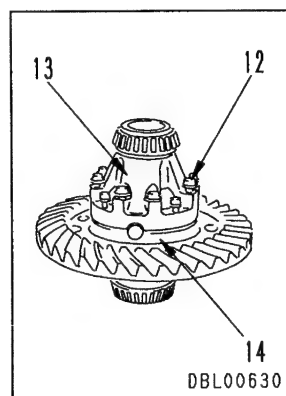
023S02

• Disassembly of bevel gear case assembly

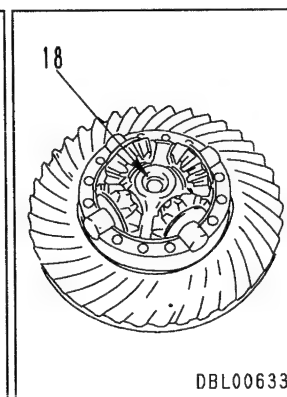
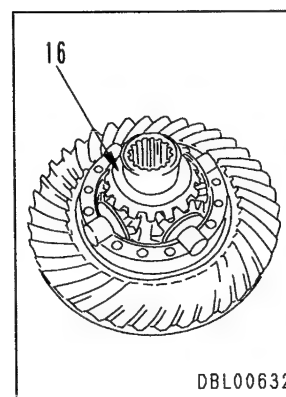


CEL00900

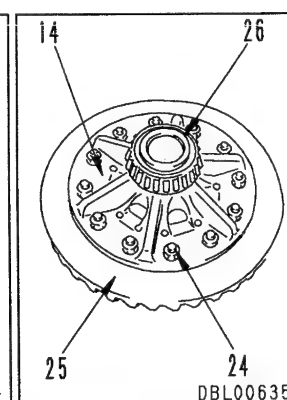
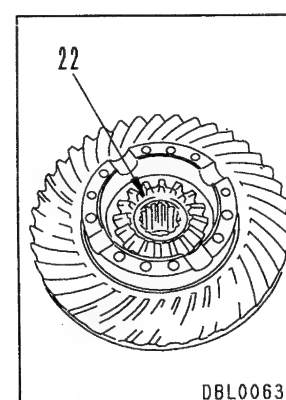
- 1) Remove bearing outer races (10) and (11).
- 2) Remove bolt (12), then remove case (13).
★ Before removing the bolt, make match marks on case (13) and case (14).
- 3) Remove bearing (15) from case (13).



- 4) Remove gear (16), then remove thrust washer (17).
- 5) Remove spider and gear assembly (18).
- 6) Remove thrust washer (19) and gear (20) from spider (21).



- 7) Remove gear (22), then remove thrust washer (23).
- 8) Remove mounting bolts (24), then remove bevel gear (25) from case (14).
- 9) Remove bearing (26) from case.



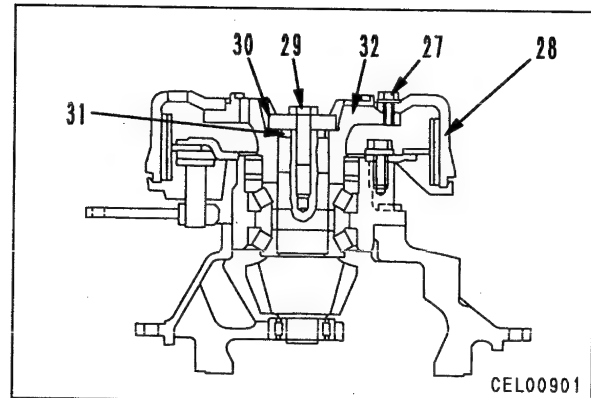
023S02

6. Drum (front differential only)

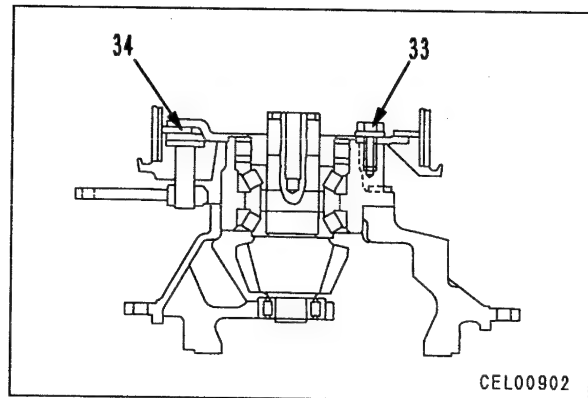
Remove mounting bolt (27), then remove drum (28).

7. Coupling

Remove mounting bolt (29), remove holder (30) and O-ring (31), then remove coupling (32).

**8. Center brake assembly (front differential only)**

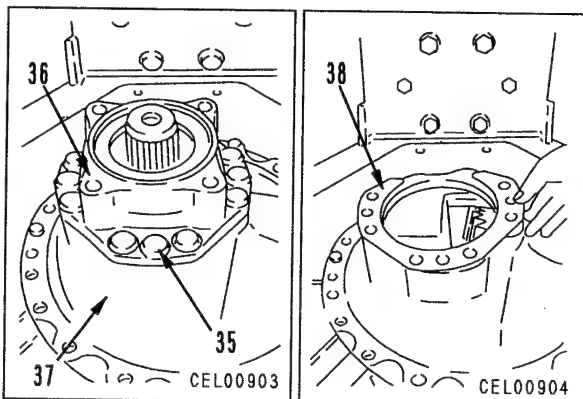
Remove mounting bolt (33), then remove center brake assembly (34).

**9. Pinion cage assembly, shims**

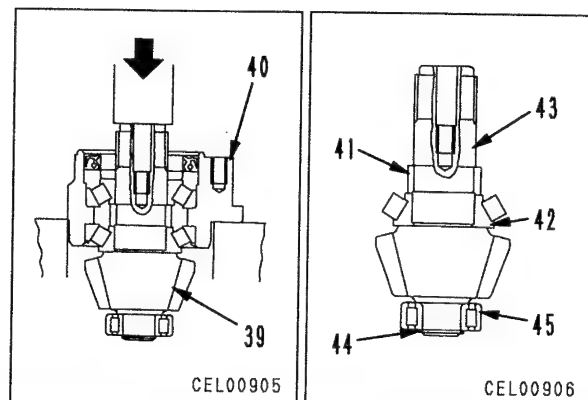
1) Remove mounting bolts (35), then remove pinion cage assembly (36) from carrier (37).

2) Remove shims (38).

★ Check the number and thickness of the shims, and keep in a safe place.

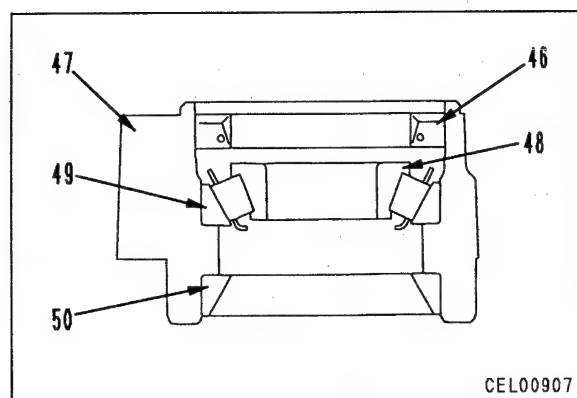
**• Disassembly of pinion cage assembly**

- i) Set pinion cage assembly in press, then remove pinion assembly (39) from cage assembly (40).
- ii) Remove spacer (41), then remove bearing (42) from pinion (43).
- iii) Remove snap ring (44), then remove bearing (45) from pinion (43).



023S02

- iv) Remove oil seal (46) from cage (47), then remove bearing (48).
- v) Remove outer races (49) and (50) from cage (47).



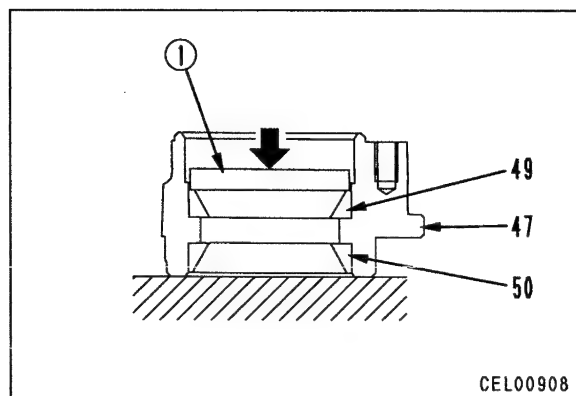
023S02

ASSEMBLY OF DIFFERENTIAL ASSEMBLY

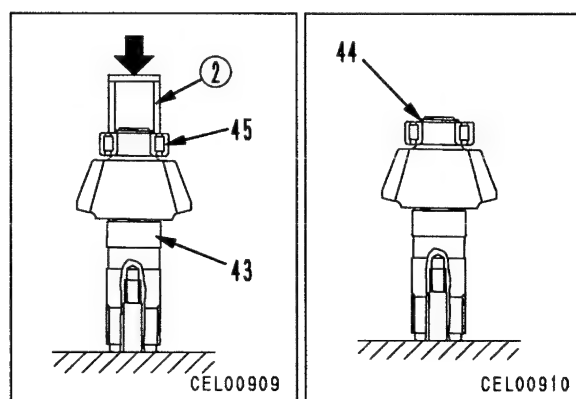
- ★ Clean all parts, and check for dirt or damage. Coat the sliding surfaces of all parts with axle oil (AX075) before installing.

1. Pinion, cage assembly

- Assembly of pinion, cage assembly
- 1) Using push tool ①, press fit bearing outer races (49) and (50) to cage (47).



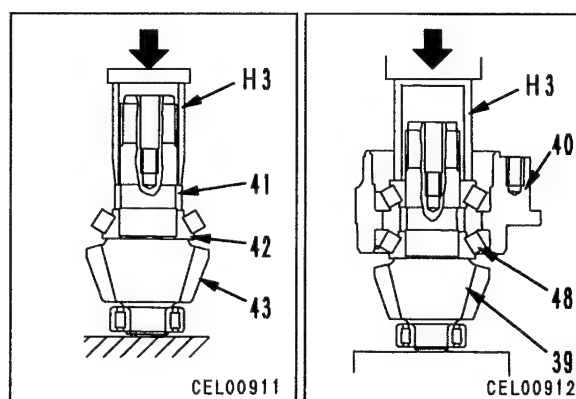
- 2) Using push tool ②, press fit bearing (45) to pinion (43), then install snap ring (44).



- 3) Assemble bearing (42) and spacer (41) to pinion (43), then using tool H3, press fit bearing.

- 4) Set cage assembly (40) to pinion assembly (39), assemble bearing (48), then press fit with tool H3.

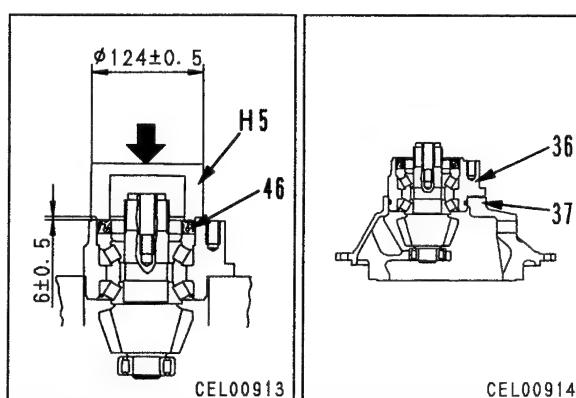
- ★ The end play of the pinion bearing is set right, so there is no need to adjust.



- 5) Using tool H5, press fit oil seal (46) to cage.

- ✎ Outside circumference of oil seal:
Liquid adhesive (Seal end 242)
- ✎ Lip of oil seal : **Grease (G2-LI)**

- 6) Without fitting shim, install pinion and case assembly (36) to carrier (37).



023S02

7) Adjusting shims

- i) Install tool **H6** to carrier (37).
- ii) Measure distance "**L**" to pinion gear from tool **H6**, and calculate shim thickness.

- ★ When the bearing, pinion gear, or ring gear have been replaced, carry out the above shim adjustment.

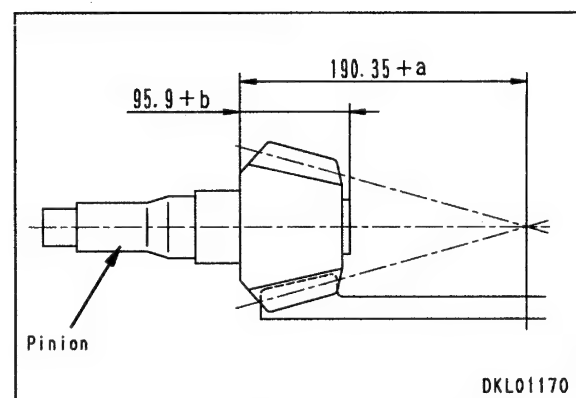
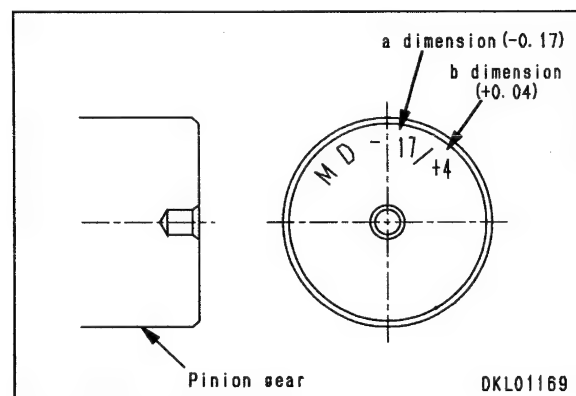
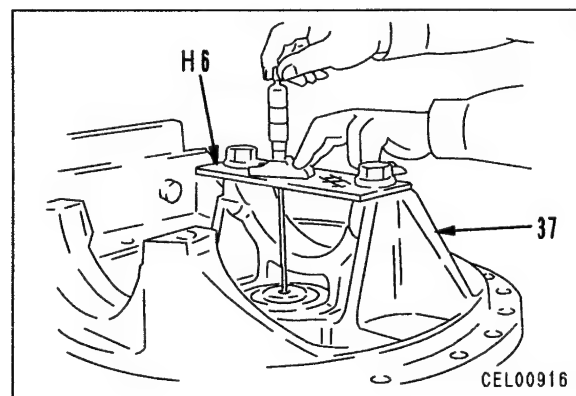
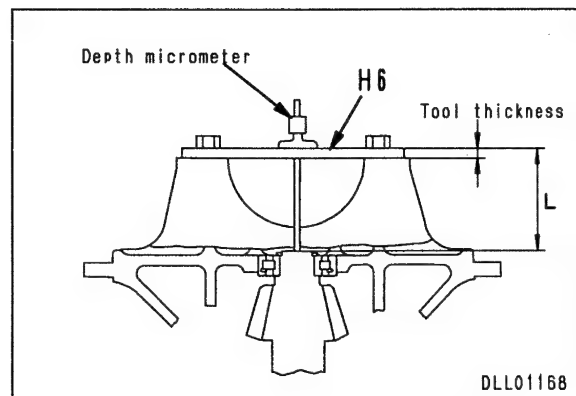
Shim thickness =

Standard value – (**L** – tool thickness)

Standard value:


$$(190.35 + \mathbf{a}) - (95.9 + \mathbf{b})$$

- ★ The values displayed on the tip of the pinion shaft for dimension **a** and dimension **b** are the values in 1/100.
(Be careful to check if the value is + or –.)
- ★ The relationship between dimension **a** and dimension **b** is as shown in the figure on the right.




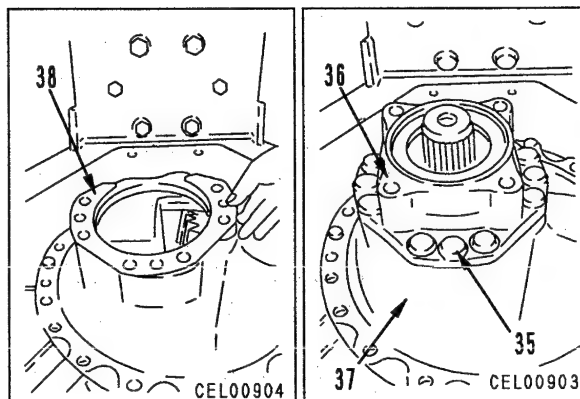
- 8) Set shims (38) selected in Steps 1-7) to carrier (37).

Fit O-ring and set pinion and cage assembly (36) to carrier (37), then tighten mounting bolts (35).

 O-ring and O-ring contact surface :
Grease (G2-LI)


- ★ Replace the O-ring with a new part.
When using the part again, check carefully that there is no damage, settling, cracks, or other deterioration.

 **kgm** Mounting bolt :
 $176.4 \pm 19.6 \text{ Nm}$ { $18 \pm 2.0 \text{ kgm}$ }



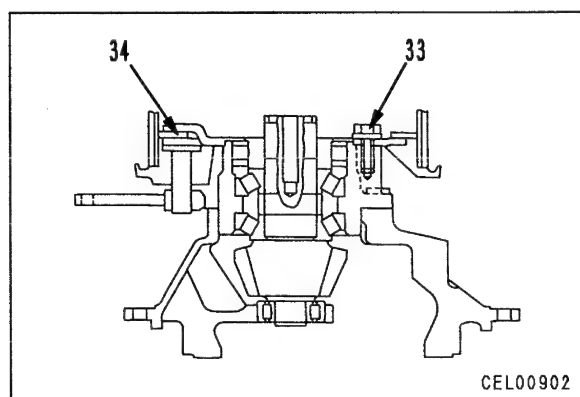
2. Center brake assembly (front differential only)

Set center brake assembly (34) to cage, and tighten mounting bolt (33).

 Plate mounting surface :
Gasket sealant (LG-7)

 Mounting bolt : **Thread tightener (LT-2)**


 **kgm** Mounting bolt :
 $276.85 \pm 31.85 \text{ Nm}$ { $28.25 \pm 3.25 \text{ kgm}$ }

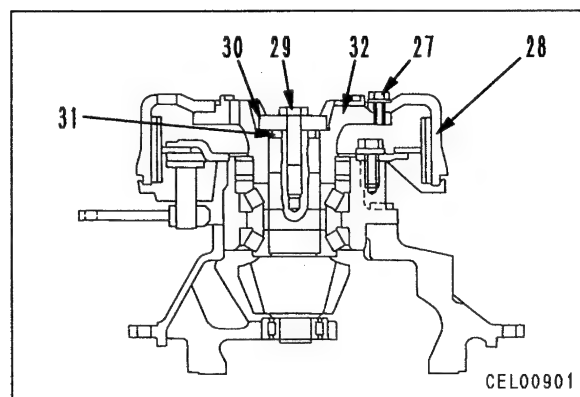


3. Coupling

Assemble coupling (32), then fit O-ring (31) and holde (30), and tighten mounting bolt (29).


 Coupling contact surface :
Molybdenum disulphide lubricant (LM-G)

 **kgm** Mounting bolt :
 $276.85 \pm 31.85 \text{ Nm}$ { $28.25 \pm 3.25 \text{ kgm}$ }



4. Drum

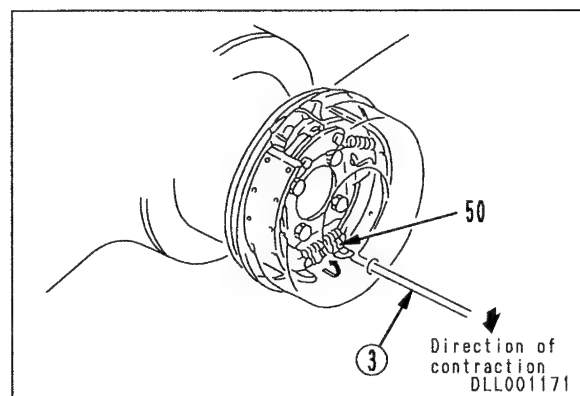
- 1) Fit drum (28) and tighten mounting bolt (27).

 **kgm** Mounting bolt :
 $110.25 \pm 12.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }

- 2) Insert screwdriver ③ in brake drum adjustment hole, turn adjustment screw (50) in direction to expand shoe, and bring shoe and drum into tight contact.

From this condition, turn the adjustment screw back 8 clicks in the direction of contraction.

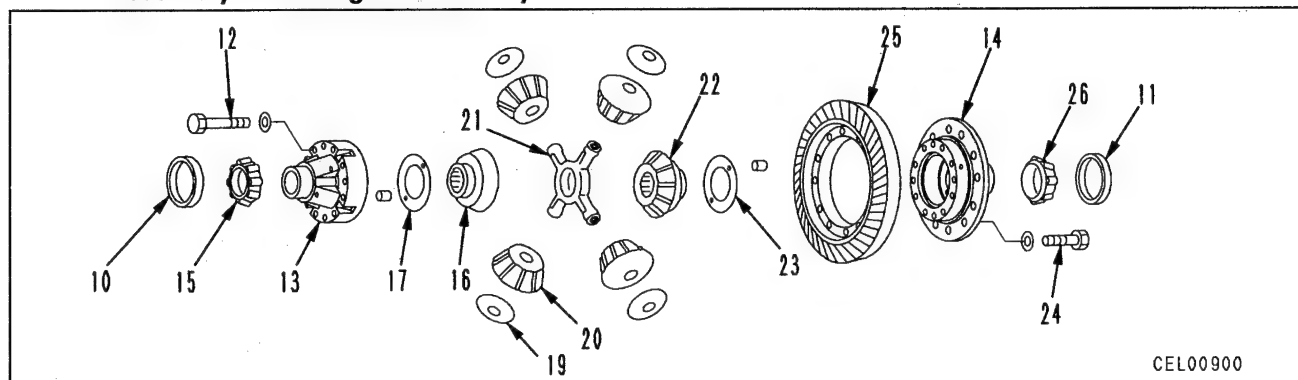
- ★ Shoe clearance when this is done:
0.23 mm



023S02

5. Bevel gear, case assembly

• Assembly of bevel gear assembly



- 1) Set bevel gear (25) to case (14), and tighten with mounting bolts (24).

★ Tighten the bolts uniformly in turn.

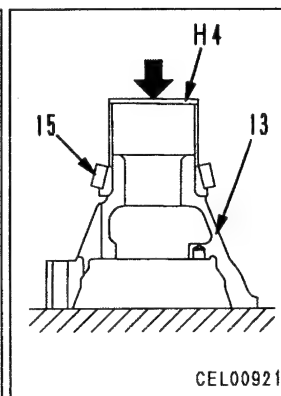
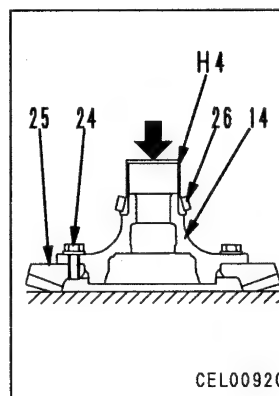
 Bolt thread portion :

Thread tightener (LT-2)

 **Mounting nut :**

$279.3 \pm 29.4 \text{ Nm} \{28.5 \pm 3.0 \text{ kgm}\}$

- 2) Using tool **H4**, press fit bearing (26) to case (14), and press fit bearing (15) to case (13).



- 3) Install thrust washer (19) and gear (20) to spider (21).

- 4) Assemble thrust washer (23), and install gear (22).

- 5) Set spider and gear assembly (18) in position.


- 6) Install gear (16), and assemble thrust washer (17).

- 7) Align match marks of case (14) and case (13) to set in position.

- 8) Tighten mounting bolts (12).

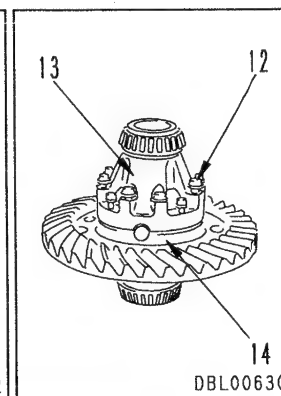
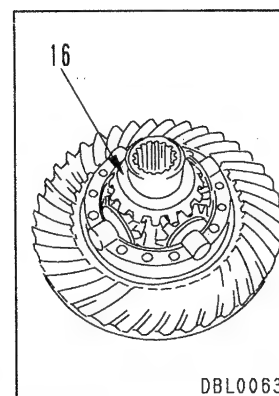
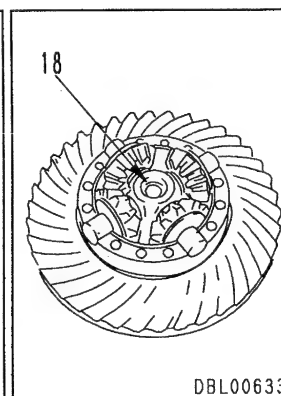
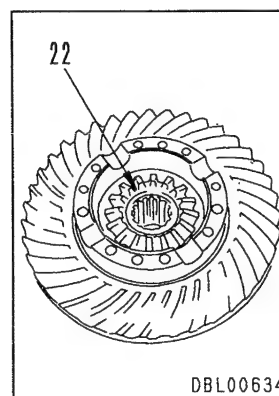
 Bolt thread portion :

Thread tightener (LT-2)

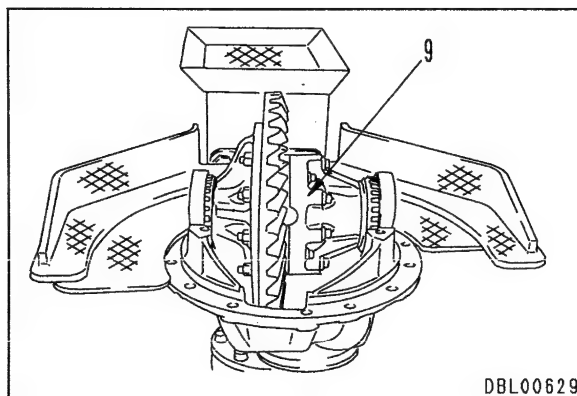
 **Mounting nut :**

$112.7 \pm 9.8 \text{ Nm} \{11.5 \pm 1.0 \text{ kgm}\}$

- 9) Install bearing outer races (11) and (10).



- 10) Raise bevel gear (9) and set to carrier.




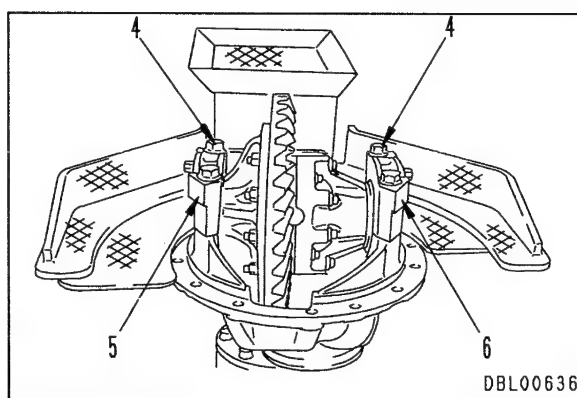
DBL00629

6. Caps

Align match marks of cap and carrier, then set caps (6) and (5) in position, and tighten mounting bolts (4) to specified torque.

 Mounting bolt : **Thread tightener (LT-2)**

 Mounting bolt :
 $279.3 \pm 29.4 \text{ Nm} \{28.5 \pm 3.0 \text{ kgm}\}$



DBL00636

7. Adjustment rings

Install left and right adjustment rings (8) and (7).

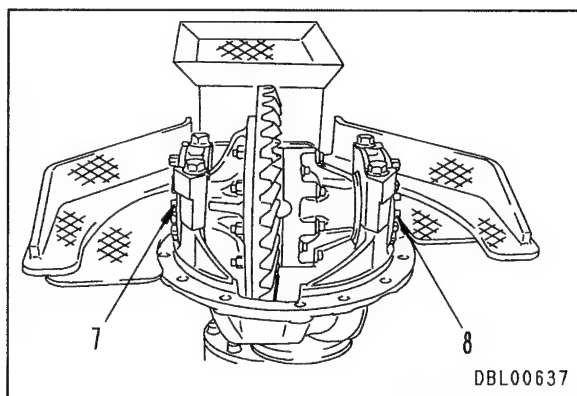
8. Adjusting preload of bearing

- 1) Turn adjustment ring until ring gear contacts pinion gear, and adjust until there is no more backlash.

- ★ Rotate the bearing sufficiently to give complete contact between the bearing and other contact parts, then tap the ring gear with a copper hammer.
- ★ Coat the bearing well with oil.
- ★ If the adjustment ring on one side is loosened one turn, tighten the adjustment ring on the other side by one turn.

- 2) Install spring balance to bevel gear, and measure rolling resistance torque.

- Rolling resistance torque :
 $9.8 - 17.64 \text{ N} \{1.0 - 1.8 \text{ kg}\}$
 - ★ Target value : $13.72 \text{ N} \{1.4 \text{ kg}\}$



DBL00637

023S02

9. Adjusting backlash

- 1) Adjust bevel gear with adjustment rings.
 - ★ When doing this, turn the adjustment rings on both sides by the same amount in the same direction.
- 2) Put a dial gauge in contact with tooth face at outside edge of bevel gear, then turn adjustment ring to adjust.
 - ★ Keep the pinion gear fixed in position and measure at 3 or 4 places.
 - ★ Backlash: 0.25 – 0.33 mm



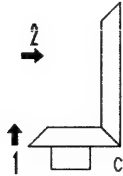
10. Adjusting tooth contact

- 1) Mix red lead (minium) with oil, then coat tooth face of 7 or 8 teeth of bevel gear.
- 2) Rotate pinion gear forward and in reverse and check tooth contact.
 - ★ Use the following procedure to judge the tooth contact and carry out adjustment.

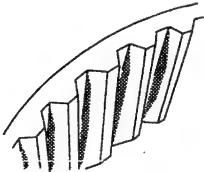
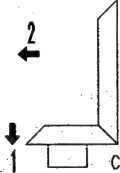
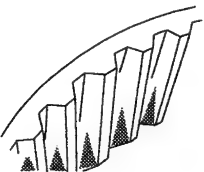
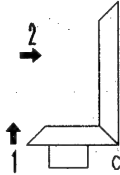
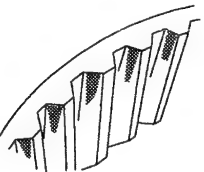
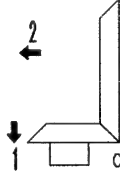
- **Adjusting tooth contact**

Mix red lead (minium) with spindle oil, then coat tooth face of 7 or 8 teeth of bevel gear. Hold pinion gear down by hand to apply brake, rotate pinion gear forward and in reverse, and check tooth contact.

Use the following procedure to judge the tooth contact and carry out adjustment.

Tooth contact	Cause	Procedure for adjustment
 CEL00922	The tooth contact pattern should start from about 5 mm from the toe and cover about 50% of the length of the tooth. It should be in the center of the tooth height.	Adjust the bevel pinion by adjusting the shims at the cage. Adjust the bevel gear in the same way as when adjusting the backlash.
 CEL00923	Bevel pinion is too far from bevel gear.	<ol style="list-style-type: none"> 1. Reduce shims at bevel pinion to bring closer to bevel gear. 2. Move bevel gear further away from bevel pinion and adjust backlash correctly.  CDL00924

023S02

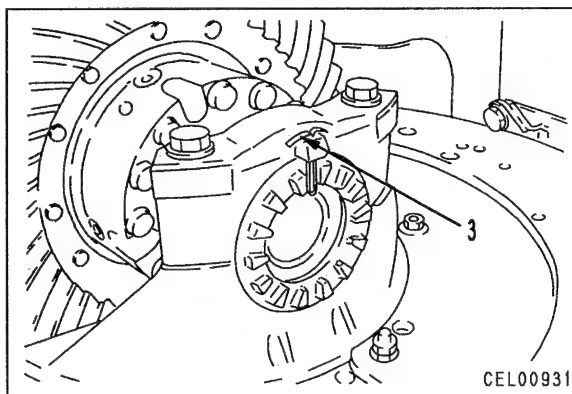
Tooth contact	Cause	Procedure for adjustment
 CEL00925	Bevel pinion is too close to bevel gear.	<ol style="list-style-type: none"> 1. Increase shims at bevel pinion to move away from bevel gear. 2. Move bevel gear closer to bevel pinion and adjust backlash correctly.  CDL00928
 CEL00926	Bevel pinion is too close to bevel gear.	<ol style="list-style-type: none"> 1. Reduce shims at bevel pinion to bring closer to bevel gear. 2. Move bevel gear further away from bevel pinion and adjust backlash correctly.  CDL00924
 CEL00927	Bevel gear is too far from bevel pinion.	<ol style="list-style-type: none"> 1. Increase shims at bevel pinion to move away from bevel gear. 2. Move bevel gear closer to bevel pinion and adjust backlash correctly.  CDL00928

★ When adjusting the bevel gear, move shims from one position to the other. Always keep the same total shim thickness on the left and right.

11. Cotter pin

Install cotter pins (3) for locking left and right adjustment rings.

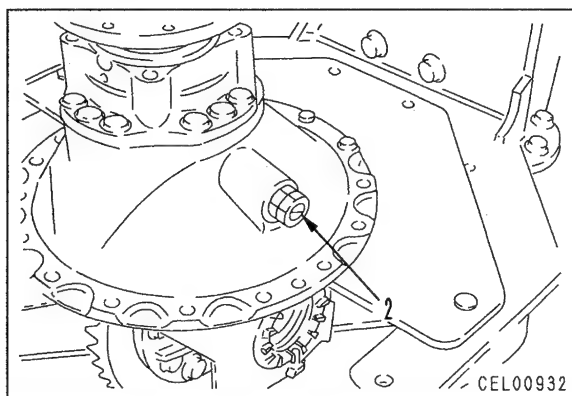
- ★ Bend the cotter pin securely.
- ★ If the cotter pin does not match the hole in the cap, rotate the adjustment ring in the direction of tightening to align.



12. Adjustment bolt

- 1) Screw in adjustment bolt (2) until it contacts rear face of bevel gear.
- 2) Turn back adjustment bolt 1/4 turns and tighten locknut.
 - ★ This gives a clearance of 0.25 – 0.50 mm between the tip of the adjustment bolt and the bevel gear.

 **kgm** Locknut :
220.5 ± 24.5 Nm (22.5 ± 2.5 kgm)




023S02

REMOVAL OF PARKING BRAKE SHOE

- !** Extend the outriggers and set securely in contact with the ground so that the machine does not move.

1. Drain differential oil from drain plug (1). ※ 1

 Differential case : 25 ℓ

2. Disconnect front drive shaft (2) at differential end. ※ 2

3. Set parking brake switch to OFF and release brake.

4. Remove brake drum (3). ※ 3

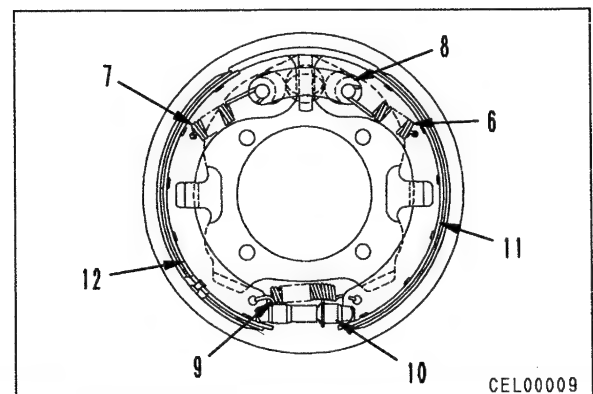
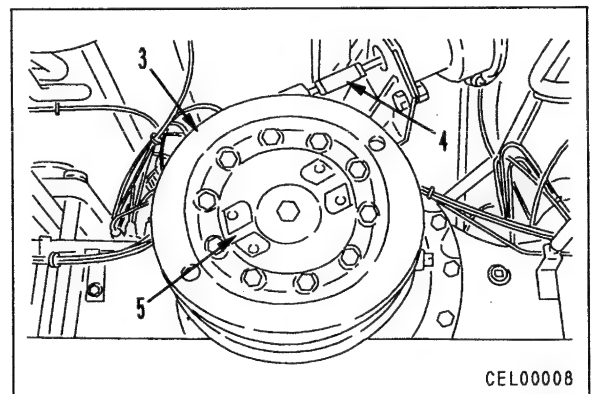
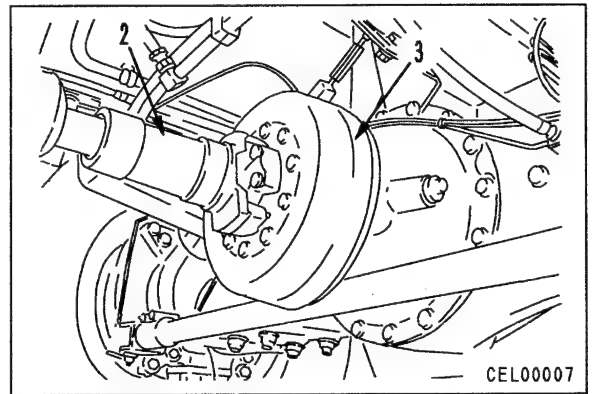
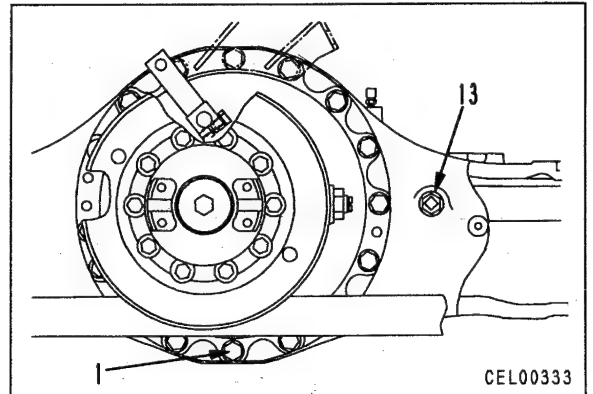
★ If there is no supply of air on the machine, start the engine and charge with air, or turn rod (4) of the parking brake chamber to release the brake, then remove the brake drum. ※ 4

5. Remove coupling (5). ※ 5

6. Remove springs (6) and (7), then remove brace (8).

7. Remove spring (9), then remove adjustment screw (10).

8. Remove parking brake shoes (11) and (12).




INSTALLATION OF PARKING BRAKE SHOE

- Carry out installation in the reverse order to removal.

※ 1

 Drain plug, oil filler plug :
 $68.6 \pm 9.8 \text{ Nm}$ { $7 \pm 1 \text{ kgm}$ }

※ 2

 Drive shaft mounting bolt :
 $110.25 \pm 2.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }

※ 3


 Brake drum mounting bolt :
 $110.25 \pm 12.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }

※ 4

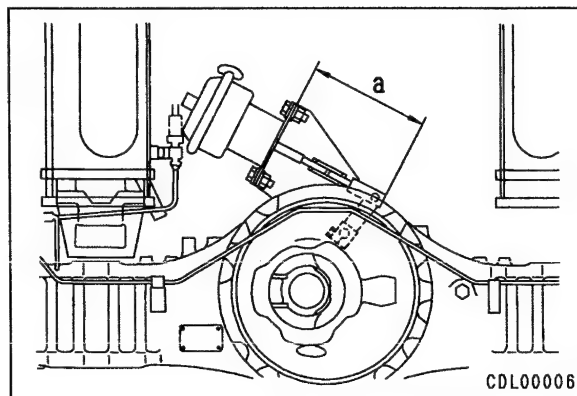
- ★ Check that dimension a between the tip of the rod and the parking brake chamber mounting surface is $110 \pm 3 \text{ mm}$.

 Rod locknut :
 $51.45 \pm 7.35 \text{ Nm}$ { $5.25 \pm 0.75 \text{ kgm}$ }

※ 5

 Coupling mounting bolt :
 $276.85 \pm 31.85 \text{ Nm}$ { $28.25 \pm 3.25 \text{ kgm}$ }

- Refilling with oil (differential case)**
Set horizontal, then add hydraulic oil (AX075) through the hole of oil filler plug (13) until the oil reaches the bottom of the oil filler plug hole.



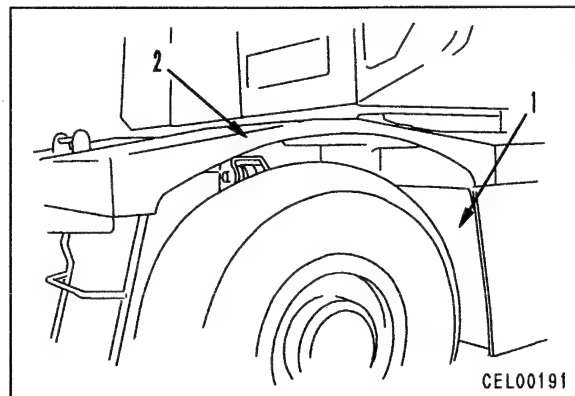
REMOVAL OF WHEEL ASSEMBLY

- ⚠** Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.

1. Remove mudguard (1) and fender (2).
2. Sling wheel assembly and remove mounting bolts (3), then remove wheel assembly (4). ※ 1



Wheel assembly : 950 kg

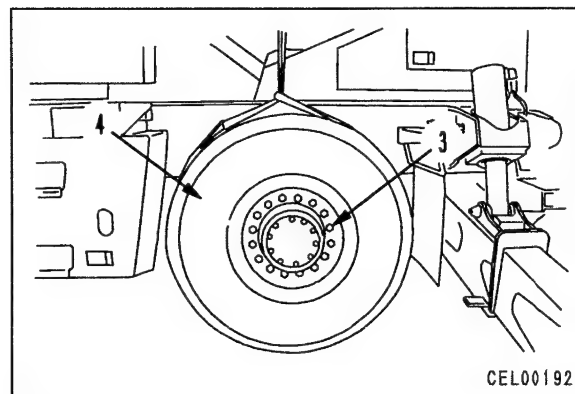


INSTALLATION OF WHEEL ASSEMBLY

- Carry out installation in the reverse order to removal.



Wheel assembly mounting bolt :
548.8 ± 58.8 Nm {56 ± 6 kgm}



023S02

REMOVAL OF WHEEL BRAKE DISC PLATE ASSEMBLY

! Extend the outriggers and set securely in contact with the ground, then raise the machine and swing the revolving frame 90°.

1. Remove caliper assembly.
For details, see REMOVAL OF WHEEL BRAKE CALIPER ASSEMBLY.

2. Remove drain plug and drain oil from final drive case.

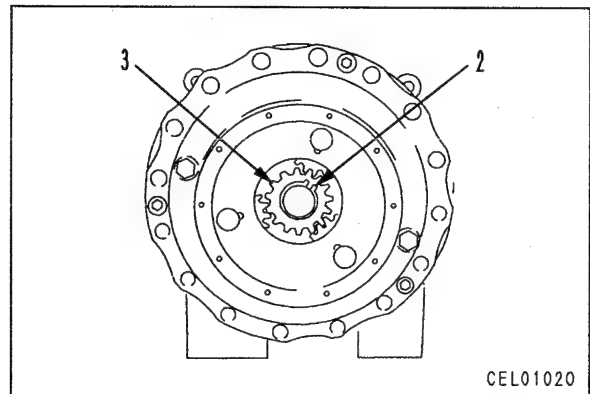
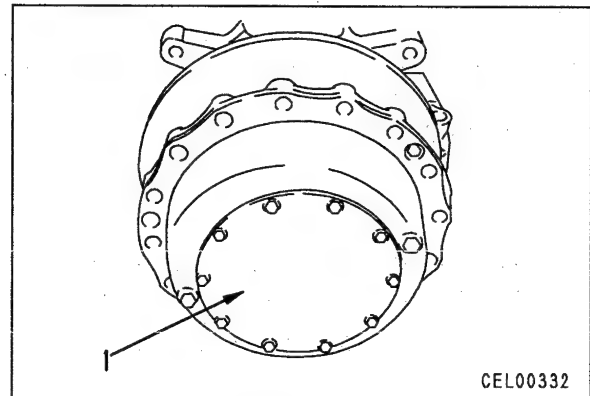


Final drive case : 3.5 ℓ

3. Remove cover (1).

※ 1

4. Remove snap ring (2), then remove sun gear (3).

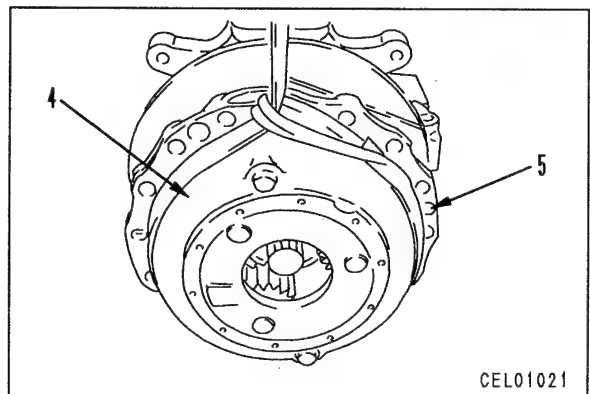


5. Sling carrier assembly (4), then remove 3 mounting bolts (5), and lift off.

※ 2



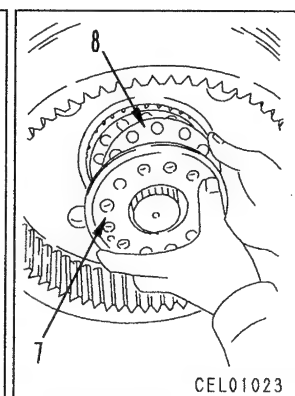
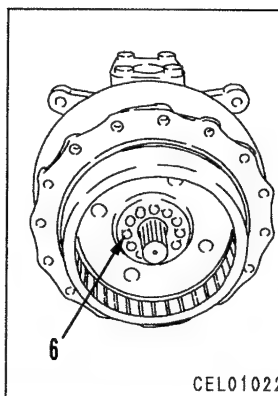
Carrier assembly : 66 kg



6. Remove retainer mounting bolts (6), then remove retainer (7) and shim (8).

※ 3

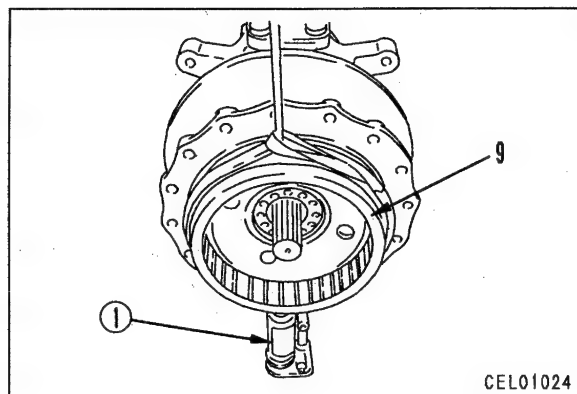
★ Check the number and thickness of the shims, and keep in a safe place.



023S02

7. Support bottom of wheel hub with jack ① and remove ring gear (9).

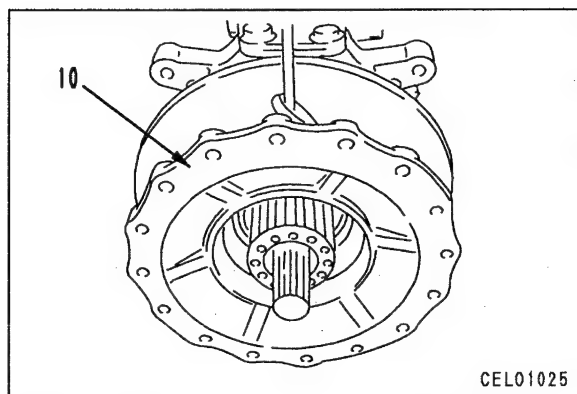
※ 4



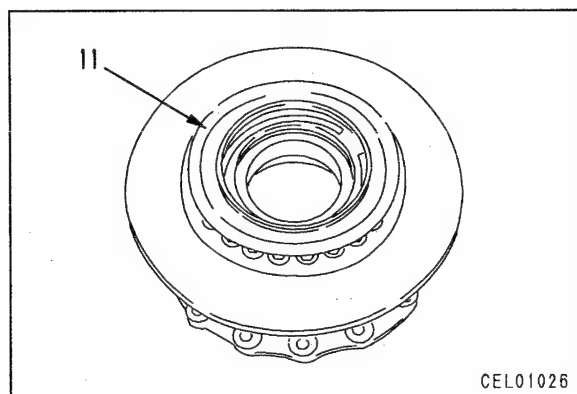
8. Lift off wheel hub and disc plate assembly (10).
★ When removing, be extremely careful not to damage the oil seal.



Wheel hub, disc plate assembly :
65 kg

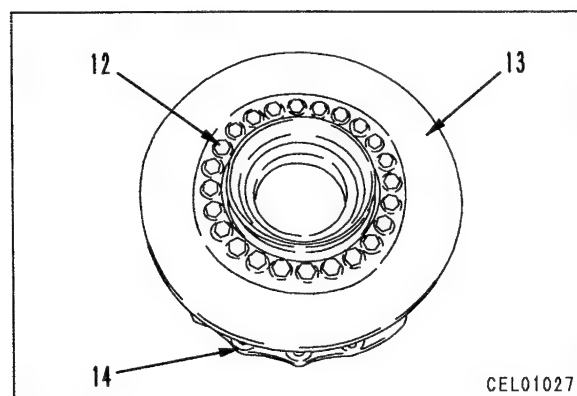


9. Remove protector (11).



10. Remove mounting bolts (12), then remove disc plate (13) from wheel hub (14).

※ 5





023S02


INSTALLATION OF WHEEL BRAKE DISC PLATE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1



-  Cover mounting bolt :
Thread tightener (LT-2)
 Cover mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ ($6.75 \pm 0.75 \text{ kgm}$)

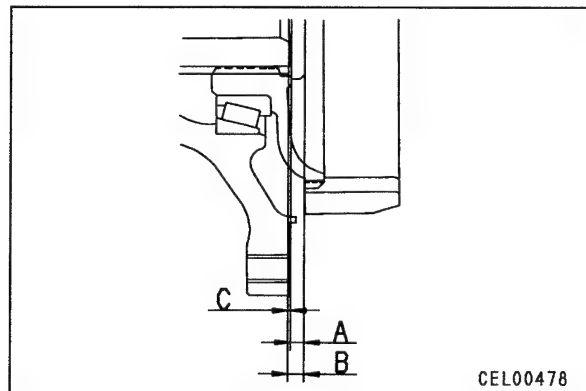
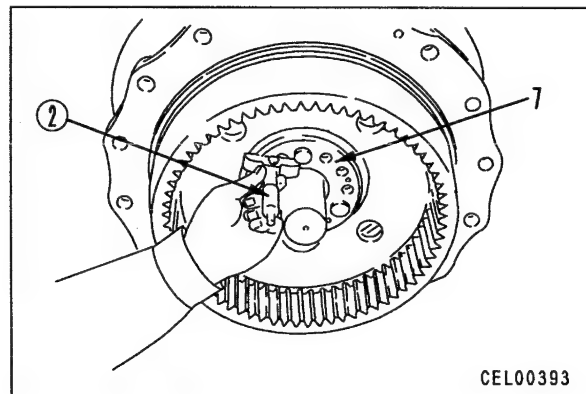
※ 2

-  Carrier assembly mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ ($6.75 \pm 0.75 \text{ kgm}$)

※ 3

- ★ Adjusting shims
 - Without inserting shim, tighten retainer (7) with mounting bolts to 29.4 Nm (3 kg/cm^2).
 - Rotate wheel hub 2 – 3 turns, then tighten mounting bolts to 29.4 Nm (3 kg/cm^2). Repeat until 3 bolts are tightened stably to 29.4 Nm (3 kg/cm^2).
 - Using depth micrometer ②, measure dimension **B** from retainer to end face of axle at 3 places and take average.
 - Remove retainer (7), measure thickness **A** of retainer, then take difference **C** in measured values (**$C=B-A$**) and add $0.10 - 0.15 \text{ mm}$ to obtain shim thickness.
 - Assemble shim, tighten mounting bolts of retainer to specified torque, then check rotation of wheel hub.

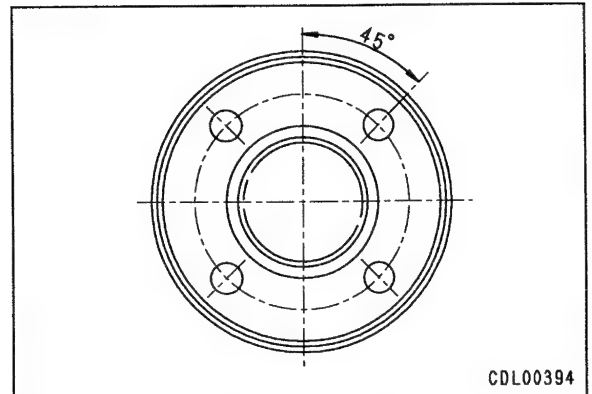
-  Retainer mounting bolt :
Thread tightener (LT-2)
 Retainer mounting bolt :
 $10.25 \pm 12.25 \text{ Nm}$ ($11.25 \pm 1.25 \text{ kgm}$)
 ★ Rotating force of wheel hub:
 $14.7 - 58.8 \text{ N}$ ($1.5 - 6.0 \text{ kg}$)



023S02

※ 4

- ★ Install the ring gear in the position shown in the diagram on the right.



※ 5



Disc plate mounting bolt :

Thread tightener (LT-2)

Disc plate mounting bolt :




 $276.85 \pm 31.85 \text{ Nm}$ ($28.25 \pm 3.25 \text{ kgm}$)

- **Refilling with oil**

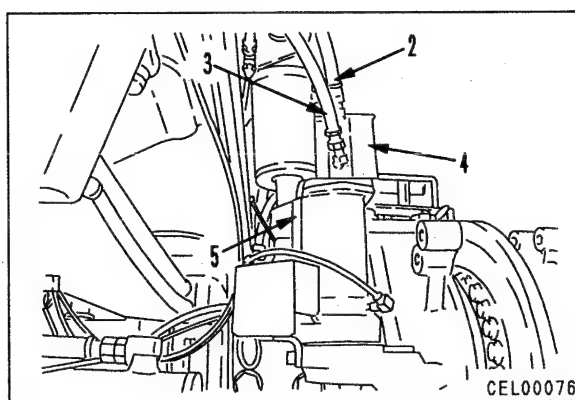
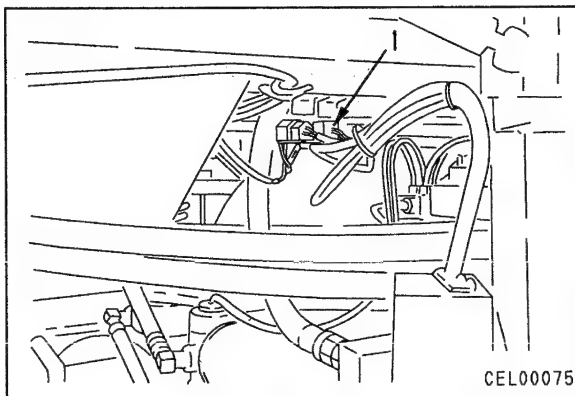
Set the drain plug to the horizontal position, then add axle oil (AX075) to the final drive case to the specified level.

Final drive case : **3.5 ℓ**

REMOVAL OF REAR STEERING LOCK CYLINDER ASSEMBLY

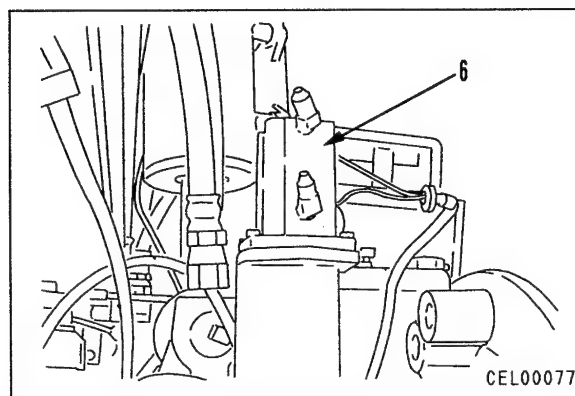
-  Extend the outriggers and set securely in contact with the ground, then set to the rear steering mode and operate the steering to the right.
-  Open the drain valve of the air tank and drain the air.
-  Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (L11) (1).
2. Disconnect hoses (2) and (3).
3. Remove covers (4) and (5).
4. Remove rear steering lock cylinder assembly (6).



INSTALLATION OF REAR STEERING LOCK CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.



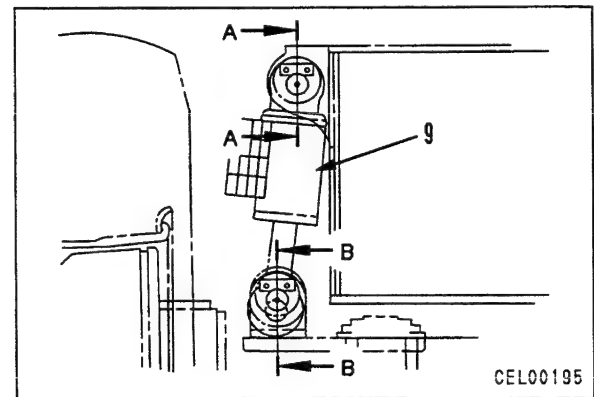
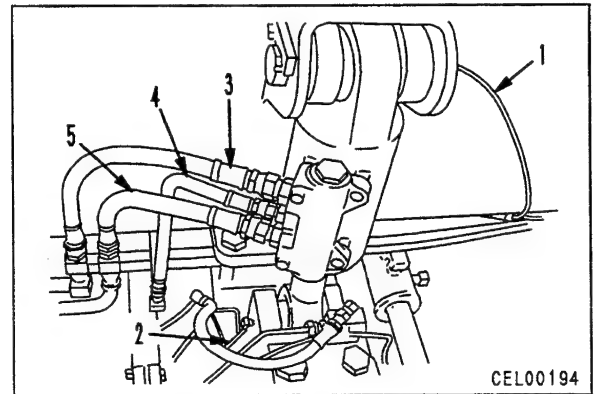
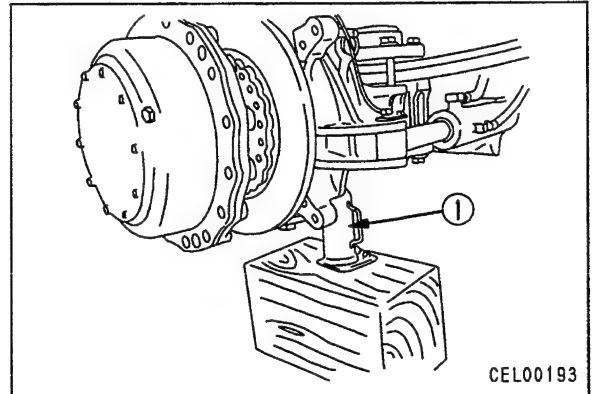
023S02

REMOVAL OF SUSPENSION LOCK CYLINDER ASSEMBLY

! Extend the outriggers, then raise the machine and swing the revolving frame 90°.

1. Remove wheel assembly.
For details, see REMOVAL OF WHEEL ASSEMBLY.
2. Put jack ① under knuckle to support it.
3. Disconnect grease hoses (1) and (3) from top and bottom pins.
4. Disconnect hoses (3), (4), and (5).
5. Remove lock plate (6), pin (7), and spacer (8).
6. Remove suspension lock cylinder (9).

※ 1



INSTALLATION OF SUSPENSION LOCK CYLINDER ASSEMBLY

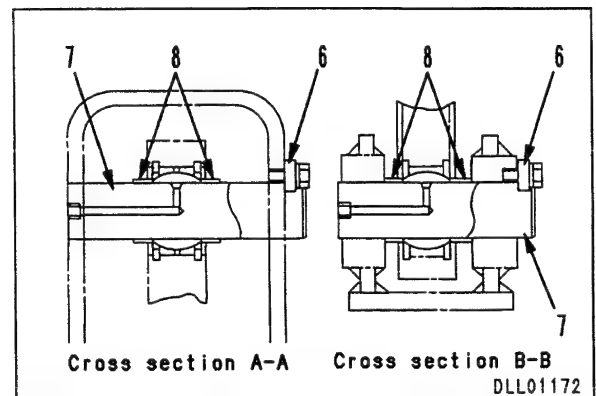
- Carry out installation in the reverse order to removal.

※ 1

! When aligning the position of the pin hole, never insert your fingers in the pin hole.

 Pin portion : **Grease (G2-LI)**

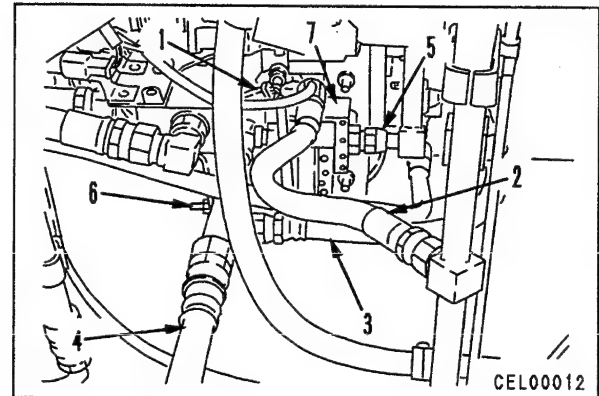
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



REMOVAL OF SUSPENSION LIFT VALVE ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Disconnect wiring connector (L31) (1).
2. Disconnect hoses (2), (3), and (4), and tube (5).
3. Remove U-clamp (6).
4. Remove 2 mounting bolts from top of suspension lift valve assembly, then remove suspension lift valve assembly (7).




INSTALLATION OF SUSPENSION LIFT VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ If the solenoid valve has been removed from the suspension lift valve assembly, be sure to tighten correctly to the tightening torque below.

 Solenoid valve mounting bolt
(M5 with hexagonal socket) :
4.90 – 6.86 Nm {0.5 – 0.7 kgm}

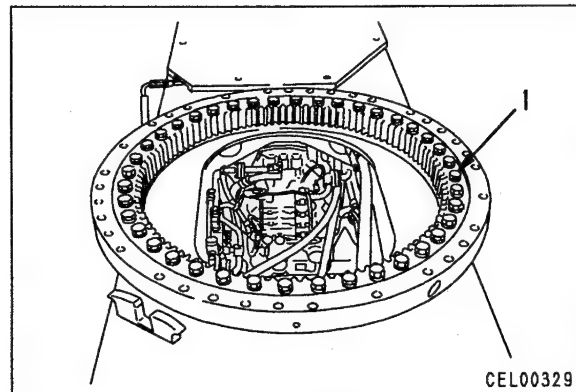
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

REMOVAL OF SWING CIRCLE

1. Remove revolving frame assembly.
For details, see REMOVAL OF REVOLVING FRAME ASSEMBLY.
2. Remove 40 mounting bolts (1) of swing circle assembly. ※ 1
3. Lift off swing circle assembly (2). ※ 2



Swing circle assembly : 360 kg



INSTALLATION OF SWING CIRCLE

- Carry out installation in the reverse order to removal.

※ 1



Swing circle assembly :
 $926.1 \pm 102.9 \text{ Nm}$ { $94.5 \pm 10.5 \text{ kgm}$ }

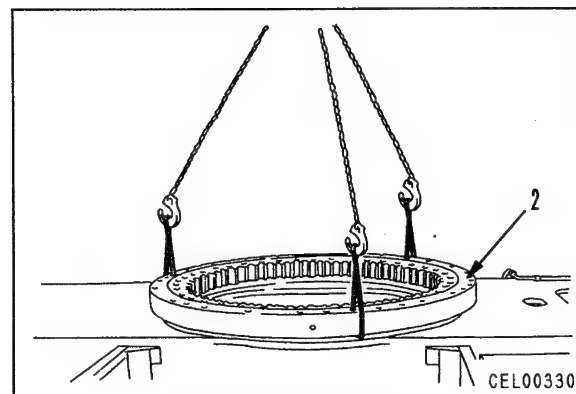
※ 2



Swing circle gear tooth face :
Grease (G2-LI)



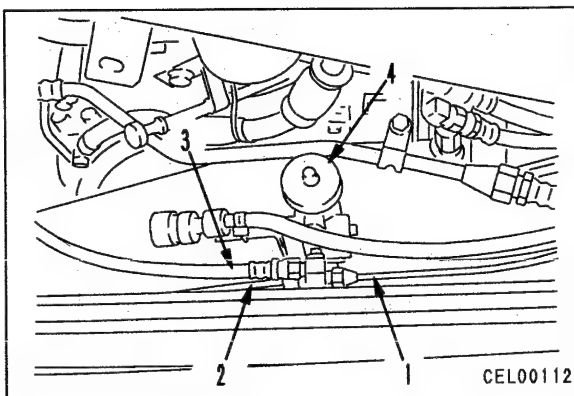
Mating surface of swing circle :
Thread tightener (Loctite 648)



023S02

REMOVAL OF AIR GOVERNOR ASSEMBLY




- ⚠ Set the parking brake switch to PARKING.
 - ⚠ Open the drain valve of the air tank and drain the air.
1. Open side cover on right side of hood.
 2. Disconnect tubes (1) and (2).
 3. Disconnect air hose (3).
 4. Remove air governor assembly (4).



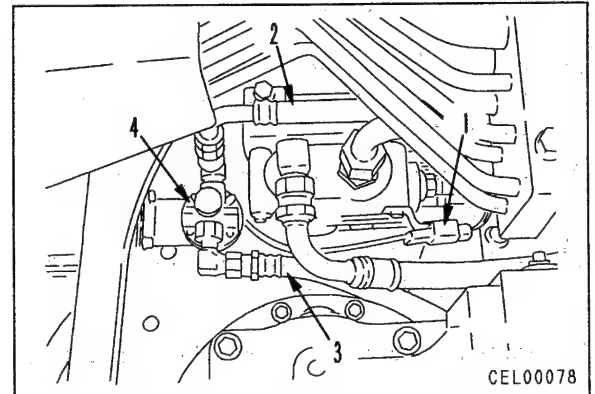
INSTALLATION OF AIR GOVERNOR ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF AIR REGULATOR VALVE ASSEMBLY

-  Extend the outriggers and set securely in contact with the ground so that the machine cannot move.
-  Open the drain valve of the air tank and drain the air.
-  Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (R41) (1).
2. Disconnect hoses (2) and (3).
3. Remove air regulator valve assembly (4).



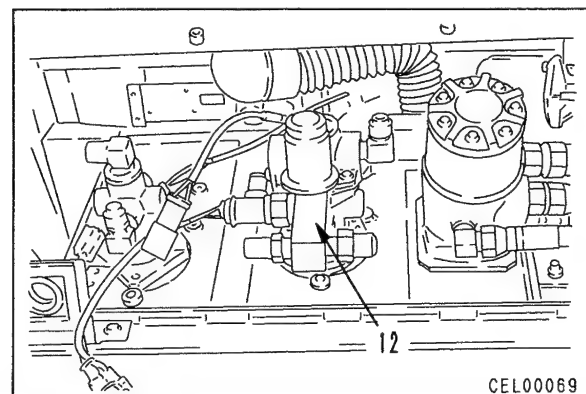
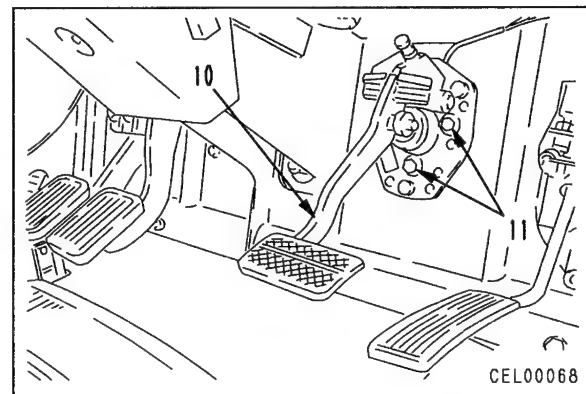
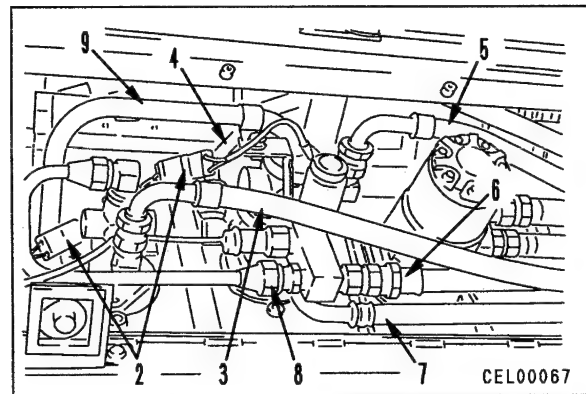
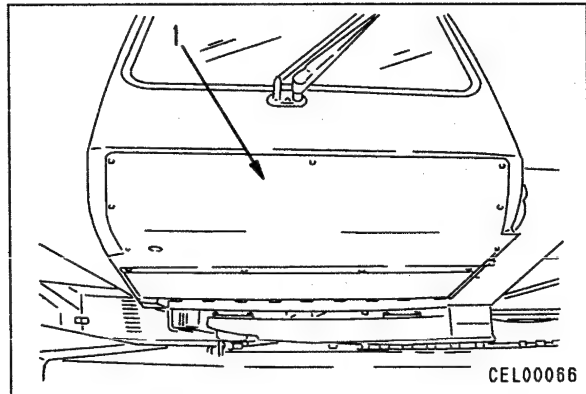
INSTALLATION OF AIR REGULATOR VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF WHEEL BRAKE VALVE ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove cover (1) at front of operator's cab.
2. Disconnect wiring connectors (C114, C112) (2).
3. Disconnect hoses (3), (4), (5), (6), and (7).
4. Remove tubes (8) and (9).
5. Remove 3 mounting bolts (11) of brake valve from bracket of brake pedal (10).
 - ★ When removing the mounting bolts, be careful not to drop brake valve assembly (12).
6. Remove wheel brake valve assembly (12).



INSTALLATION OF WHEEL BRAKE VALVE ASSEMBLY

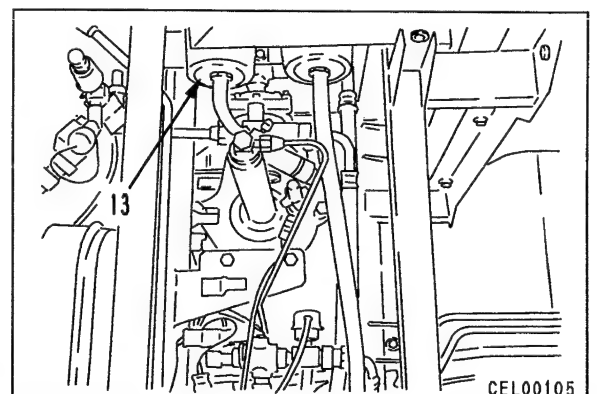
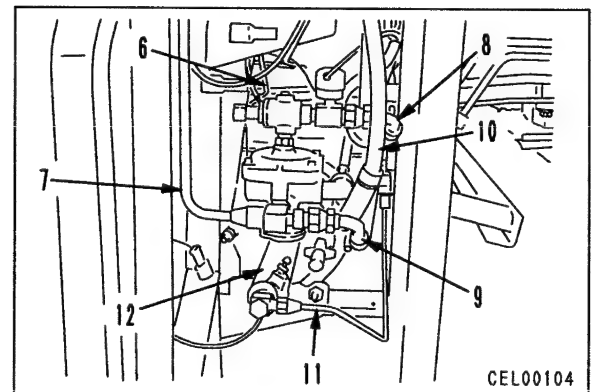
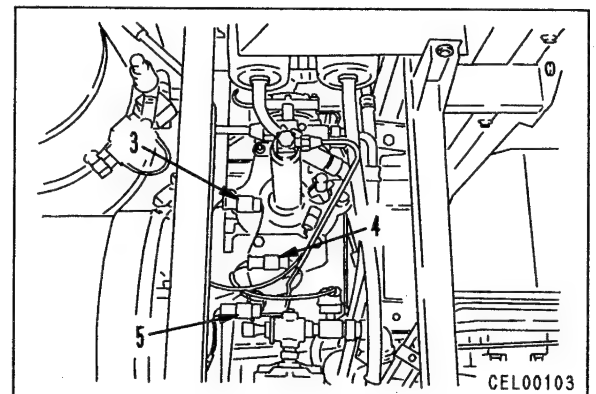
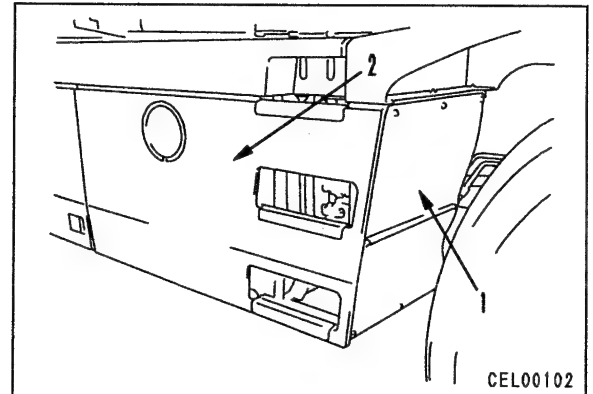
- Carry out installation in the reverse order to removal.
- **Bleeding air**
Bleed the air from the brake line.
For details, see TESTING AND ADJUSTING, Bleeding air.
- **Refilling with oil (reserve tank)**
Add oil through the oil filler to the specified level.

023S02

REMOVAL OF WHEEL BRAKE AIR MASTER ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove mudguard (1) and fuel tank side cover (2).
2. Disconnect wiring connectors (L76) (3), (L106) (4), and (L75) (5).
 - ★ Top air master (for rear) : CN-L76 (3)
 - Bottom air master (for front) : CN-L106 (4)
 - CN-175 (5)
3. Disconnect air tubes (6) and (7), air hoses (8) and (9), brake oil hose (10), and brake tube (11).
4. Remove wheel brake air master (12).
 - ★ When removing the top air master (for rear), remove rear brake oil reservoir (13).

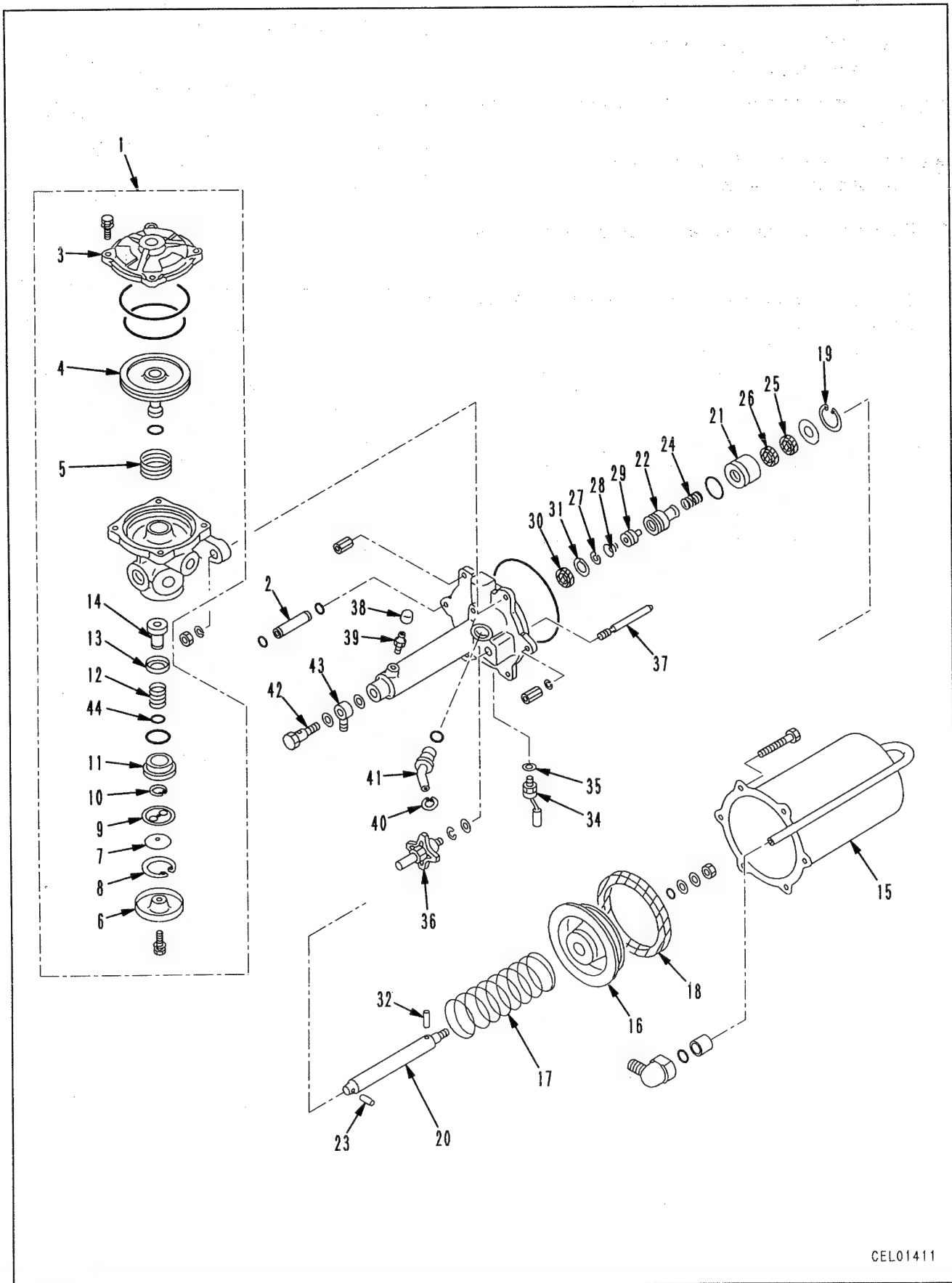


INSTALLATION OF WHEEL BRAKE AIR MASTER ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Bleeding air**
Bleed the air from the brake line.
For details, see TESTING AND ADJUSTING, Bleeding air.
- **Refilling with oil (reserve tank)**
Add oil through the oil filler to the specified level.

023S02

DISASSEMBLY OF WHEEL BRAKE AIR MASTER ASSEMBLY



023S02

CEL01411

1. Relay valve assembly

- 1) Remove relay valve assembly (1) and pipe (2).
- 2) Remove cover (3).
- 3) Remove relay piston (4) and spring (5).
- 4) Remove cover (6) and exhaust cover (7).
- 5) Remove snap ring (8), then remove valve seat (9).
- 6) Remove snap ring (10), then remove guide (11), spring (12), retainer (13), and valve (14).

2. Cylinder

Remove cylinder (15).

3. Spring

- 1) Remove piston (16) and spring (17).
- 2) Remove packing (18) from piston (16).

4. Piston assembly

- 1) Remove snap ring (19), then remove push rod (20), retainer (21), and piston (22) as assembly.
- 2) Pull out pin (23), then remove piston (22), spring (24), and retainer (21) from push rod (20).
- 3) Remove seals (25) and (26) from retainer (21).
- 4) Remove snap ring (27), then remove spring (28) and valve seat (29) from piston (22).
- 5) Remove packing (30) and back-up ring (31).

5. Pin

Remove pin (32) from push rod (20).

6. Switch assembly

Remove switch assembly (34) and shim (35).

7. Rod

- 1) Remove retainer (36).
- 2) Remove rod (37).

8. Plug

Remove cap (38) and plug (39).

9. Connector

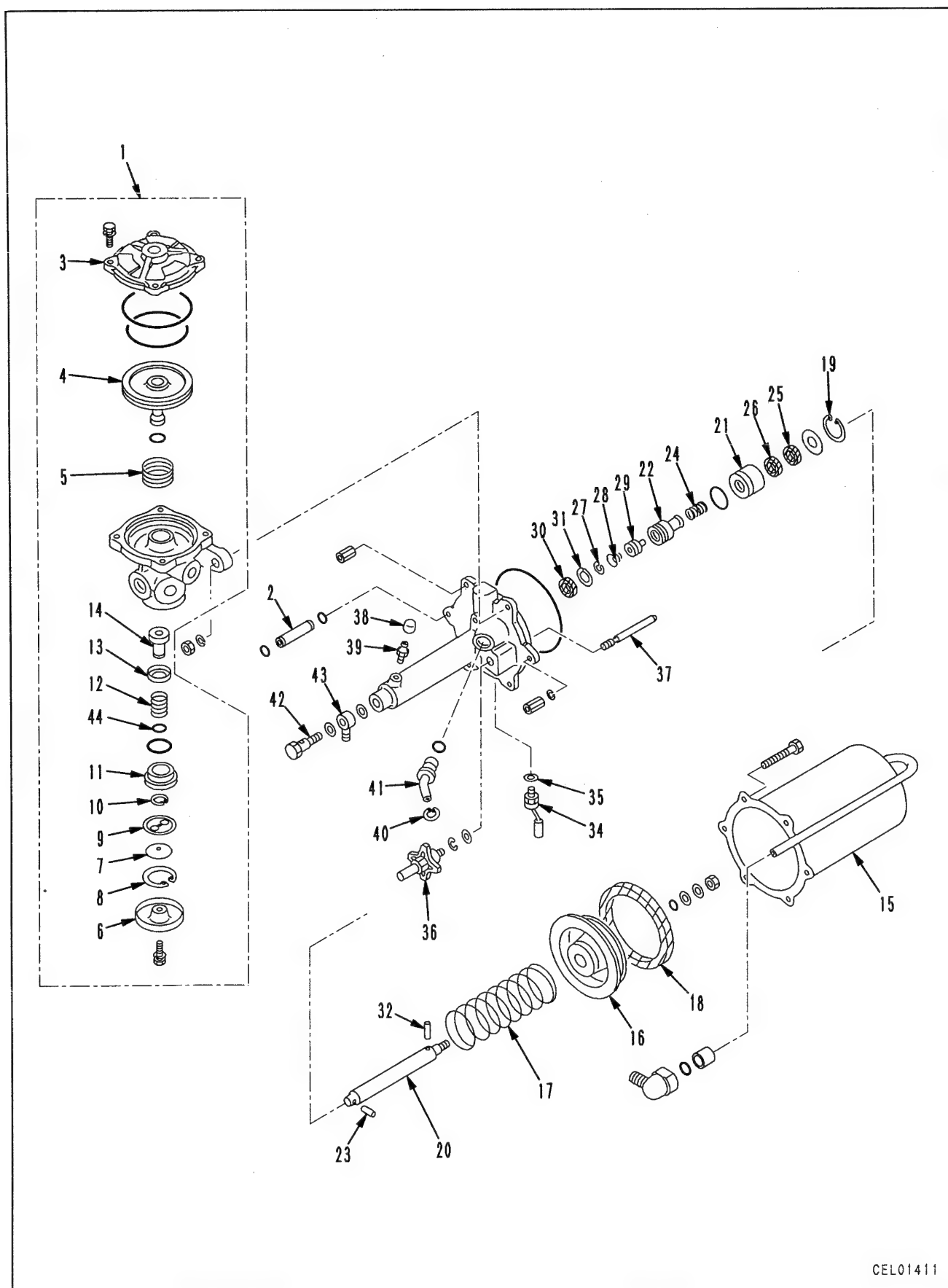
Remove snap ring (40), then remove connector (41).

10. Connector

Remove joint bolt (42), then remove connector (43).

023S02

ASSEMBLY OF WHEEL BRAKE AIR MASTER ASSEMBLY



023S02


CEL01411

1. Connector

Fit gasket and install connector (43) and joint bolt (42).

- ★ Tighten the joint bolt temporarily.
(Install to the machine and tighten fully after bleeding the air from the system.)

 Joint bolt (temporary tightening torque) :
 $5.39 \pm 1.47 \text{ Nm}$ { $0.55 \pm 0.15 \text{ kgm}$ }

 Joint bolt (final tightening torque) :
 $9.8 \pm 1.96 \text{ Nm}$ { $1 \pm 0.2 \text{ kgm}$ }

2. Connector

Fit O-ring and install connector (41), then install snap ring (40).


3. Plug

Install plug (39) and cap (38).

 Plug : **$9.8 \pm 2.94 \text{ Nm}$ { $1 \pm 0.3 \text{ kgm}$ }**


4. Rod

- 1) Assemble rod (37).
- 2) Install retainer (36).

 Retainer :
 $13.72 \pm 5.88 \text{ Nm}$ { $1.4 \pm 0.6 \text{ kgm}$ }

5. Switch assembly

Install shim (35) and switch assembly (34).


 Switch assembly :
 $29.4 \pm 4.9 \text{ Nm}$ { $3 \pm 0.5 \text{ kgm}$ }

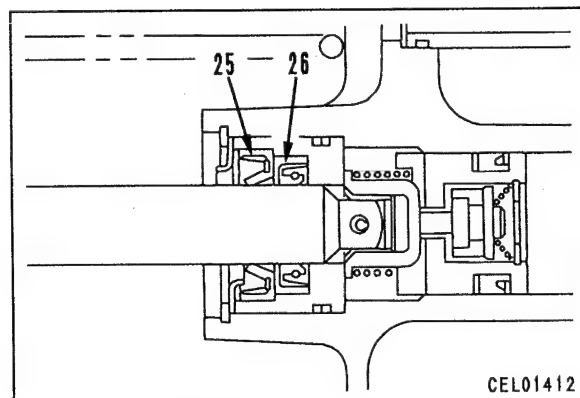
6. Pin

Install pin (32) to push rod (33).

7. Piston assembly

- 1) Install back-up ring (31) and packing (30) to piston (22).
- 2) Assemble valve seat (29) and spring (28), and install snap ring (27).
- 3) Install seals (26) and (25) to retainer (21).
 - ★ Install seals (26) and (25) facing in the direction shown in the diagram on the right.
 - ★ Fill the lip of seal (25) with grease (silicon grease G40M).

 Seal (26) : Oil (silicon oil)




CEL01412

- 4) Fit retainer (21), spring (24), and piston (22) to push rod (20), then install pin.
- 5) Assemble push rod (20), retainer (21), and piston (22) as assembly, then install snap ring (19).

8. Spring

- 1) Install packing (18) to piston (16).
 - ★ Install the packing facing in the direction shown in the diagram on the right.
 - ★ Fill the lip of the packing with air master paste (JS-D6002).
- 2) Install spring (17) and piston (16).

 **Mounting nut :**
 $24.5 \pm 4.9 \text{ Nm } \{2.5 \pm 0.5 \text{ kgm}\}$

9. Cylinder

Install cylinder (15).

- ★ Coat the inside surface of the cylinder with approx. 10g fair master paste (JS-D6002).

10. Relay valve


- 1) Fit O-ring (44) and assemble valve (14), retainer (13), spring (12), and guide (11).

 Valve and O-ring (44) :
Air master paste (JS-D6002)


- 2) Install snap ring (10).
- 3) Assemble valve seat (9), and install snap ring (8).
- 4) Install exhaust cover (7) and cover (6).

 **Mounting bolt :**
 $98 \pm 29.4 \text{ Nm } \{10 \pm 3 \text{ kgm}\}$


- 5) Assemble spring (5).
- 6) Fit O-ring and assemble relay piston (4).

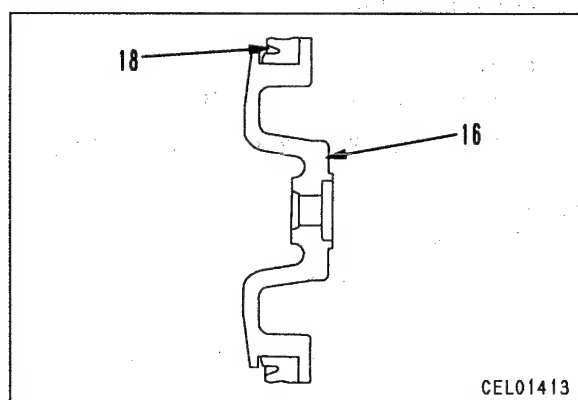
 O-ring and relay piston :
Air master paste (JS-D6002)

- 7) Fit O-ring and cover (3).

 **Mounting bolt :**
 $15.19 \pm 3.43 \text{ Nm } \{1.55 \pm 0.35 \text{ kgm}\}$

- 8) Fit O-ring and install pipe (2) and relay valve assembly (1).

 **Mounting nut :**
 $2.45 \pm 4.9 \text{ Nm } \{2.5 \pm 0.5 \text{ kgm}\}$

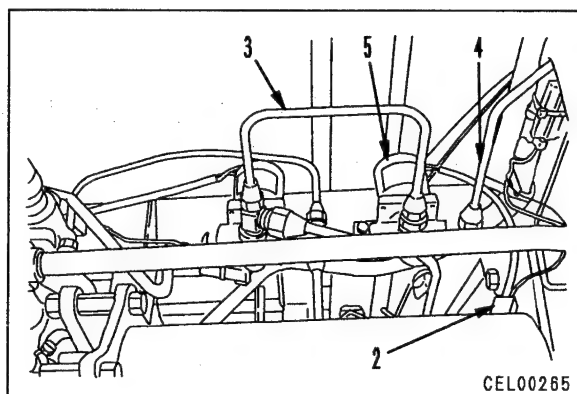
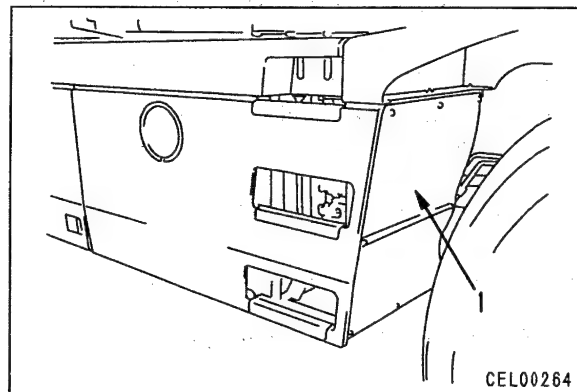


023S02

REMOVAL OF PARKING BRAKE SOLENOID VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Remove mudguard (1).
2. Disconnect wiring connector (L73) (2).
3. Disconnect tubes (3) and (4).
4. Remove parking brake solenoid valve assembly (5).



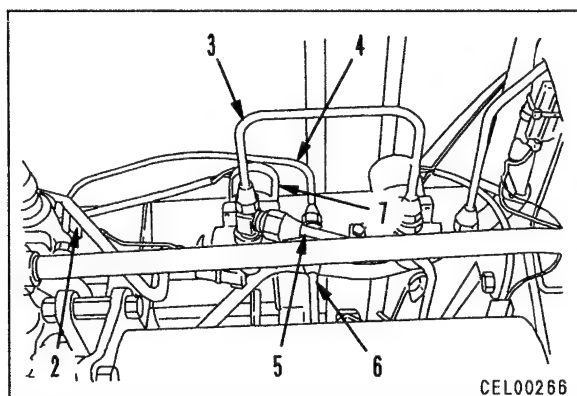
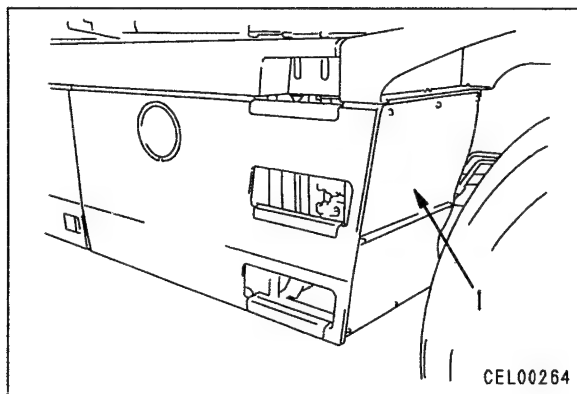
INSTALLATION OF PARKING BRAKE SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF AUXILIARY BRAKE SOLENOID VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Remove mudguard (1).
2. Disconnect wiring connector (L71) (2).
3. Disconnect tubes (3), (4), (5), and (6).
4. Remove auxiliary brake solenoid valve assembly (7).



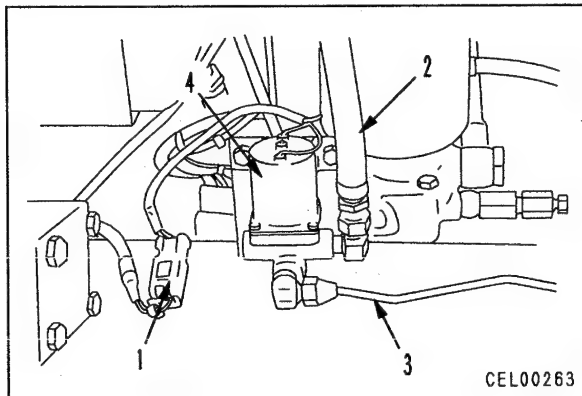
INSTALLATION OF AUXILIARY BRAKE SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF EXHAUST BRAKE SOLENOID VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Open the drain valve of the air tank and drain the air.

1. Open cover on right side of hood.
2. Disconnect wiring connector (L58) (1).
3. Disconnect hose (2) and tube (3).
4. Remove exhaust brake solenoid valve (4).



INSTALLATION OF EXHAUST BRAKE SOLENOID VALVE ASSEMBLY

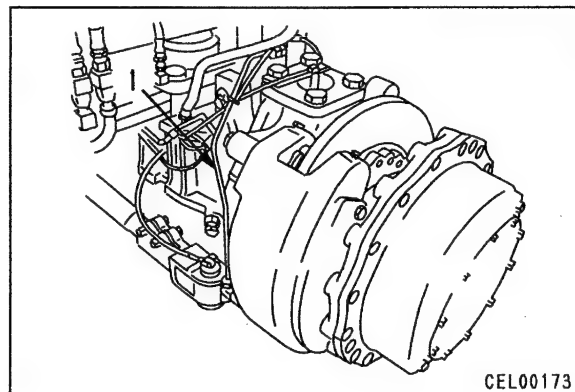
- Carry out installation in the reverse order to removal.

REMOVAL OF WHEEL BRAKE CALIPER ASSEMBLY

1. Remove wheel assembly.
For details, see REMOVAL OF WHEEL ASSEMBLY.
2. Remove brake tube (1). ※ 1
3. Sling wheel brake caliper assembly (2), and remove 4 mounting bolts (3), then remove wheel brake caliper assembly. ※ 2



Front brake caliper assembly : **40 kg**
Rear brake caliper assembly : **45 kg**



INSTALLATION OF WHEEL BRAKE CALIPER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1



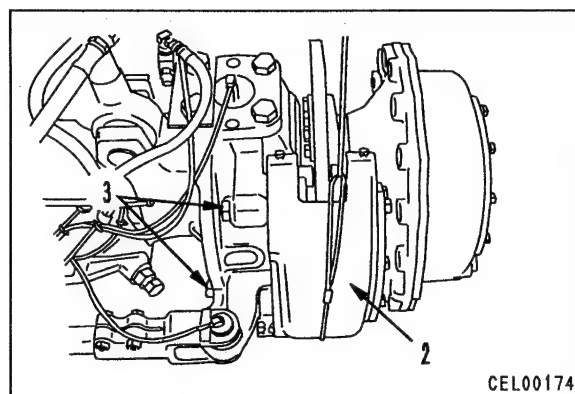
Brake tube sleeve nut :
 $31.85 \pm 12.25 \text{ Nm}$ { $3.25 \pm 1.25 \text{ kgm}$ }

※ 2



Wheel brake caliper assembly mounting bolt : **$548.8 \pm 58.8 \text{ Nm}$ { $56 \pm 6 \text{ kgm}$ }**

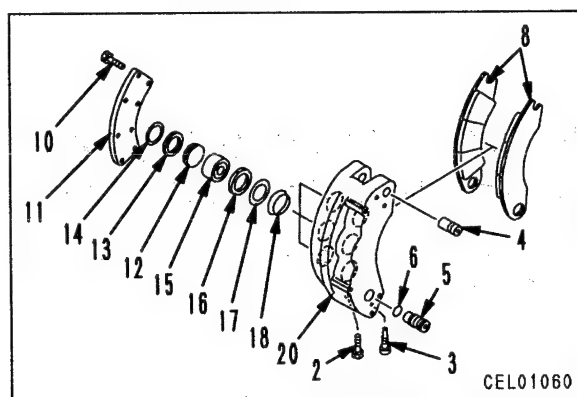
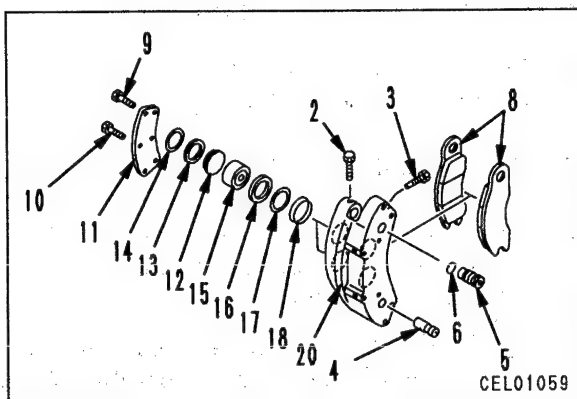
- **Bleeding air**
Bleed the air from the brake line.
For details, see TESTING AND ADJUSTING, Bleeding air.
- **Refilling with oil (reserve tank)**
Add oil through the oil filler to the specified level.



023S02

DISASSEMBLY OF WHEEL BRAKE CALIPER ASSEMBLY

1. Loosen bolts (2) and (3), and remove torque pins (4) and (5), then remove lining pads (8).
2. Remove cap bolts (9) and (10), then remove cover plate (11).
3. Push out piston assembly (15) and piston plug (12) at cover plate end. Pull out piston assembly (15) on opposite side and remove.
4. Remove scraper ring (18), then remove piston seal (16), cap seal (13), and back-up rings (14) and (17).
★ Wash off the metal particles with trichlene or brake fluid. Never use mineral oil.
5. Disassemble other pistons in same way.



ASSEMBLY OF WHEEL BRAKE CALIPER ASSEMBLY

- ★ Always use new parts for cap seal (13), piston seal (16), back-up rings (14) and (17), and scraper ring (18).

1. Coat back-up rings (14) and (17), piston seal (16), cap seal (13), scraper ring (18) and inside surface of cylinder with lubricant.



Seal, inside surface of cylinder :
Silicon grease (included in seal kit)

2. Insert back-up ring (17), piston seal (16), and scraper ring (18) in order in cylinder groove portion of caliper body (20).

- ★ Insert the piston assembly from inside the caliper body until it passes the seal.
★ Insert the piston so that it is level with the surface of the caliper body. Be careful not to insert it too far: the seal may be cut.

3. Install cover plate (11) to caliper body.



Bolt (9) : $305.76 \pm 14.7 \text{ Nm}$ $\{31.2 \pm 1.5 \text{ kgm}\}$



Bolt (10) : $206.78 \pm 9.8 \text{ Nm}$ $\{21.1 \pm 1.9 \text{ kgm}\}$

4. Install lining pads (8) and torque pins (4) and (5), and tighten bolts (2) and (3).

- ★ If O-ring (6) has any cuts or other marked damage, replace it with a new part.



Torque pin insertion hole: **Silicon grease (included in seal kit)**



Bolt (2), (3) :
 $51.45 \pm 2.45 \text{ Nm}$ $\{5.25 \pm 0.25 \text{ kgm}\}$

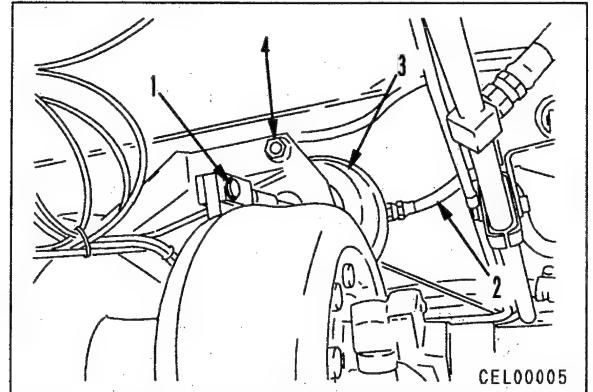
5. Assemble other pistons in same way.

023S02

REMOVAL OF PARKING BRAKE CHAMBER ASSEMBLY

⚠ Extend the outriggers and raise the machine.

1. Remove connecting pin (1). ※ 1
 - ⚠** Turn the starting switch ON, set the parking brake switch to PARKING, remove pin (1), then turn the starting switch OFF again.
2. Disconnect hose (2) at brake chamber end. ※ 2
3. Remove mounting bolt (4), then remove parking brake chamber assembly (3).




INSTALLATION OF PARKING BRAKE CHAMBER ASSEMBLY


- Carry out installation in the reverse order to removal.

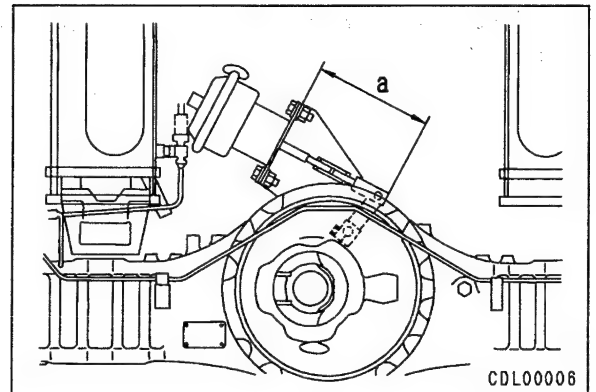
※ 1

- ★ Bend the cotter pin securely.
- ★ Check that dimension **a** between the tip of the rod and the parking brake chamber mounting surface is 110 ± 3 mm.

 kgm Rod locknut :
 51.45 ± 7.35 Nm $\{5.25 \pm 0.75$ kgm $\}$

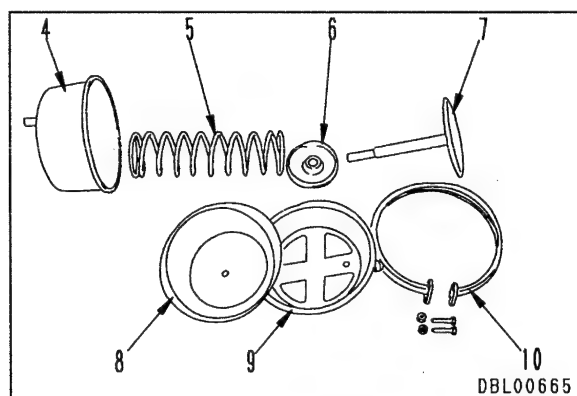
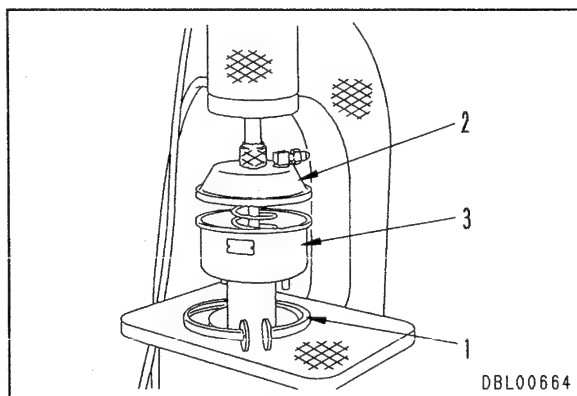
※ 2

- ★  kgm Hose sleeve nut :
 49 ± 19.6 Nm $\{5 \pm 2$ kgm $\}$
- ★ Install the hoses without twisting or interference.



DISASSEMBLY OF PARKING BRAKE CHAMBER ASSEMBLY

1. Set brake chamber assembly in press.
 - ★ When setting in the press, set so that the pressure plate is held down lightly.
 - ★ Before dividing into parts, make match marks on the pressure plate and inner pressure plate and ring.
2. Remove ring (1), then retract piston rod slowly, and divide into pressure plate assembly (2) and inner pressure plate assembly (3).
3. Disassemble into inner pressure plate (4), spring (5), seat (6), push rod (7), diaphragm (8), pressure plate (9), and ring (10).

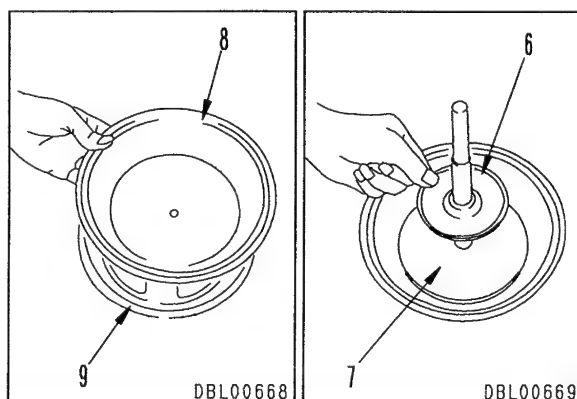
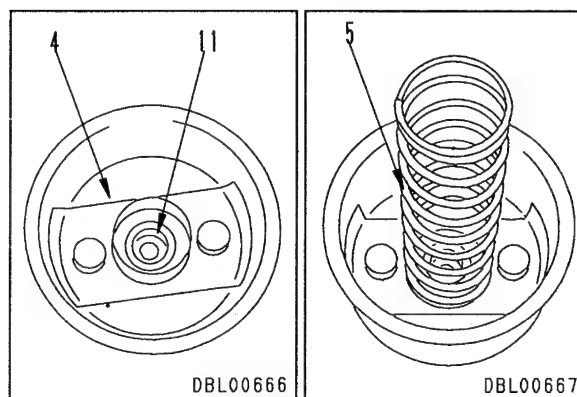


ASSEMBLY OF PARKING BRAKE CHAMBER ASSEMBLY

1. Assemble dust cover (11) to inner pressure plate (4), and fit spring (5).
2. Fit diaphragm (8), push rod (7), and seat (6) to pressure plate (9).
3. Set inner pressure plate assembly (3) and pressure plate assembly (2) in press as assembly.
4. Align match marks, then extend piston rod slowly to compress spring, and install ring (1).

Ring : $17.15 \pm 2.45 \text{ Nm}$ { $1.75 \pm 0.25 \text{ kgm}$ }

- ★ When pushing the pressure plate and compressing the spring, be careful not to push too much.
- ★ Check that the diaphragm is securely assembled, then install the ring.
- ★ After the completion of assembly, carry out an air check to check for air leakage and to test the movement of the push rod.



023502

REMOVAL OF HYDRAULIC TANK ASSEMBLY

⚠ Set the parking brake switch to PARKING.

1. Drain oil from hydraulic tank.

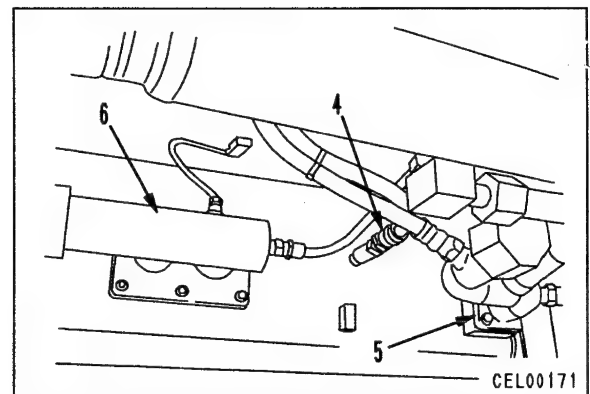
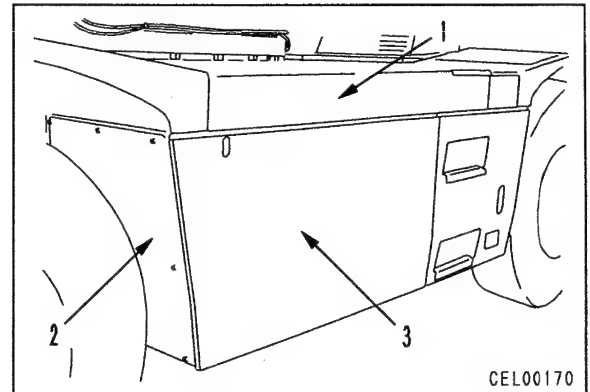


Hydraulic tank : 420 ℓ

2. Remove hydraulic tank top cover (1), mudguard (2), and hydraulic tank side cover (3).
3. Disconnect hose (4) and suction tubes (5) and (6).
4. Remove mounting band (7) of hydraulic tank, pull out and stop at a point just before hydraulic tank (8) comes out, then place on transmission jack (1) and remove.



Hydraulic tank assembly : 130 kg

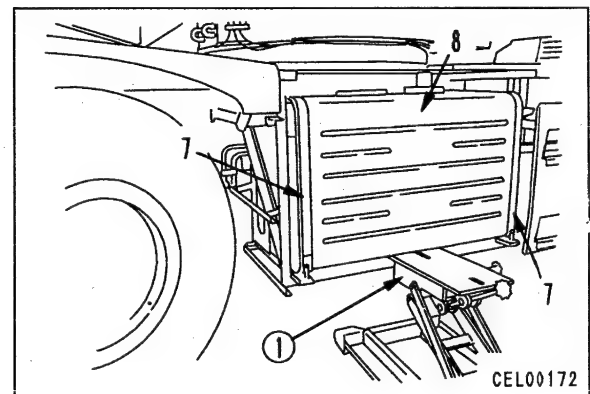


INSTALLATION OF HYDRAULIC TANK ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Add oil through oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.



Hydraulic tank : 420 ℓ (H046-HM)



REMOVAL OF WINCH, BOOM, PPC PUMP ASSEMBLY

- ⚠** Extend the outriggers, then raise the machine and swing the revolving frame 90°.

1. Drain oil from hydraulic tank.

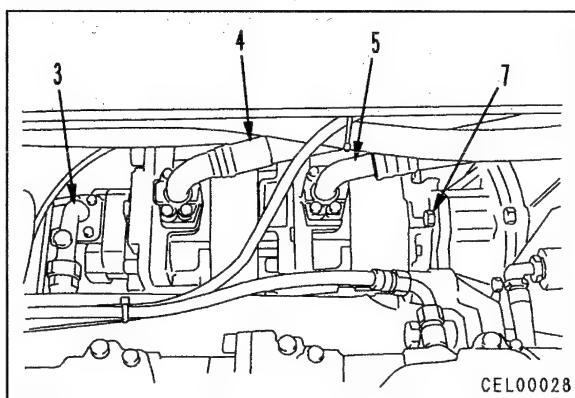
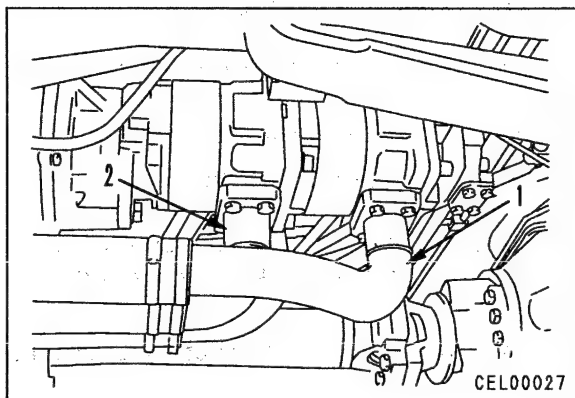


Hydraulic tank : 420 ℓ

2. Remove pump top cover.
3. Disconnect suction tubes (1) and (2) from under pump.
4. Disconnect tube (3) and hoses (4) and (5) from top of pump.
5. Sling winch, boom, and PPC pump assembly (6), and remove mounting bolt (7), then remove winch, boom, and PPC pump (6).

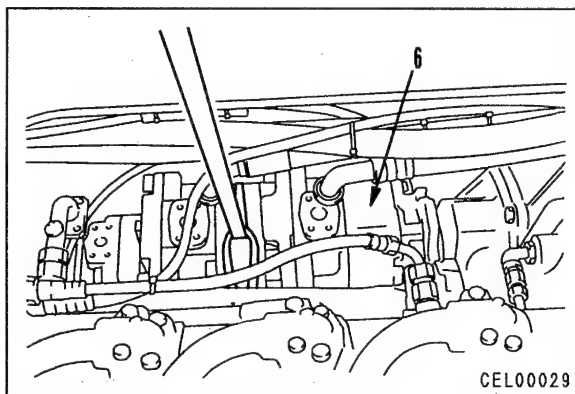


Winch, boom, PPC pump assembly : 40 kg



INSTALLATION OF WINCH, BOOM, PPC PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Add oil through oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.



023S02

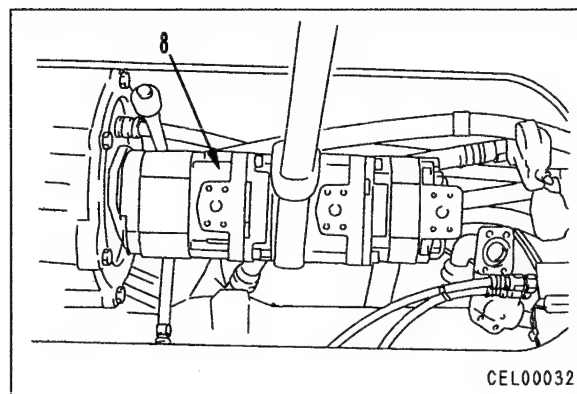
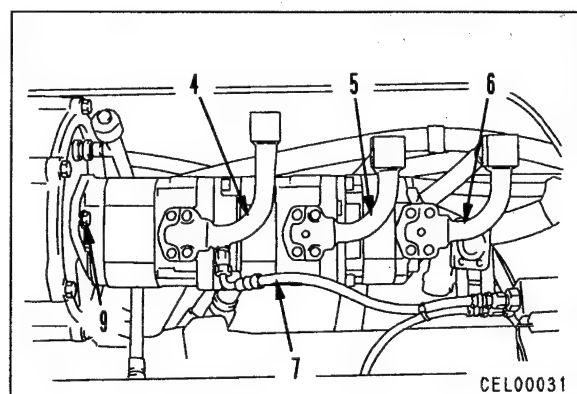
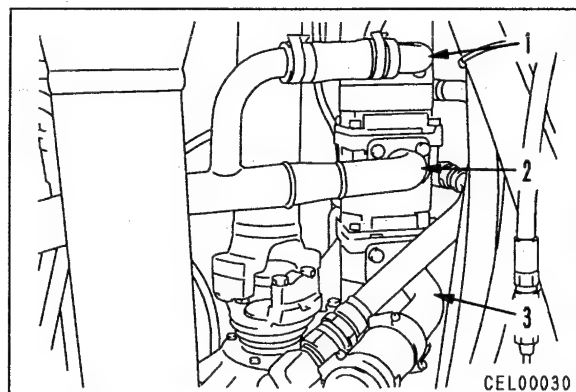
REMOVAL OF TRANSMISSION, STEERING (OUTRIGGER), SWING PUMP ASSEMBLY

⚠ Extend the outriggers, then raise the machine and swing the revolving frame 90°.

1. Remove pump top cover.
2. Disconnect suction tubes (1), (2), and (3) from under pump.
3. Disconnect tubes (4), (5), and (6), and hose (7) from top of pump.
4. Sling transmission, steering (outrigger), and swing pump assembly (8), then remove mounting bolt (9), and remove transmission, steering (outrigger), and swing pump assembly.



Transmission, steering (outrigger), swing pump assembly : **25 kg**



INSTALLATION OF WINCH, BOOM, PPC PUMP ASSEMBLY

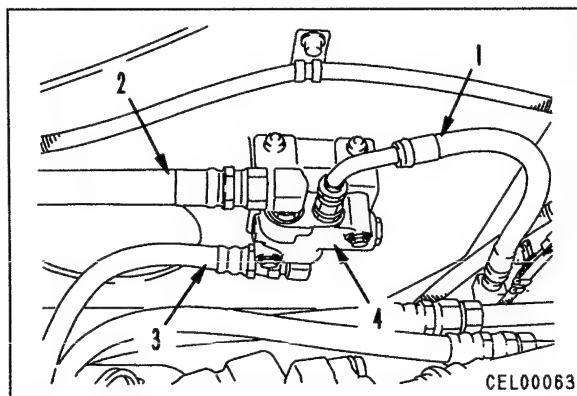
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

REMOVAL OF MAXIMUM FLOW CONTROL VALVE ASSEMBLY

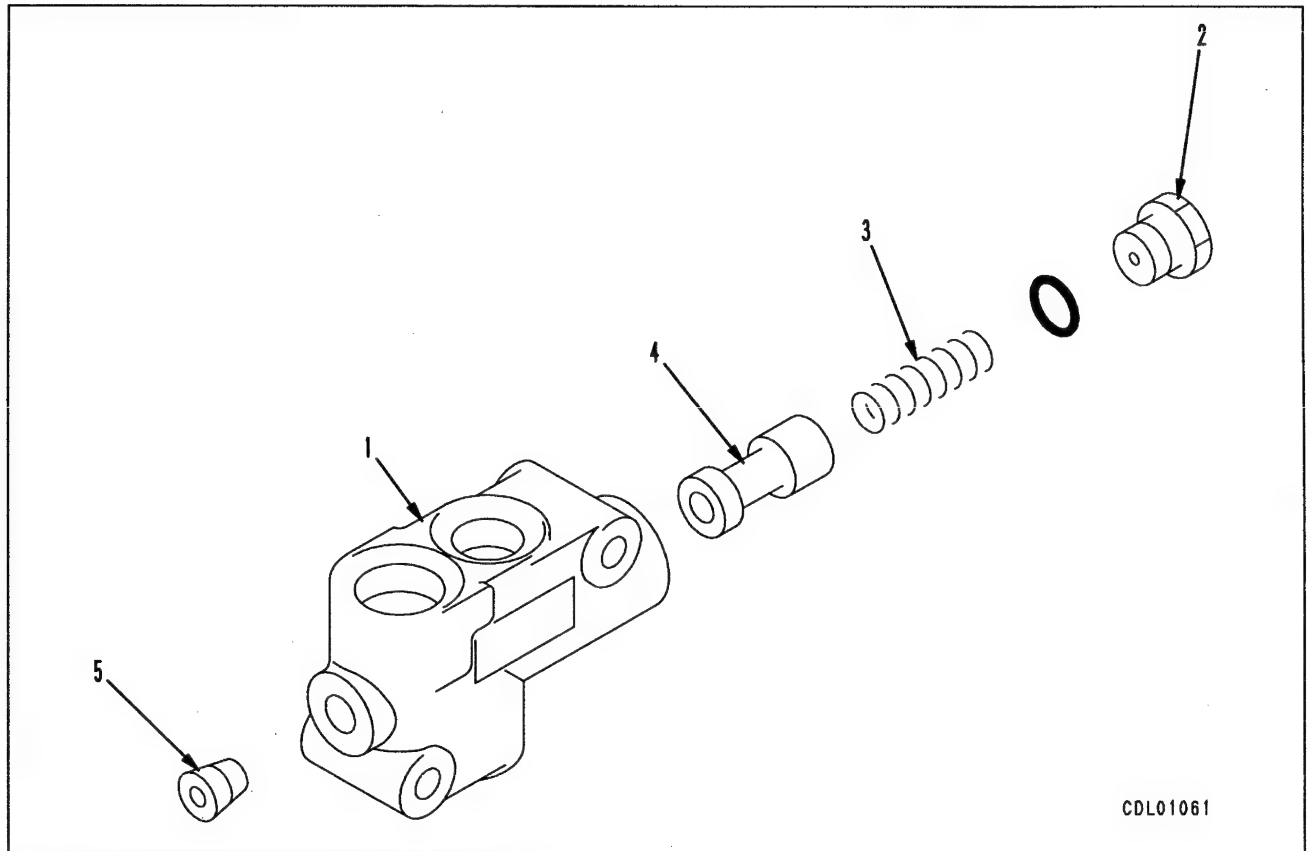
⚠ Extend the outriggers and set securely in contact with the ground, then raise the boom.

1. Disconnect hoses (1), (2), and (3).
2. Remove maximum flow control valve assembly (4).



INSTALLATION OF MAXIMUM FLOW CONTROL VALVE ASSEMBLY


- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



DISASSEMBLY OF MAXIMUM FLOW CONTROL VALVE ASSEMBLY

1. Remove stopper (2) from body (1).
2. Remove spring (3) and piston (4).
★ If there is any abnormality in the piston or body, replace the piston and body as an assembly.
3. Remove plug (5).

ASSEMBLY OF MAXIMUM FLOW CONTROL VALVE ASSEMBLY

1. Install plug (5) to body (1).
 2. Assemble piston (4) and spring (3).
 3. Fit O-ring and install stopper (2).
-  **Stopper : $49 \pm 4.9 \text{ Nm}$ ($5 \pm 0.5 \text{ kgm}$)**

023S02

REMOVAL OF CENTER SWIVEL JOINT ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Raise the boom to the maximum height.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Drain coolant.

2. Drain oil from hydraulic tank.



Hydraulic tank : 420 ℓ

3. Remove boom assembly.

For details, see REMOVAL OF BOOM ASSEMBLY.

- ★ If there is enough space for the boom to be raised to the maximum height, it is not necessary to remove the boom assembly.

4. If boom assembly is removed, raise tip of boom hoist cylinder assembly (1) and tip it over to rear.

- ⚠ To prevent the boom hoist cylinder from falling, tie it with rope.

5. Disconnect following wiring and piping from chassis end.

1) Disconnect wiring connector (L04) (2).

2) Disconnect 4 air hoses (3).

- ★ To prevent mistakes in the mounting position when installing the hoses, mark the hoses with tags before removing them.

3) Disconnect 10 oil hoses (4).

- ★ To prevent mistakes in the mounting position when installing the hoses, mark the hoses with tags before removing them.

4) Disconnect oil tube (5).

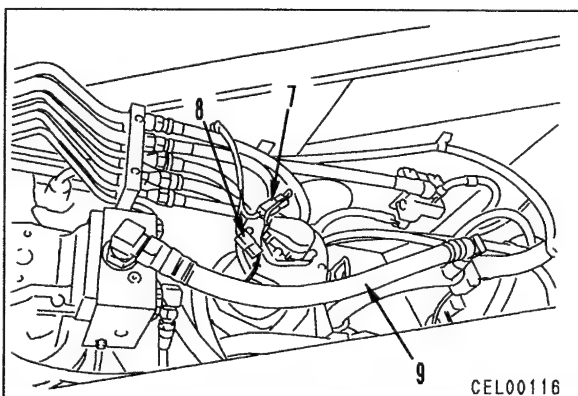
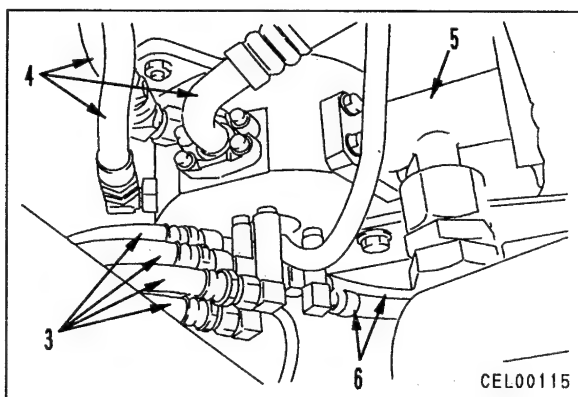
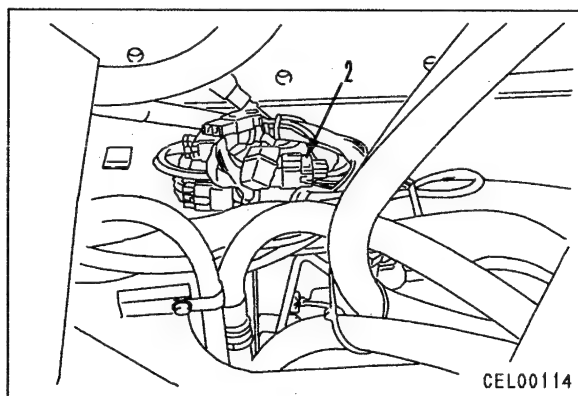
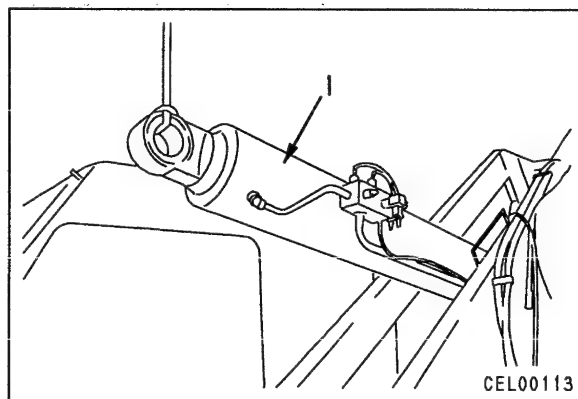
5) Disconnect 2 heater hoses (6).

- ★ To prevent mistakes in the mounting position when installing the hoses, mark the hoses with tags before removing them.

6. Disconnect following wiring and piping from top of chassis.

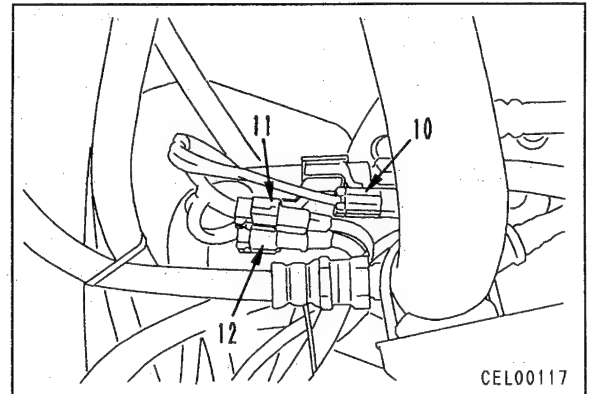
1) Disconnect wiring connectors (R05) (7) and (R42) (8).

2) Remove oil hose (9).

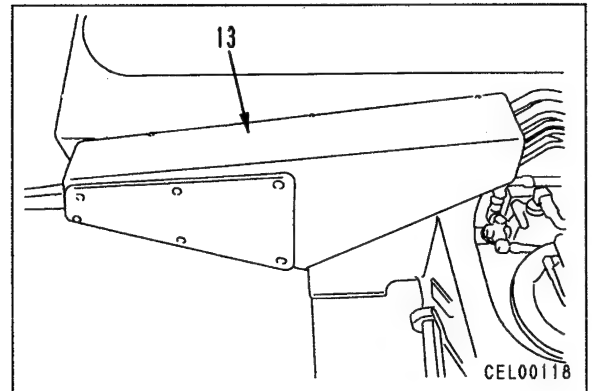


023S02

- 3) Disconnect wiring connectors (R01) (10), (R03) (11), and (R04) (12).

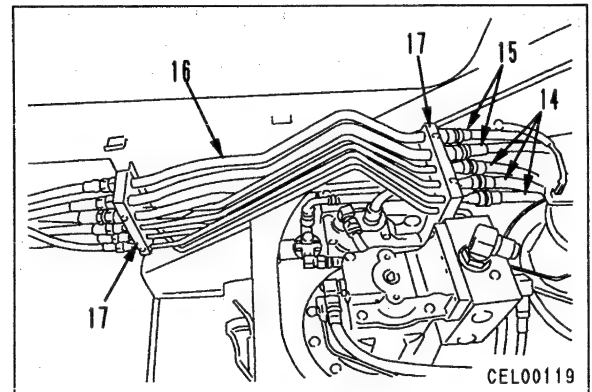


- 4) Remove cover (13) on left of operator's cab.



- 5) Disconnect 5 air hoses (14).
 ★ To prevent mistakes in the mounting position when installing the hoses, mark the hoses with tags before removing them.

- 6) Disconnect 5 oil hoses (15).
 ★ To prevent mistakes in the mounting position when installing the hoses, mark the hoses with tags before removing them.



- 7) Remove bracket (17) of air and oil tube assembly (16).

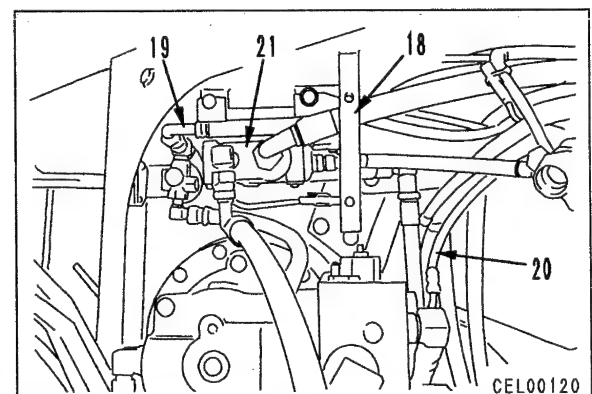
★ Move air and oil tube assembly (16) to the outside of the swing motor.

- 8) Remove bracket (18).

- 9) Disconnect air hose (19).

- 10) Disconnect oil hose (20).

- 11) Remove priority valve (21).
 For details, see REMOVAL OF PRIORITY VALVE ASSEMBLY.



023S02

12) Disconnect heater hoses (22) and (23).

- ★ To prevent mistakes in the mounting position when installing the hoses, mark the hoses with tags before removing them.

13) Disconnect oil hoses (24), (25), (26), (27), (28), (29), (30), and (31).

- ★ To prevent mistakes in the mounting position when installing the hoses, mark the hoses with tags before removing them.

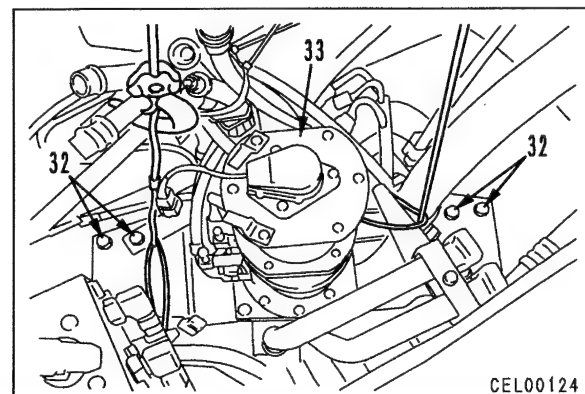
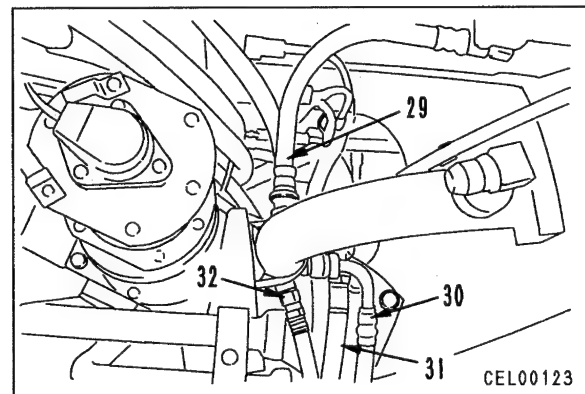
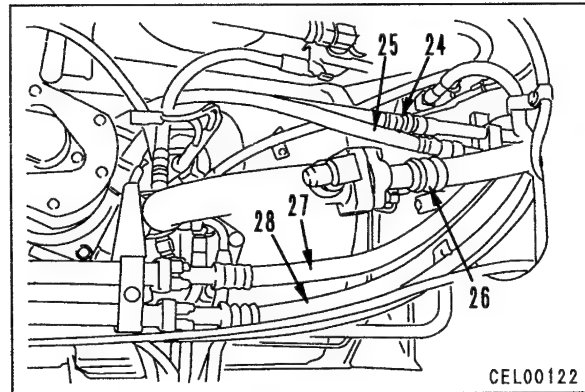
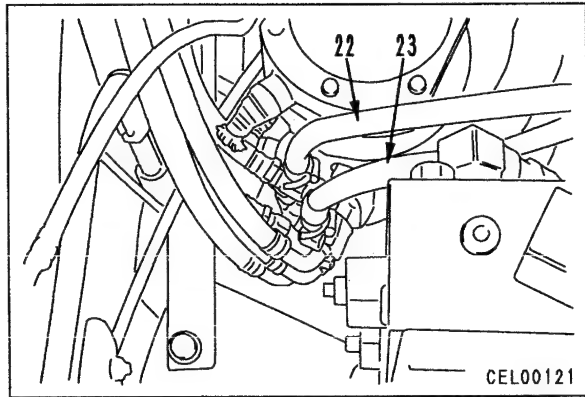
7. Remove 8 mounting bolts (32) of center swivel joint bracket.

8. Lift off center swivel joint assembly (33).

- ★ Check that all wiring and piping has been disconnected before removing the center swivel joint assembly.
- ★ Be careful not to damage the wiring and piping when removing.



Center swivel joint assembly : 210 kg

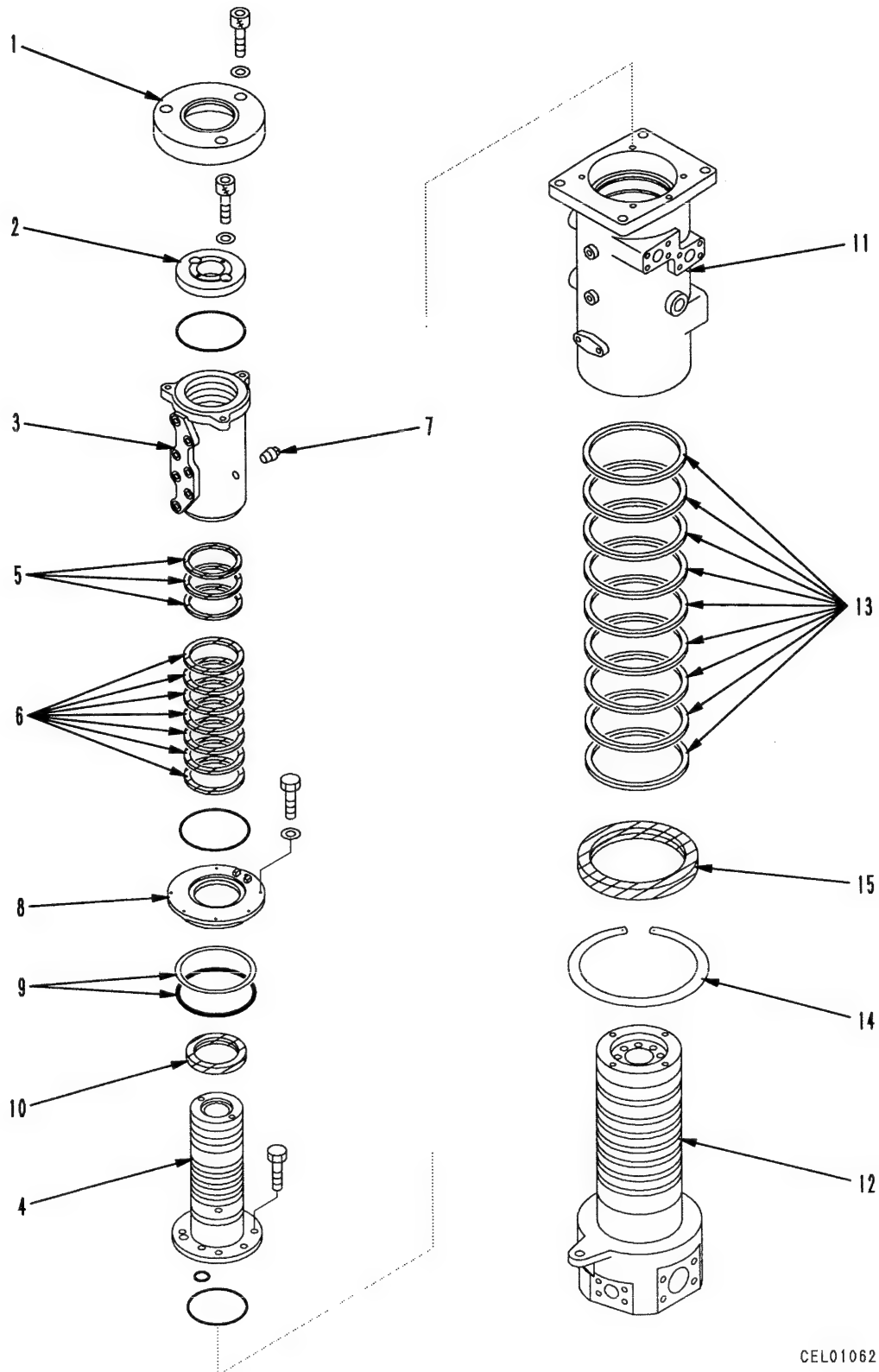


INSTALLATION OF CENTER SWIVEL JOINT ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Add oil through oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- **Refilling with water**
Add water through water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

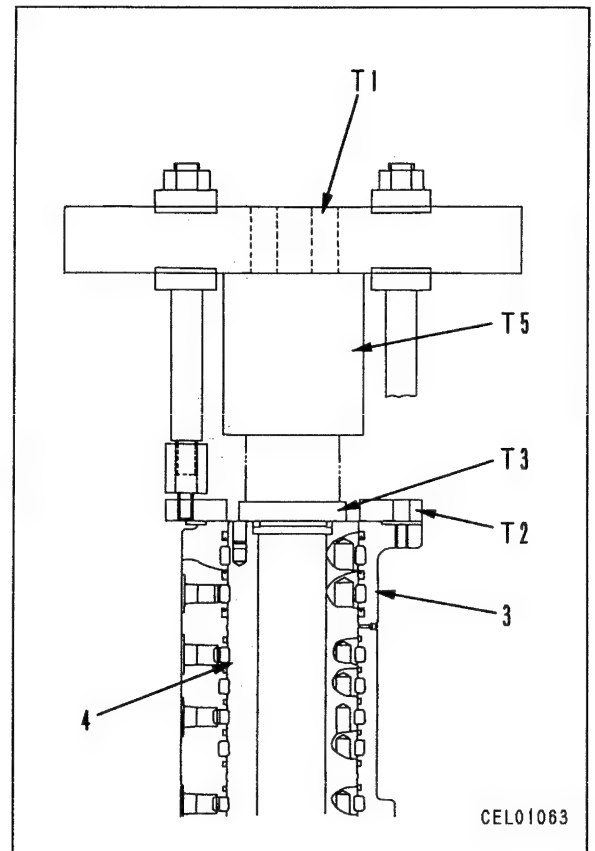
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DISASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY

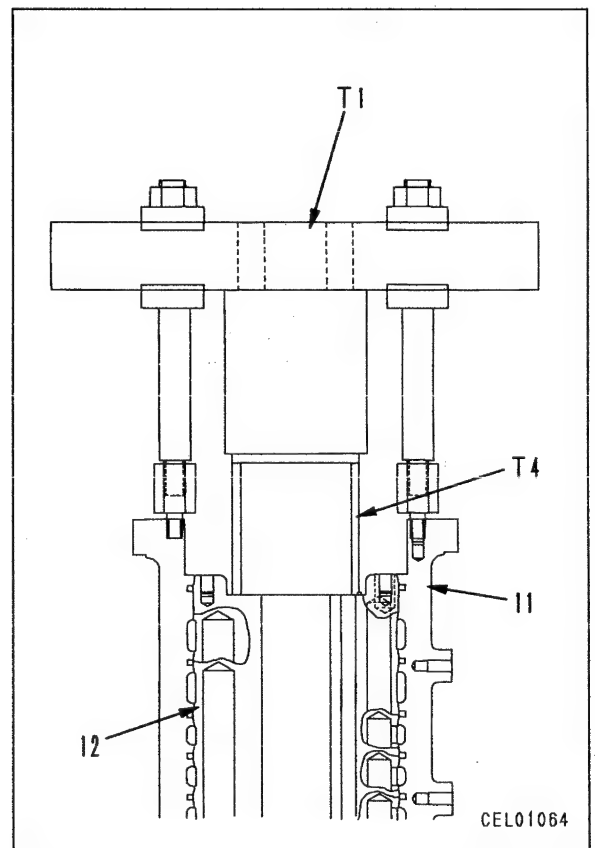


023S02

1. Remove cover (1).
2. Remove cover (2).
3. Using tools **T1**, **T2**, **T3**, and **T5**, remove rotor (3) from shaft (4).
4. Remove 3 seals (5) and 7 seals (6) from rotor (3).
5. Remove grommet (7) from rotor (3).
6. Remove spacer (8).
7. Remove O-ring (9), back-up ring (9), and oil seal (10) from spacer (8).
8. Remove shaft (4).

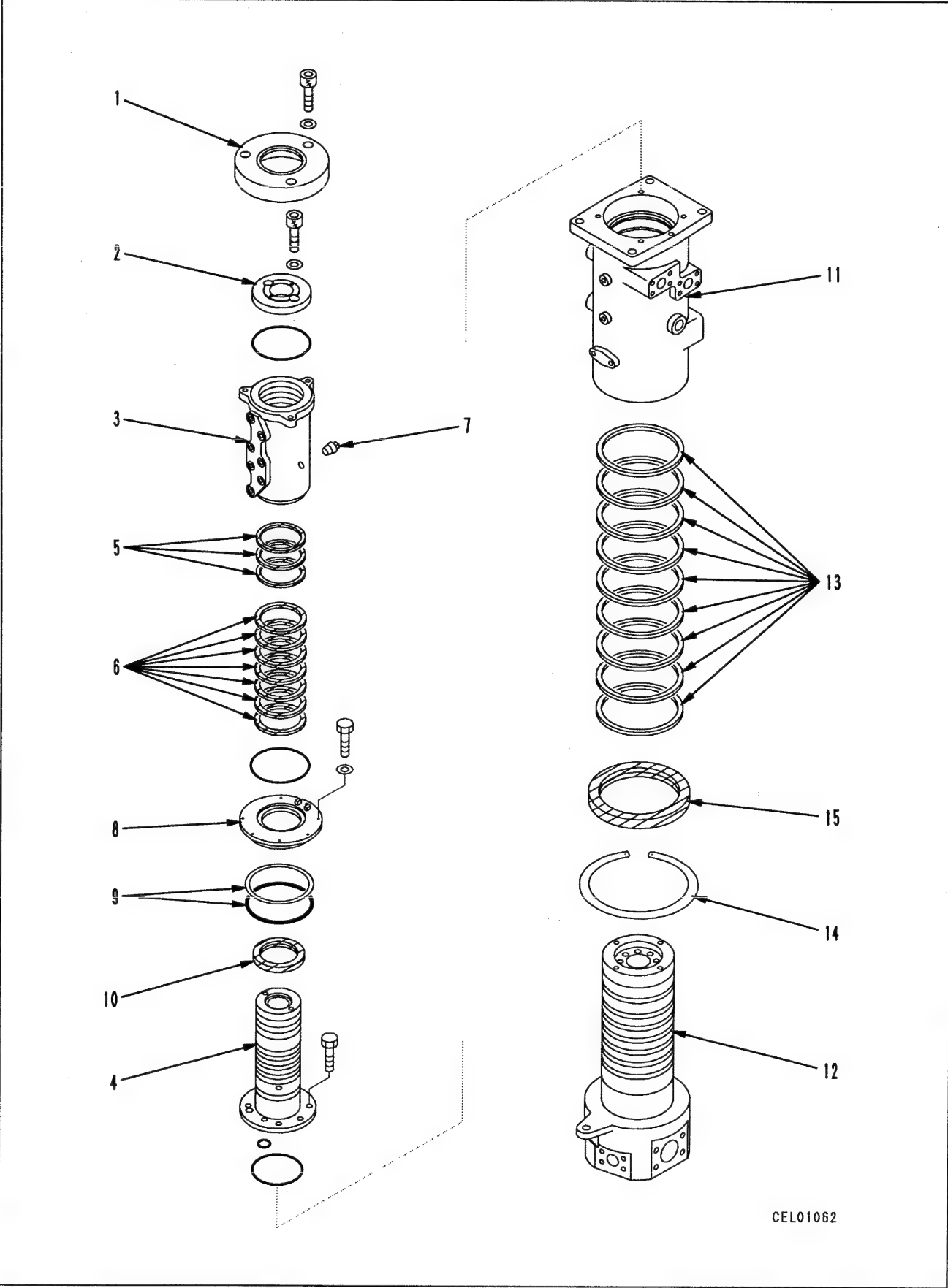


9. Using tools **T1** and **T4**, remove rotor (11) from shaft (12).
10. Remove 9 slipper seals (13) from rotor (11).
11. Remove snap ring (14) and oil seal (15) from rotor (11).



023S02

ASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY



023S02

CEL01062

1. Install oil seal (15) and snap ring (14) to rotor (11).



Oil seal : **Grease (G2-LI)**

2. Install 9 slipper seals (13) to rotor (11).

3. Install rotor (11) to shaft (12).



Contact surface of rotor and shaft :
Grease (G2-LI)

4. Fit O-ring and install shaft (4).



Mounting bolt : **Thread tightener**
(Loctite 262 or equivalent)



Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }

5. Install oil seal (10), back-up ring (9), and O-ring (9) to spacer (8).

6. Fit O-ring and install spacer (8).



Contact surface of shaft : **Grease (G2-LI)**



Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }

7. Install grommet (7) to rotor (3).

8. Install 7 seals (6) and 3 seals (5) to rotor (3).

9. Install rotor (3) to shaft (4).



Contact surface of rotor and shaft :
Grease (G2-LI)

10. Install cover (2).



Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }



Contact surface of shaft : **Grease (G2-LI)**

11. Install cover (11).



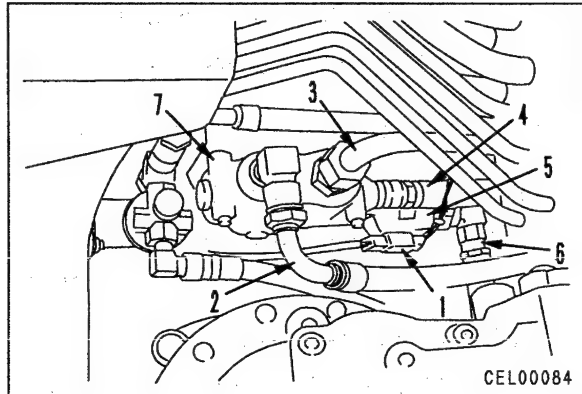
Mounting bolt :
 $66.15 \pm 7.35 \text{ Nm}$ { $6.75 \pm 0.75 \text{ kgm}$ }

023S02

REMOVAL OF STEERING PRIORITY VALVE ASSEMBLY

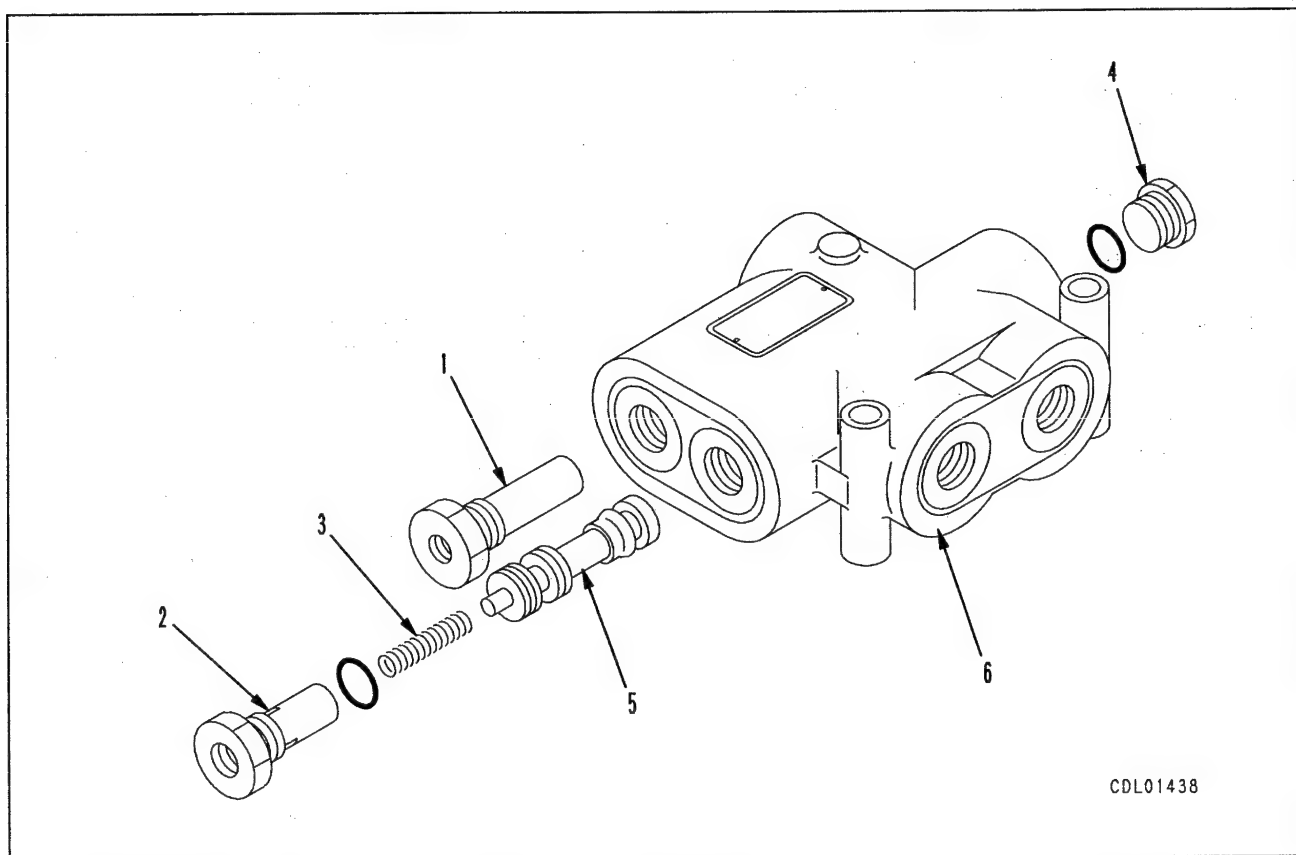
- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (R41) (1).
2. Disconnect hoses (2), (3), (4), (5), and (6).
3. Remove steering priority valve assembly (7).



INSTALLATION OF STEERING PRIORITY VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



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DISASSEMBLY OF STEERING PRIORITY VALVE ASSEMBLY

1. Remove relief valve assembly (1).
2. Remove plug (2).
3. Remove spring (3).
4. Remove plug (4).
5. Remove spool (5) from body (6).

ASSEMBLY OF STEERING PRIORITY VALVE ASSEMBLY

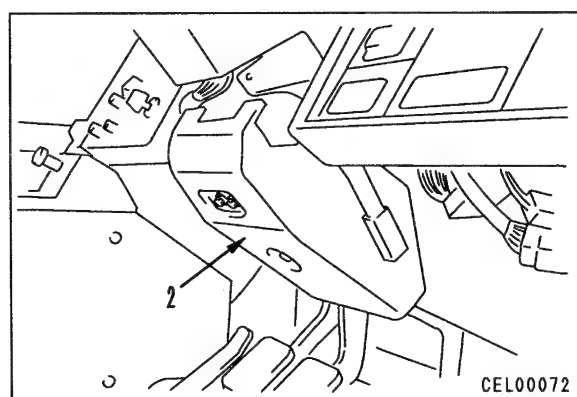
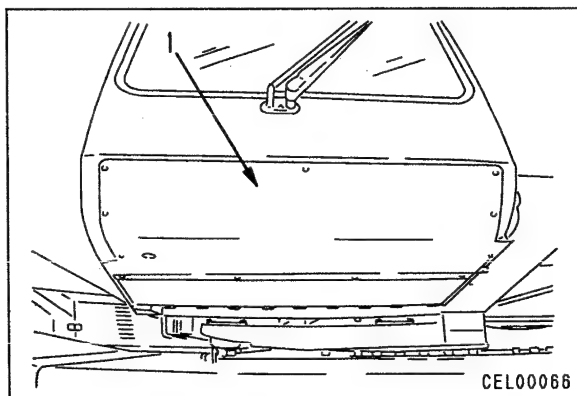
1. Assemble spool (5) to body (6).
2. Fit O-ring and install plug (4).
kgm Plug : **44.1 Nm {4.5 kgm}**
3. Assemble spring (3).
4. Fit O-ring and install plug (2).
kgm Plug : **44.1 Nm {4.5 kgm}**
5. Fit O-ring and install relief valve assembly (1).
kgm Relief valve : **20.6 Nm {2.1 kgm}**

023S02

REMOVAL OF STEERING VALVE ASSEMBLY

⚠ Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.

1. Remove cover (1) at front of operator's cab.
2. Remove cover (3) under steering wheel.
3. Disconnect hoses (3), (4), (5), (6), and (7).
4. Remove 4 steering mounting bolts (8).
★ When removing 4 mounting bolts (8), be careful not to drop steering valve assembly (9).
5. Remove steering valve assembly (9). ※ 1



INSTALLATION OF STEERING VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

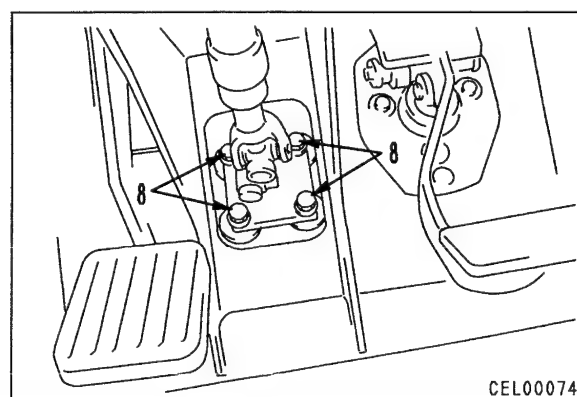
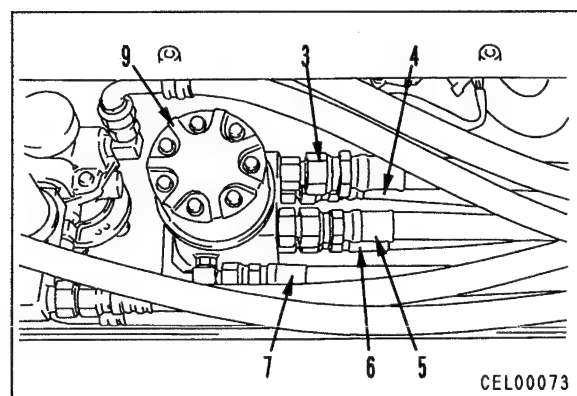
※ 1



Steering valve spline portion :

Grease (G2-LI)

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

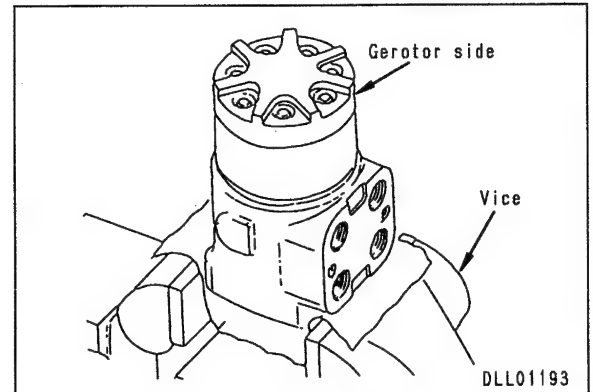


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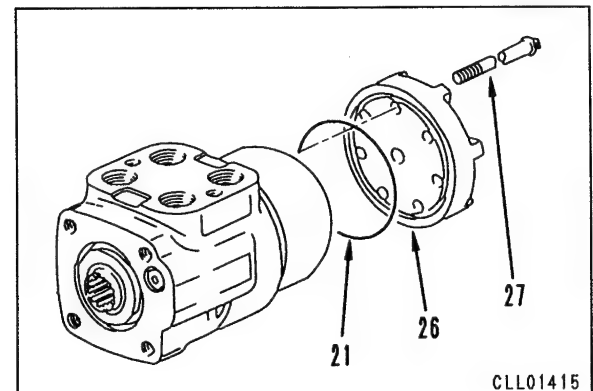
DISASSEMBLY OF STEERING VALVE ASSEMBLY

DISASSEMBLY OF GEROTOR END

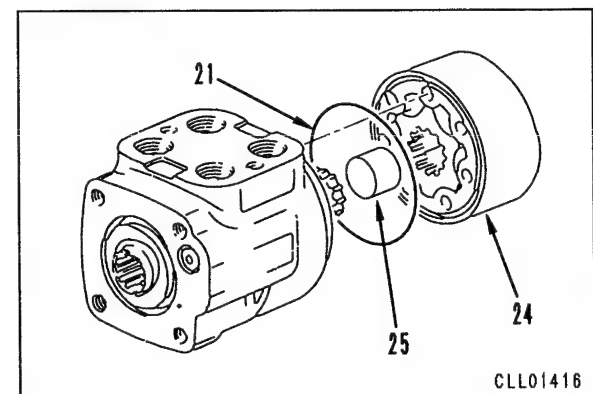
1. Set Gerotor end at top, install in vice, and hold flang portion lightly.
 - ★ Use a copper plate between the vice and the flange.



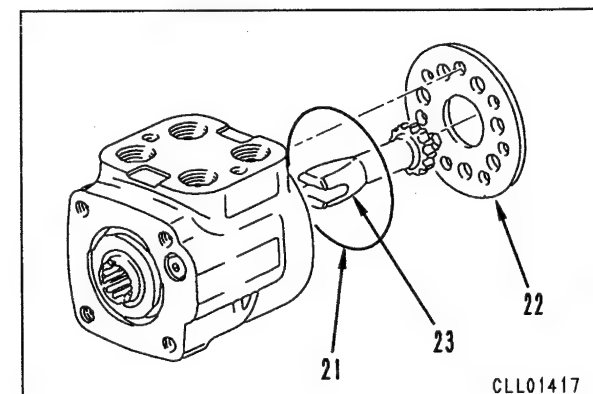
2. Remove 7 screws (27).
3. Remove end cap (26).
4. Remove O-ring (21) from end cap.



5. Remove Gerotor (24).
 - ★ Be careful not to drop the star inside the Gerotor. Remove O-ring (21) from the Gerotor.
6. Remove spacer (25).



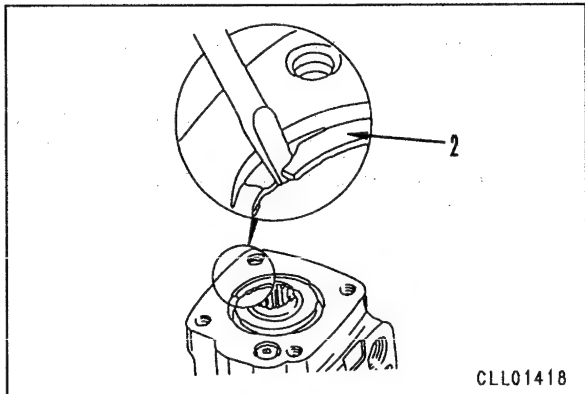
7. Remove drive (23).
8. Remove spacer plate (22).
9. Remove O-ring (21) from housing.



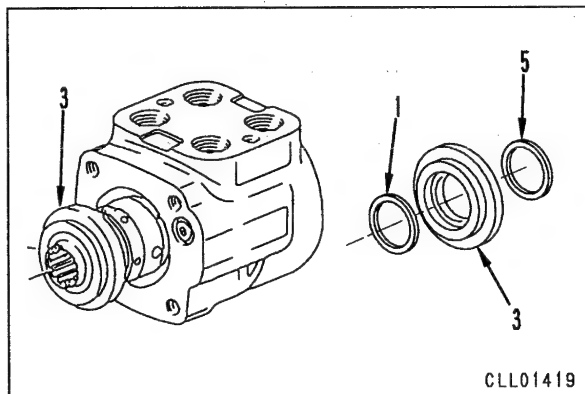
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DISASSEMBLY OF CONTROL END

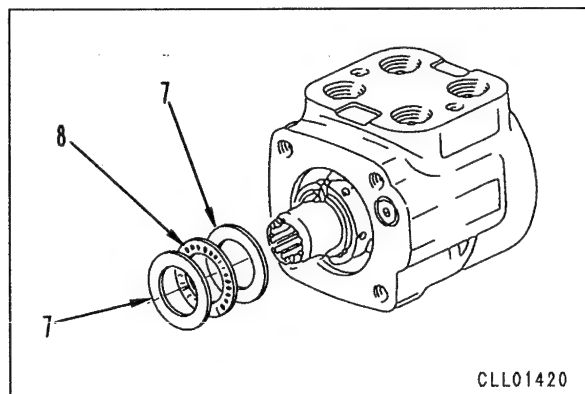
10. Remove housing from vice, then set it on a clean cloth and take care not to damage finished surface.
Raise tip of retaining ring (2) with small screwdriver and remove from housing.



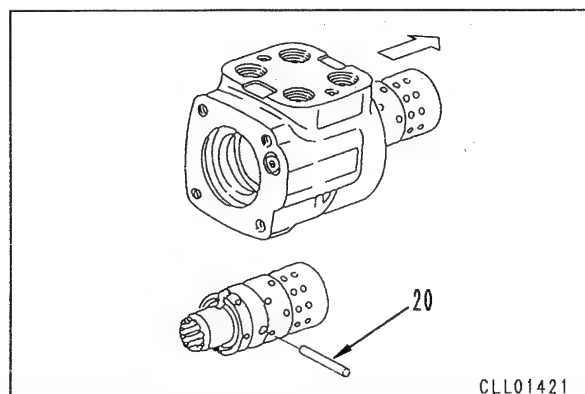
11. Rotate spool and sleeve and set pin in horizontal position, then push spool and sleeve with thumb and remove bushing (3) from housing.
12. Remove seal (5) from bushing (3).
13. Using screwdriver, remove dust seal (1) from bushing.
★ When removing the dust seal, be careful not to damage the bushing.



14. Remove race bearing (7) and needle (8) from spool and sleeve.

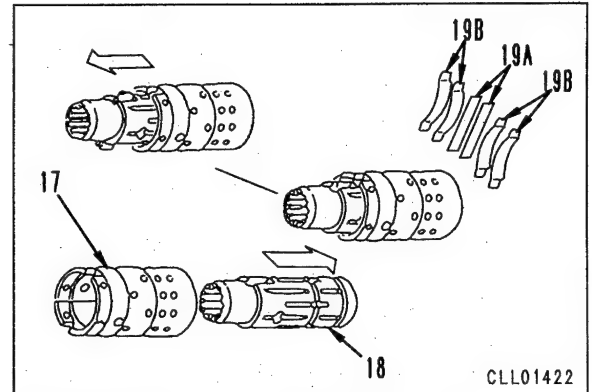


15. Pull out spool and sleeve assembly from opposite side of flange as shown in diagram on right.
★ Be careful not to let the spool and sleeve get caught in the housing, and rotate the spool and sleeve assembly slowly to the left and right to remove it from the housing.
16. Pull out pin (20) from spool and sleeve assembly.

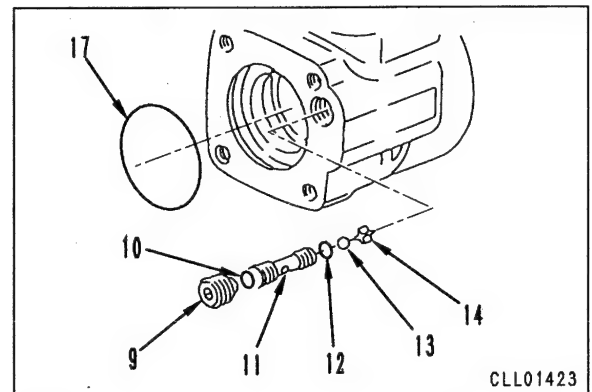


023S02

17. Push out spool (18) inside sleeve (17) slightly, then remove centering springs (19A) and (19B) from spool carefully by hand.
18. Push spool (18) in reverse direction and remove from sleeve (17).
 - ★ Rotate the spool carefully when removing it.



19. Remove O-ring (4) from housing.
20. Remove screw (9) from housing.
21. Install #10-24 threaded bar to seat (11) and pull seat out from housing.
22. Remove O-rings (10) and (12) from seat (11).
23. Tap housing and remove ball (13) and retainer (14).



023S02

ASSEMBLY OF STEERING VALVE ASSEMBLY

★ Before assembling the parts that were disassembled, check the following points.

- 1) Check that there are no scratches, flashes, or burrs on the mating faces.
- 2) Wash all metal parts with clean solvent and blow dry with air.
- 3) Replace the O-rings and seals with new parts. When using the parts again, check carefully that there is no damage, settling, or other deterioration.
- 4) Coat the O-rings with clean grease before using.

1. Using tweezers, assemble retainer (14) in check valve hole of housing.

★ Check that the retainer is assembled securely in the housing and is not at an angle.

2. Install ball (13).


3. Install O-ring (12) (inside diameter: 7.6 ϕ) and O-ring (10) (inside diameter: 9.3 ϕ) in small diameter portion and large diameter portions respectively of seat (11).

4. Set with side with hole facing down and install seat (11) to housing.

5. Install screw (9).

Check that the screw is slightly below the end face of the housing.

 Screw : Thread tightener
(Loctite #242 or equivalent)

 Screw : 11.76 Nm {1.2 kgm}

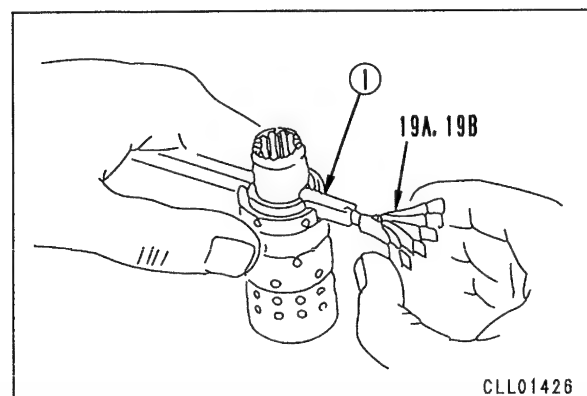
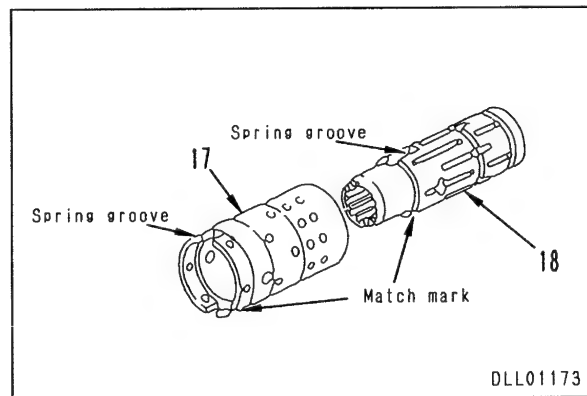
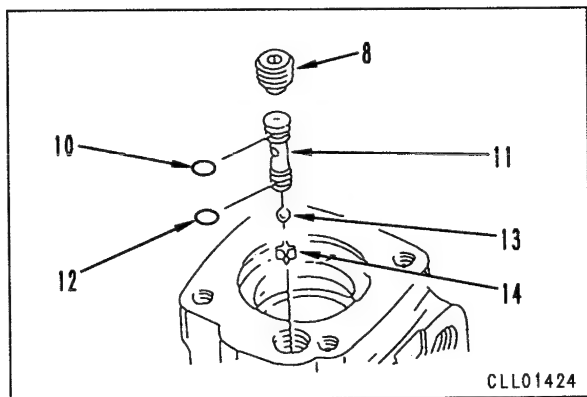
6. Rotate spool and slide to assemble so that position match marks and spring groove of spool (18) and sleeve (17) are on same side.

★ Grip the spline portion of the spool lightly and check that it rotates smoothly inside the sleeve.

7. Align position match marks and spring groove of spool (18) and sleeve (17) and stand on flat plate. Install springs in spring grooves of both parts.

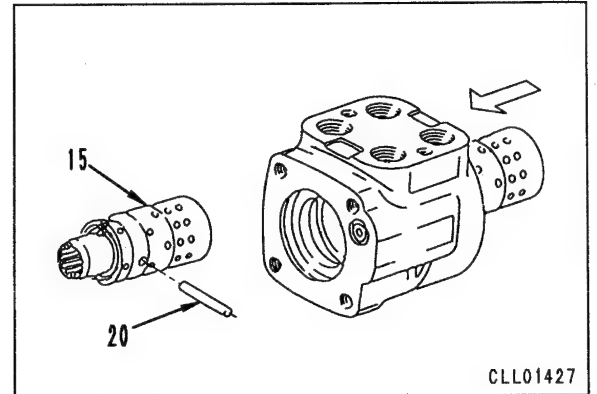
★ Put 2 springs (19A) and 2 springs (19B) each back to back, then use tool (1) to install 6 springs.

8. Hold opposite end of 6 springs (19A) and (19B) with finger, push springs into spool and sleeve groove, and align ends of spool and sleeve when springs are held at center.

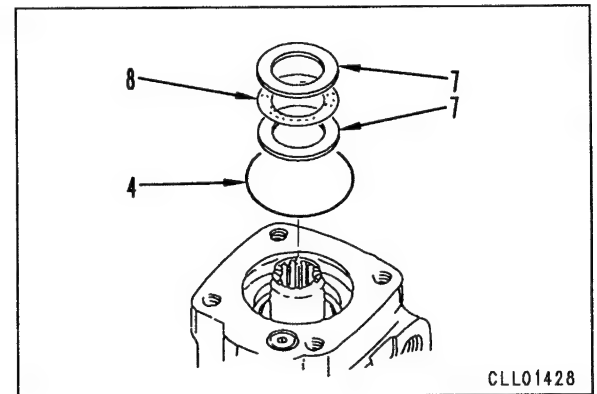


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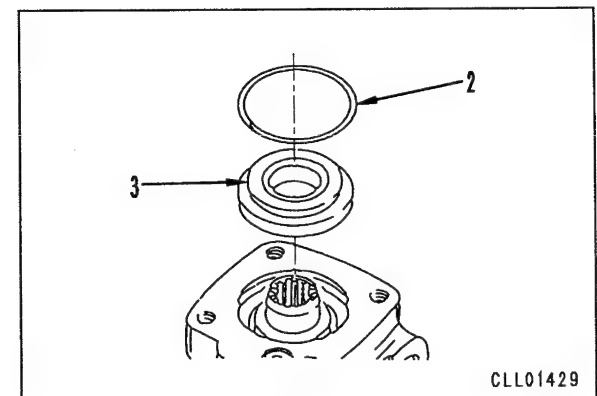
9. Insert pin (20) in hole of sleeve (17) and spool (18), and align outside diameter of sleeve and both ends of pin.
10. Install spool and sleeve assembly (15) from rear of housing.
 - ★ Keep the pin horizontal, rotate it a little at a time to the left and right, and assemble so that spool and sleeve assembly (15) are level with the surface of the housing.
 - ★ In this condition, check that spool and sleeve assembly (15) rotates smoothly inside the housing.



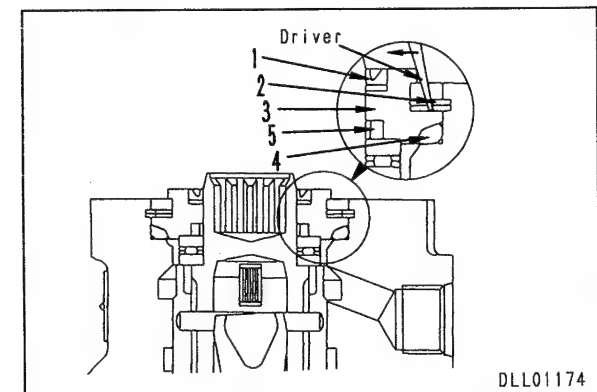
11. Set housing on clean level surface, then install O-ring (4) (inside diameter: 47.2 ϕ) to housing.
12. Install race bearing (7) and needle (8).



13. Install dust seal (1) and seal (5) to bushing (3).
 - ★ Assemble the dust seal so that the flat surface is on the bushing side, and take care not to deform the seal when assembling.
14. Rotate bushing and insert into spool.
 - ★ Check that it is in contact horizontally with the race bearing.



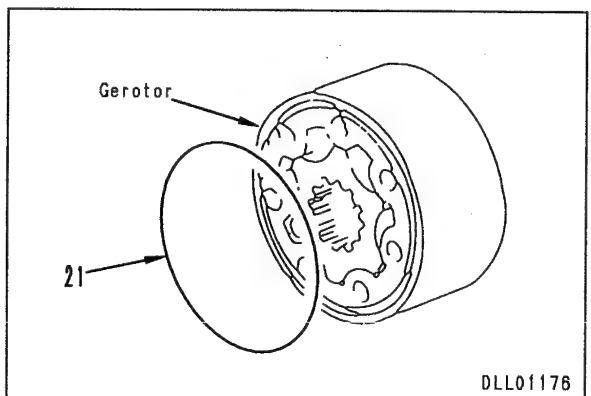
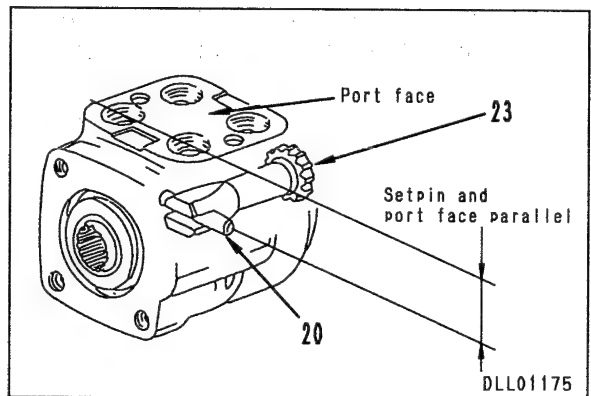
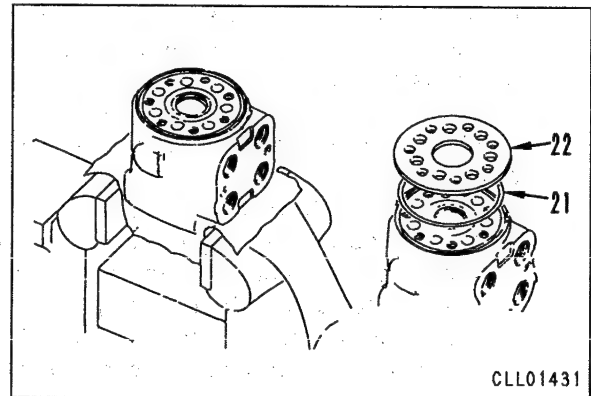
15. Install retaining ring (2) to housing.
 - ★ After fitting the ring, push open the inside diameter of the ring with a screwdriver so that it fits securely in the housing groove.



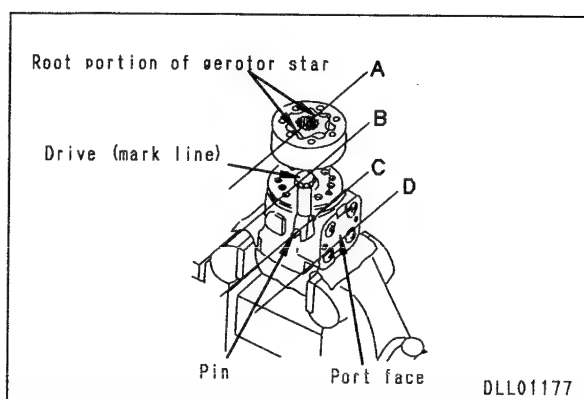
023S02

DASSEMBLY OF GEROTOR END

16. Hold flange portion of housing lightly in vice.
 - ★ Check that the spool and sleeve are slightly lower than the end face of the housing with 14 holes. Wipe the end face of the housing clean with the clean flat of your hand. Wipe the mating surface of spacer plate (22) and the Gerotor clean with the flat of your hand in the same way.
 - ★ Do not wipe with cloth or paper.
17. Install O-ring (21) (inside diameter 72.7 ϕ) to housing, then align spacer plate (22) with mounting bolt hole and tap hole of housing.
18. Set spool and sleeve assembly (15) parallel to pin (20) and port face of housing. Insert drive (23), and mate pin and yoke portion of drive. To carry out positioning accurately, make lines with paint on the end face of the drive spline.
19. Install O-ring (21) to Gerotor.

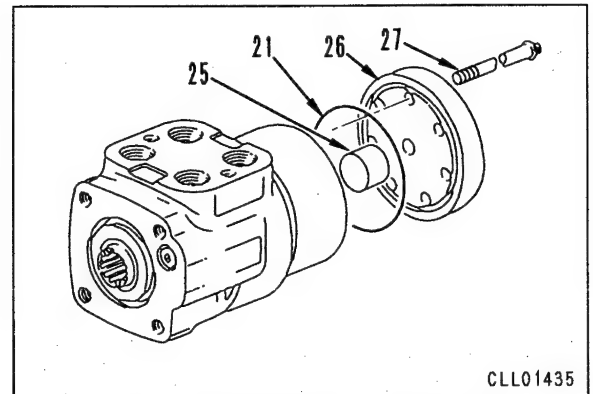


20. Set O-ring side of Gerotor on spacer plate side, align root of Gerotor star (A in diagram on right) and drive (B in diagram on right), and install. Check that lines A, B, C, and D are parallel. Align bolt holes of Gerotor without disconnecting mating of drive and star.
 - ★ The above operation is extremely important for determining the valve timing of the unit.




023S02

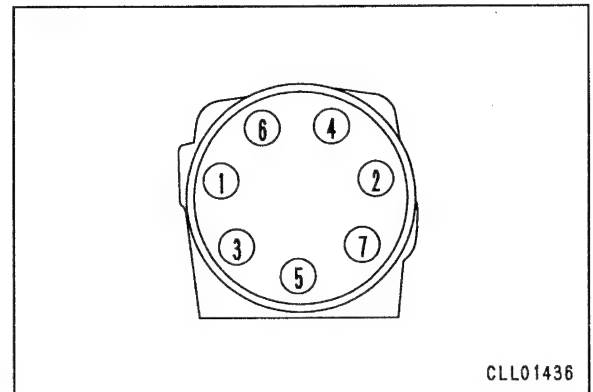
21. Assemble spacer (25) inside Gerotor.
22. Install O-ring (21) to end cap (26).
23. Put end cap (26) on top of Gerotor, and align bolt hole.



24. Coat thread of screw (27) with oil, and install end cap (26).

 **Screw : 14.7 Nm {1.5 kgm}**
(1st pass, all screws)
: 26.95±2.45 Nm {2.75±0.25 kgm}
(install in order shown in diagram on right)

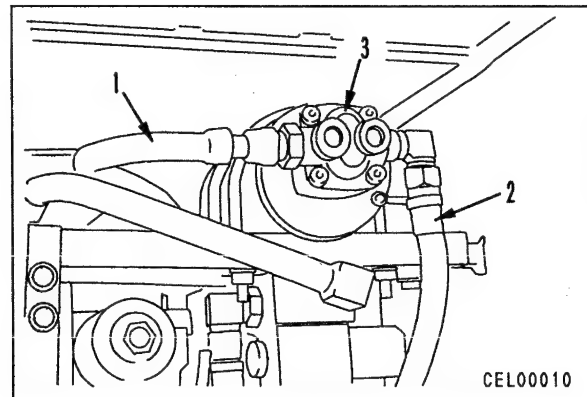
25. Install steering wheel to spool, and check that spool rotates.



REMOVAL OF EMERGENCY STEERING PUMP ASSEMBLY

⚠ Extend the outriggers and raise the machine.

1. Remove tube (1) and hose (2).
2. Remove emergency steering pump assembly (3).



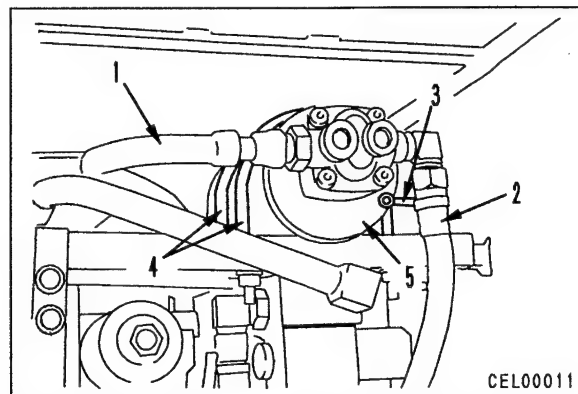
INSTALLATION OF EMERGENCY STEERING PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

REMOVAL OF EMERGENCY STEERING PUMP, MOTOR ASSEMBLY

⚠ Extend the outriggers and raise the machine.

1. Remove tube (1) and hose (2).
2. Disconnect ground connection (3).
3. Remove 2 U-clamps (4).
4. Remove emergency steering pump and motor assembly (5).



INSTALLATION OF EMERGENCY STEERING PUMP, MOTOR ASSEMBLY

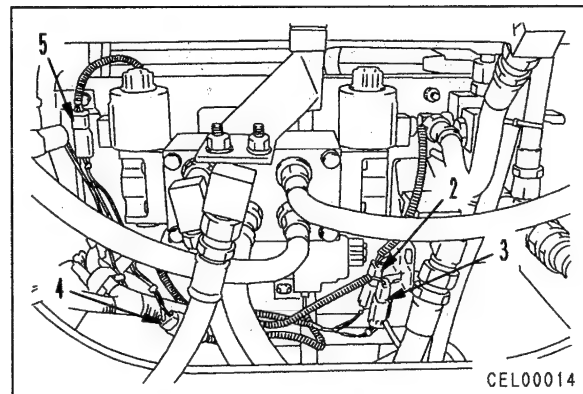
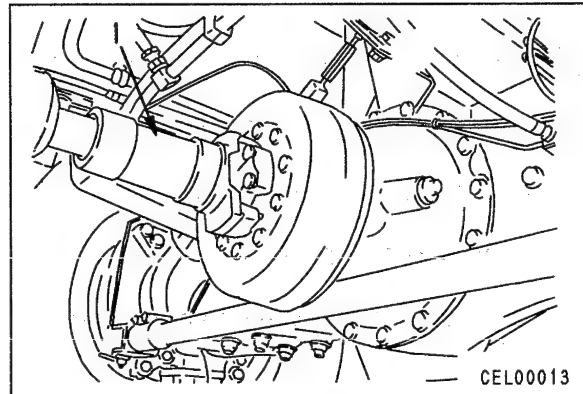
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

REMOVAL OF STEERING MODE SOLENOID VALVE ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.


1. Disconnect front drive shaft (1) at front end. ※ 1
2. Disconnect wiring connectors (L20) (2), (L23) (3), (L19) (4), and (L25) (5).
3. Disconnect 6 hoses (6).
4. Remove U-clamp (7) and clamp (8).
5. Remove steering mode solenoid valve assembly (9).

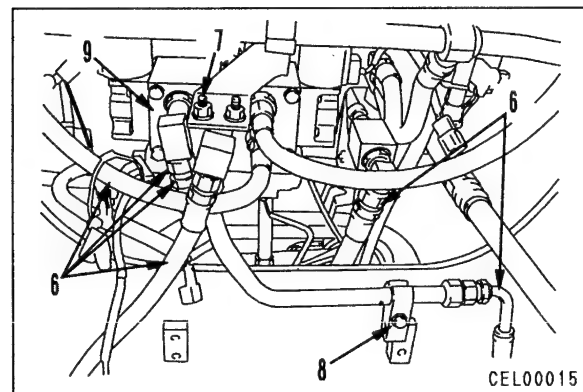


INSTALLATION OF STEERING MODE SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

※ 1

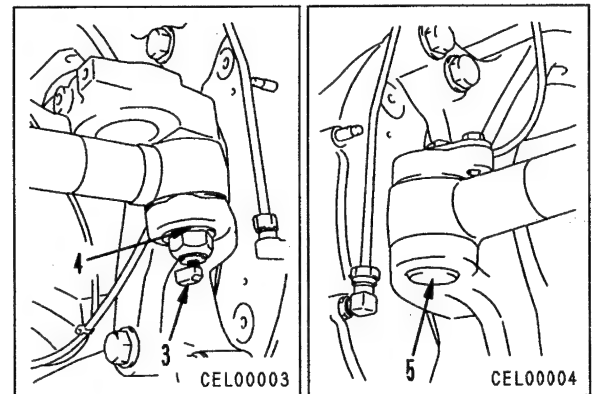
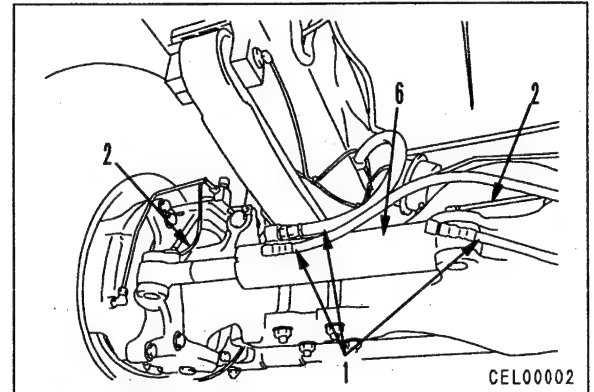
 Front drive shaft mounting bolt :
 $110.25 \pm 12.25 \text{ Nm } \{11.25 \pm 1.25 \text{ kgm}\}$



023S02

REMOVAL OF STEERING CYLINDER ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.
- 1. Remove wheel assembly. For details, see REMOVAL OF WHEEL ASSEMBLY. (Rear right cylinder only)
- 2. Disconnect 3 hoses (1) at bottom end and rod end of steering cylinder. ※ 1
- 3. Disconnect 2 grease supply hoses (2).
- 4. Remove elbow (3). (Front left and rear right cylinders only)
- 5. Remove bottom pin (4) and head pin (5). ※ 2
- 6. Remove steering cylinder assembly (6).



INSTALLATION OF STEERING CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ Install the hoses without twisting or interference.

※ 2

- ⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

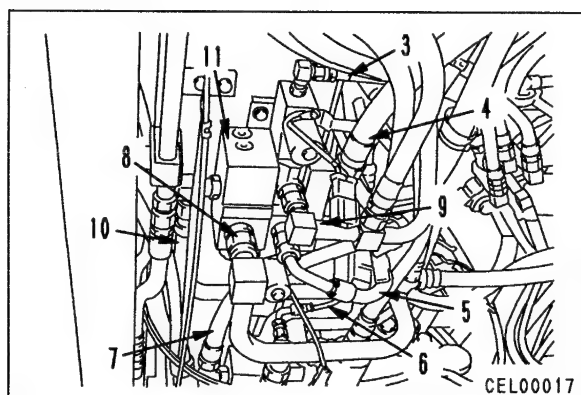
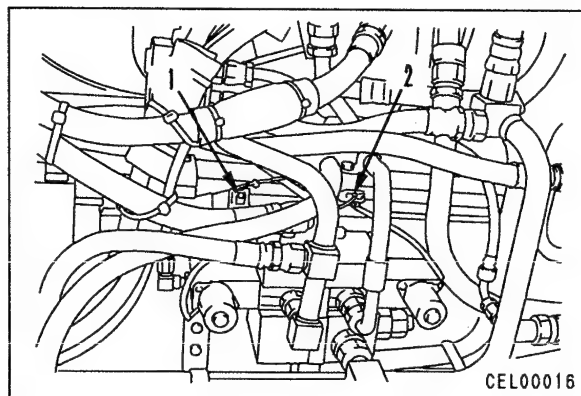
 Pin portion : Grease (G2-LI)

 Pin mounting nut : 196 Nm (20 kgm)

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF OUTRIGGER CONTROL VALVE ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
 - ⚠ Disconnect the cable from the negative (-) terminal of the battery.
1. Disconnect wiring connectors (L16) (1) and (L140) (2).
 2. Disconnect hoses (3), (4), (5), (6), and (7).
 3. Disconnect tubes (8), (9), and (10).
 - ★ Disconnect tube (10) at the swing pump and outrigger merge valve end.
 4. Remove outrigger control valve assembly (11) together with bracket.



INSTALLATION OF OUTRIGGER CONTROL VALVE ASSEMBLY

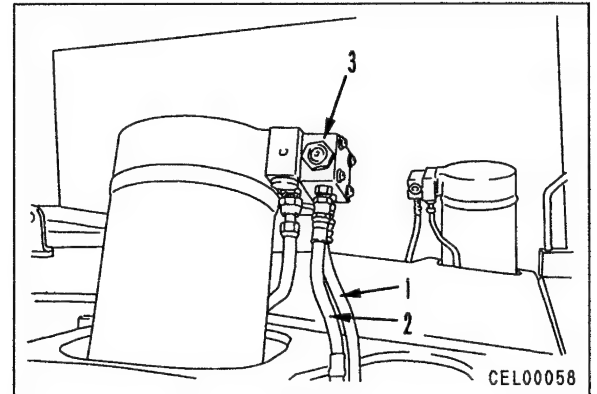
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

REMOVAL OF OUTRIGGER JACK CYLINDER CHECK VALVE ASSEMBLY

⚠ Set the parking brake switch to PARKING.

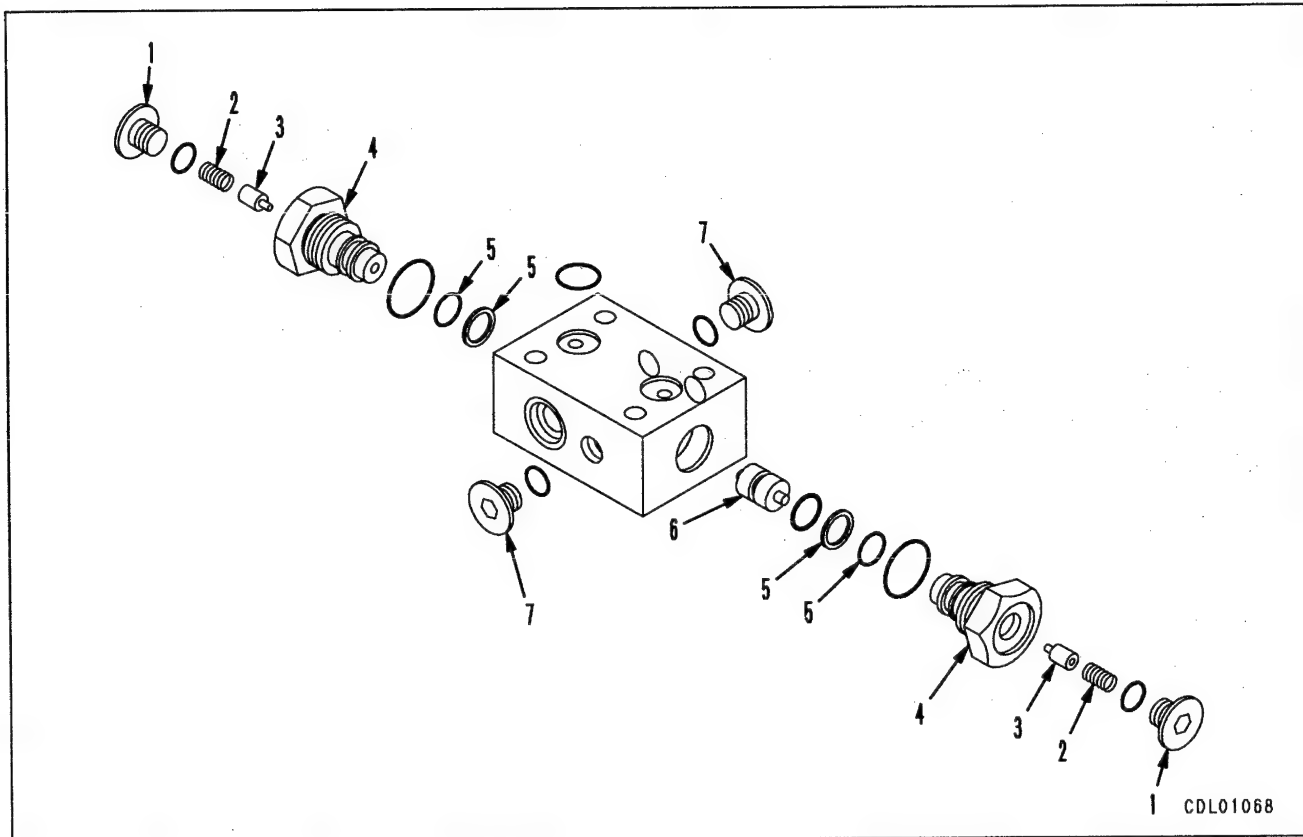
1. Disconnect hoses (1) and (2).
2. Remove outrigger jack cylinder check valve assembly (3).



INSTALLATION OF OUTRIGGER JACK CYLINDER CHECK VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02



023S02

DISASSEMBLY OF OUTRIGGER JACK CYLINDER CHECK VALVE ASSEMBLY

1. Remove plug (1).
2. Remove spring (2) and valve (3).
3. Remove sleeve (4).
4. Remove O-ring (5) and back-up ring (5) from sleeve (4).
5. Remove piston (6).
6. Remove plug (7) from body.

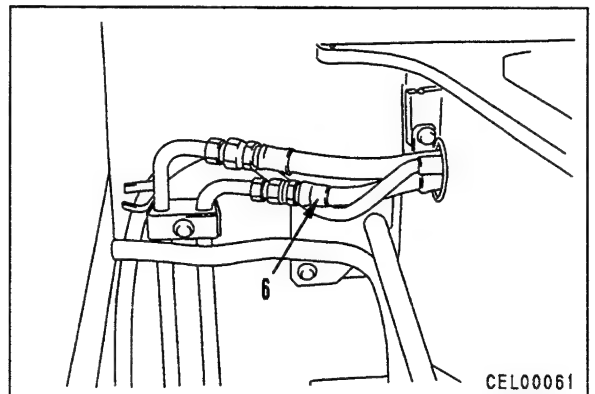
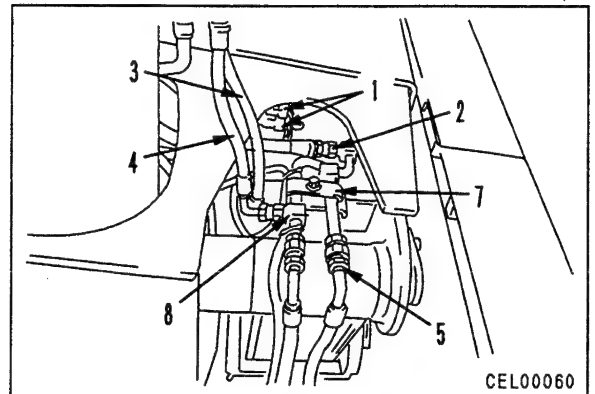
ASSEMBLY OF OUTRIGGER JACK CYLINDER CHECK VALVE ASSEMBLY

1. Fit O-ring and install plug (7) to body.
2. Fit O-ring and assemble piston (6).
3. Assemble back-up ring (5) and O-ring (5) to sleeve (4).
4. Fit O-ring and install sleeve (4).
 kgm Sleeve : $68.6 \pm 9.8 \text{ Nm}$ $\{7 \pm 1 \text{ kgm}\}$
5. Assemble valve (3) and spring (2).
6. Fit O-ring and install plug (1).
 kgm Plug : $20.09 \pm 2.45 \text{ Nm}$ $\{2.05 \pm 0.25 \text{ kgm}\}$

REMOVAL OF OUTRIGGER INDIVIDUAL SOLENOID VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING, then set the outriggers lightly in contact with the ground.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connectors (1) (2 places).
 - ★ Wiring connector Front right : (L42, L46)
 - Front left : (L40, L151)
 - Rear right : (L37, L153)
 - Rear left : (L34, L154)
2. Disconnect hoses (2), (3), (4), (5), and (6).
 - ★ Remove the clamps (2 places) of hose (6).
3. Remove bracket (7), and move tube (8).
4. Disconnect outrigger individual solenoid valve assembly (9). ※ 1




INSTALLATION OF OUTRIGGER INDIVIDUAL SOLENOID VALVE ASSEMBLY

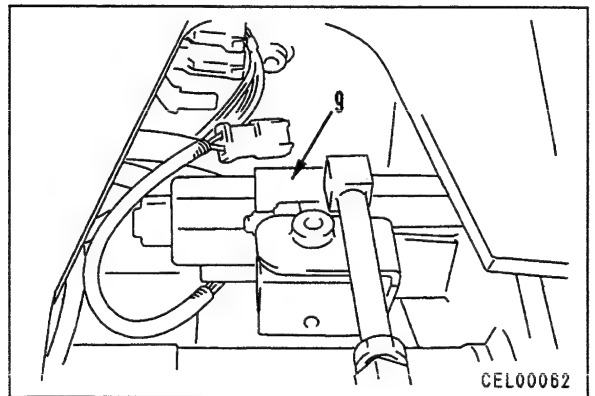
- Carry out installation in the reverse order to removal.

※ 1

- ★ If the solenoid valve has been removed from the outrigger individual solenoid valve assembly, be sure to tighten correctly to the tightening torque below.

 **kgm** Solenoid valve mounting bolt
(M5 with hexagonal socket) :
4.90 – 6.86 Nm {0.5 – 0.7 kgm}

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



REMOVAL OF OUTRIGGER SLIDE CYLINDER ASSEMBLY (X-SHAPED)

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Extend the outrigger of the cylinder to be removed to a point approx. 100 mm before the end of its stroke, and put the outriggers lightly in contact with the ground.
- 1. Remove cotter pin (1) of cylinder head end, then remove pin (2). ※ 1
 - ★ When removing the pin, support the bottom of the cylinder at the head end on a block in order to prevent the cylinder from causing damage to the grease nipple.
 - ★ After removing, run the engine and retract the cylinder.
- 2. Disconnect hoses (3) and (4) from cylinder bottom end.
- 3. Remove cotter pin (5) from cylinder bottom end, then remove pin (6). ※ 2
- 4. Sling bottom end of cylinder.
 - ★ Set block (1) under cylinder inside outrigger (7). Choose block height to make cylinder horizontal.
- 5. Pass cylinder through inside of outrigger and pull out to outside.
 - ★ The cylinder head is stepped, so push down the bottom end and pass the head end through.
- 6. Sling outrigger slide cylinder assembly (8) again outside outrigger, then lift off.



Outrigger slide cylinder assembly : 55 kg

INSTALLATION OF OUTRIGGER SLIDE CYLINDER ASSEMBLY (X-SHAPED)

- Carry out installation in the reverse order to removal.

※ 1 ※ 2



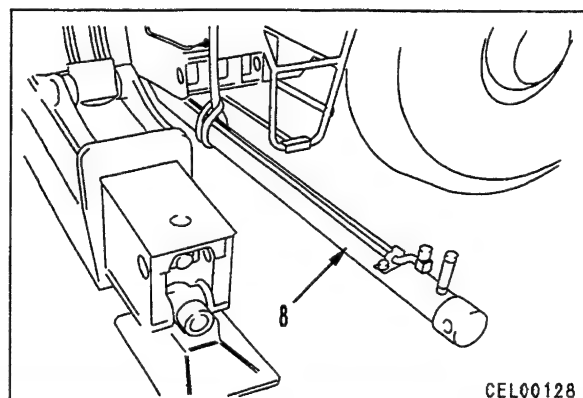
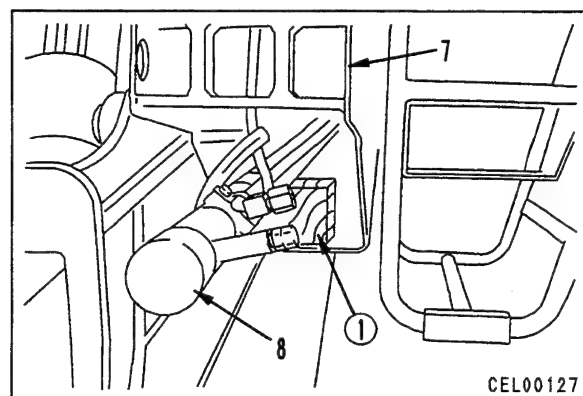
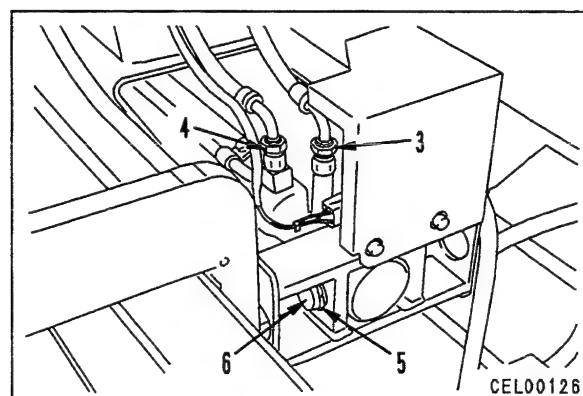
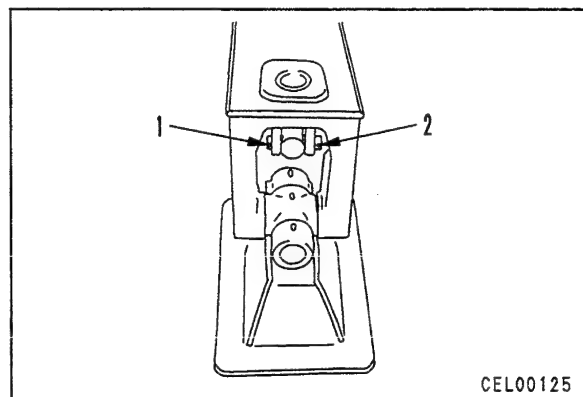
When aligning the position of the pin hole, never insert your fingers in the pin hole.



Outrigger slide cylinder pin portion :

Grease (G2-LI)

- ★ Bend the cotter pin securely.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the cylinder.
For details, see TESTING AND ADJUSTING, Bleeding air.

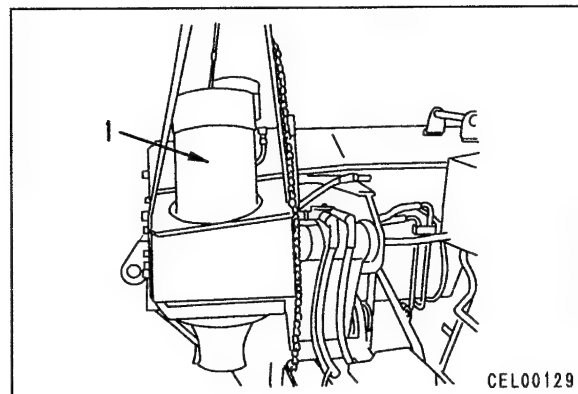


REMOVAL OF OUTRIGGER JACK CYLINDER ASSEMBLY (X-SHAPED)

1. Remove outrigger assembly.
For details, see REMOVAL OF OUTRIGGER ASSEMBLY.
2. Remove outrigger jack cylinder check valve assembly.
For details, see REMOVAL OF OUTRIGGER JACK CYLINDER CHECK VALVE ASSEMBLY.
3. Sling outrigger jack cylinder (1), then remove mounting bolts, and lift off.



Outrigger jack cylinder assembly : 130 kg



INSTALLATION OF OUTRIGGER JACK CYLINDER ASSEMBLY (X-SHAPED)

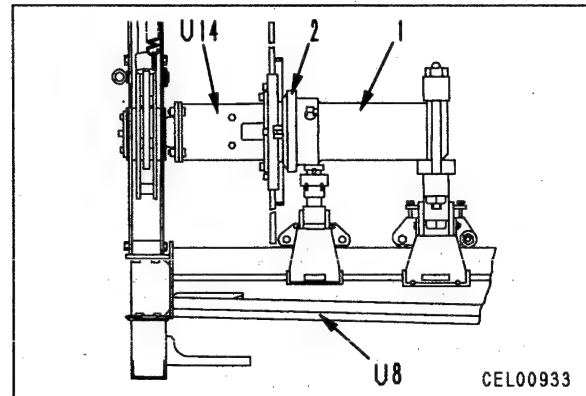
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the cylinder.
For details, see TESTING AND ADJUSTING, Bleeding air.

023S02

DISASSEMBLY OF OUTRIGGER JACK CYLINDER ASSEMBLY (X-SHAPED)

1. Piston rod assembly

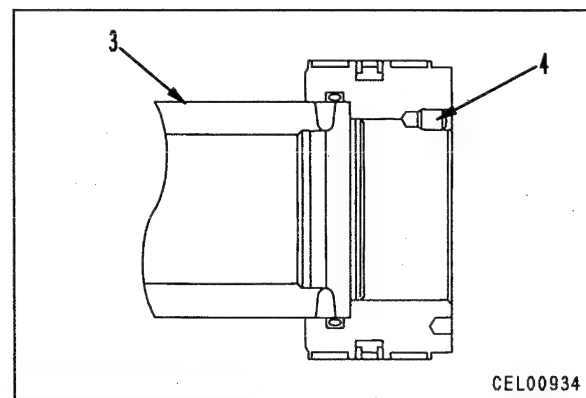
- 1) Set cylinder assembly (1) to tool U8.
- 2) Put cylinder assembly (1) on block (1), then using tool **U14**, loosen cylinder head assembly (2).



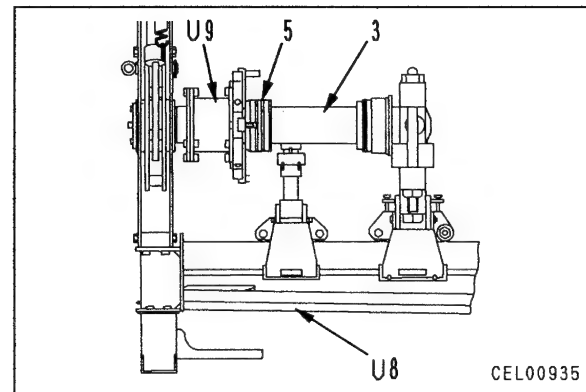
- 3) Remove piston rod assembly (3).
★ Put an oil pan under the cylinder to catch the oil.

2. Piston assembly

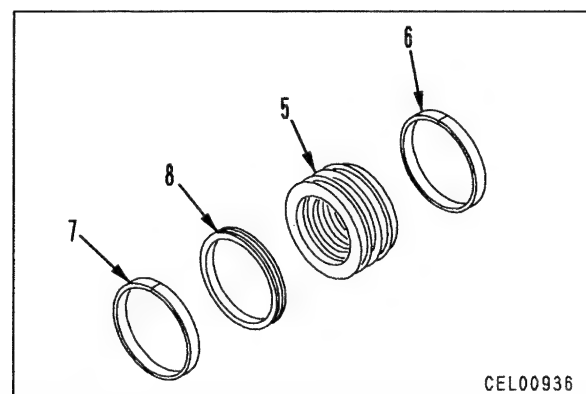
- 1) Remove stopper bolt (4).



- 2) Put piston rod assembly (3) on block (1), then set to tool **U8**.
- 3) Using tool **U9**, remove piston assembly (5).



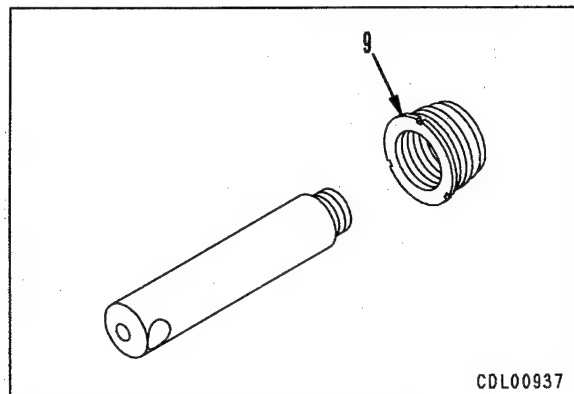
- 4) Disassemble piston rings assembly (5) as follows.
 - i) Remove wear rings (6) and (7).
 - ii) Remove piston ring (8).



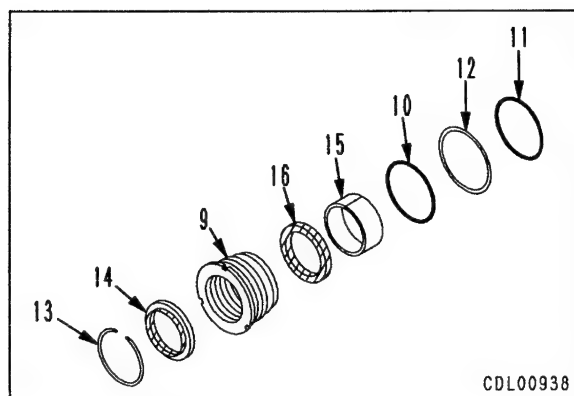
023S02

3. Cylinder head assembly

- 1) Remove cylinder head assembly (9) from piston rod.



- 2) Disassemble cylinder head assembly as follows.
 - i) Remove O-rings (10) and (11) and back-up ring (12).
 - ii) Remove snap ring (13), then remove dust seal (14).
 - iii) Remove bushing (15), then remove packing (16).



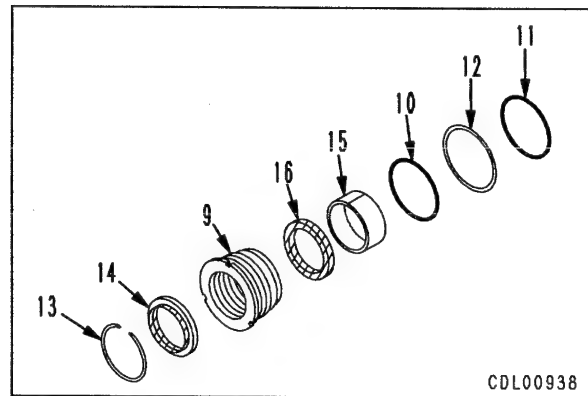
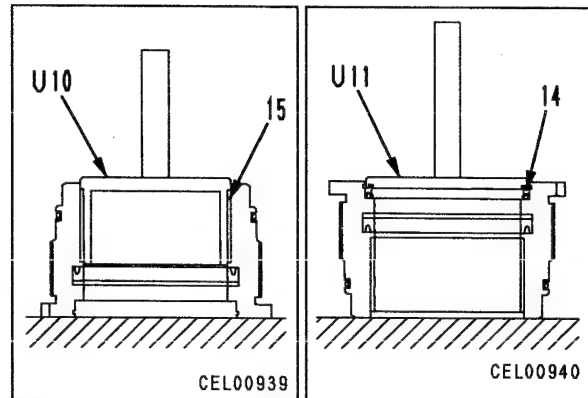
023S02

ASSEMBLY OF OUTRIGGER JACK CYLINDER ASSEMBLY (X-SHAPED)

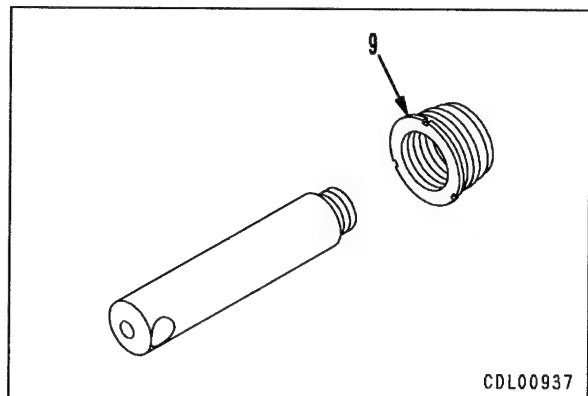
- ★ Coat the sliding surfaces of all parts with engine oil before installing. Be careful not to damage the packings, dust seals, and O-rings when installing.

1. Cylinder head assembly

- 1) Assemble cylinder assembly as follows.
 - i) Install packing (16).
 - ii) Using tool **U10**, press fit bushing (15).
 - iii) Using tool **U11**, press fit dust seal (14).
 - iv) Install snap ring (13).
 - v) Install back-up ring (12), and O-rings (11) and (10).

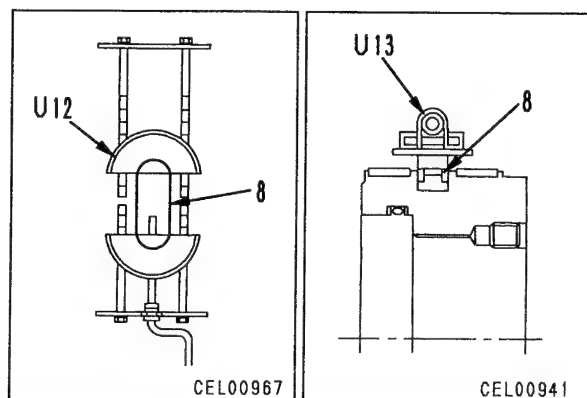


- vi) Install cylinder head assembly (9) to piston rod.

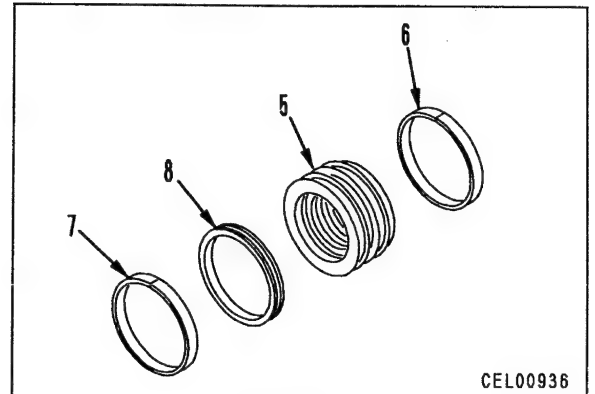


2. Piston assembly


- 1) Assemble piston assembly as follows.
 - i) Using tool **U12**, expand piston ring (8).
 - ★ Set piston ring (8) on the tool and turn the handle 8 – 10 times to expand the ring.
 - ii) Remove piston ring (8) from tool **U12**, and install to piston.
 - iii) Set tool **U13** in position, and compress piston ring (8).

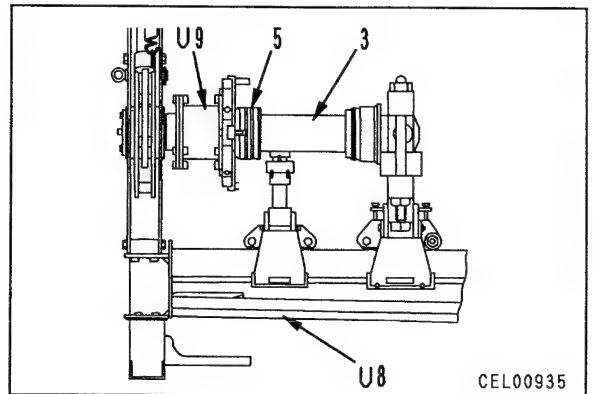


- iv) Install wear rings (7) and (6) to piston.
- 2) Install piston assembly (5) to piston rod.

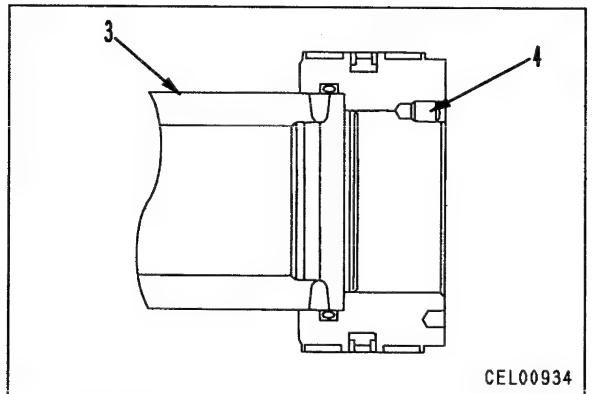


- 3) Put piston rod assembly (3) on block (1), and set to tool **U8**.
- 4) Using tool **U9**, tighten piston assembly (5).

 **kgm** Piston assembly :
 $98 \pm 9.8 \text{ Nm}$ { $10 \pm 1 \text{ kgm}$ }

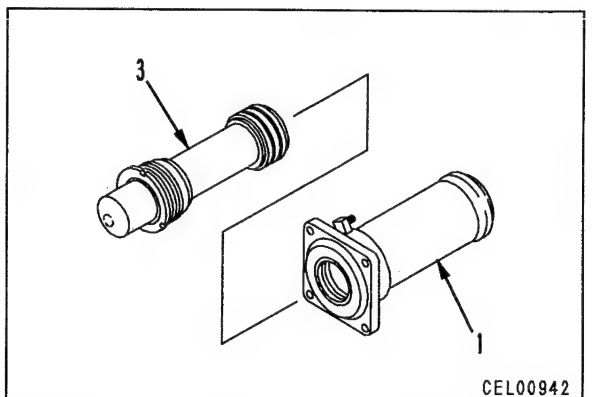


- 5) Install stopper bolt (4).




3. Piston rod assembly

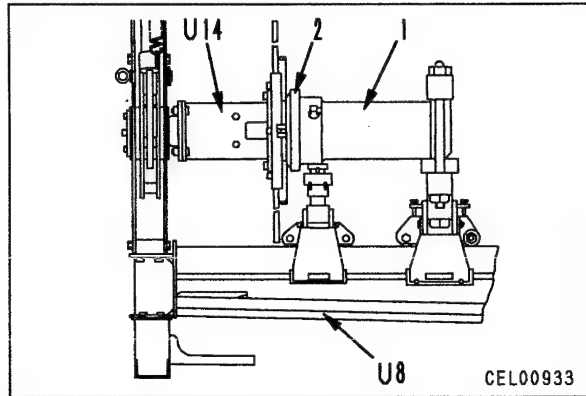
- 1) Assemble piston rod assembly (3) to cylinder (1).
- ★ Coat the seal portion of the piston with grease.
 - ★ Push the piston rod fully.
 - ★ Coat the back-up ring with grease.



2) Put cylinder assembly (1) on block (1), and set to tool **U8**.

3) Using tool **U14**, tighten cylinder head assembly (2).

 Cylinder head assembly :
1274 ± 127.4 Nm {130 ± 13 kgm}



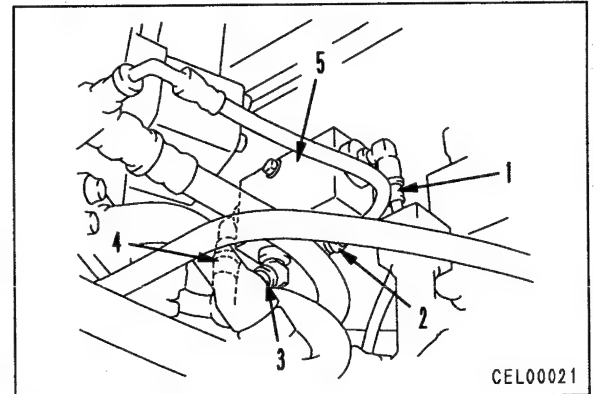
REMOVAL OF OUTRIGGER SLIDE PILOT CHECK VALVE

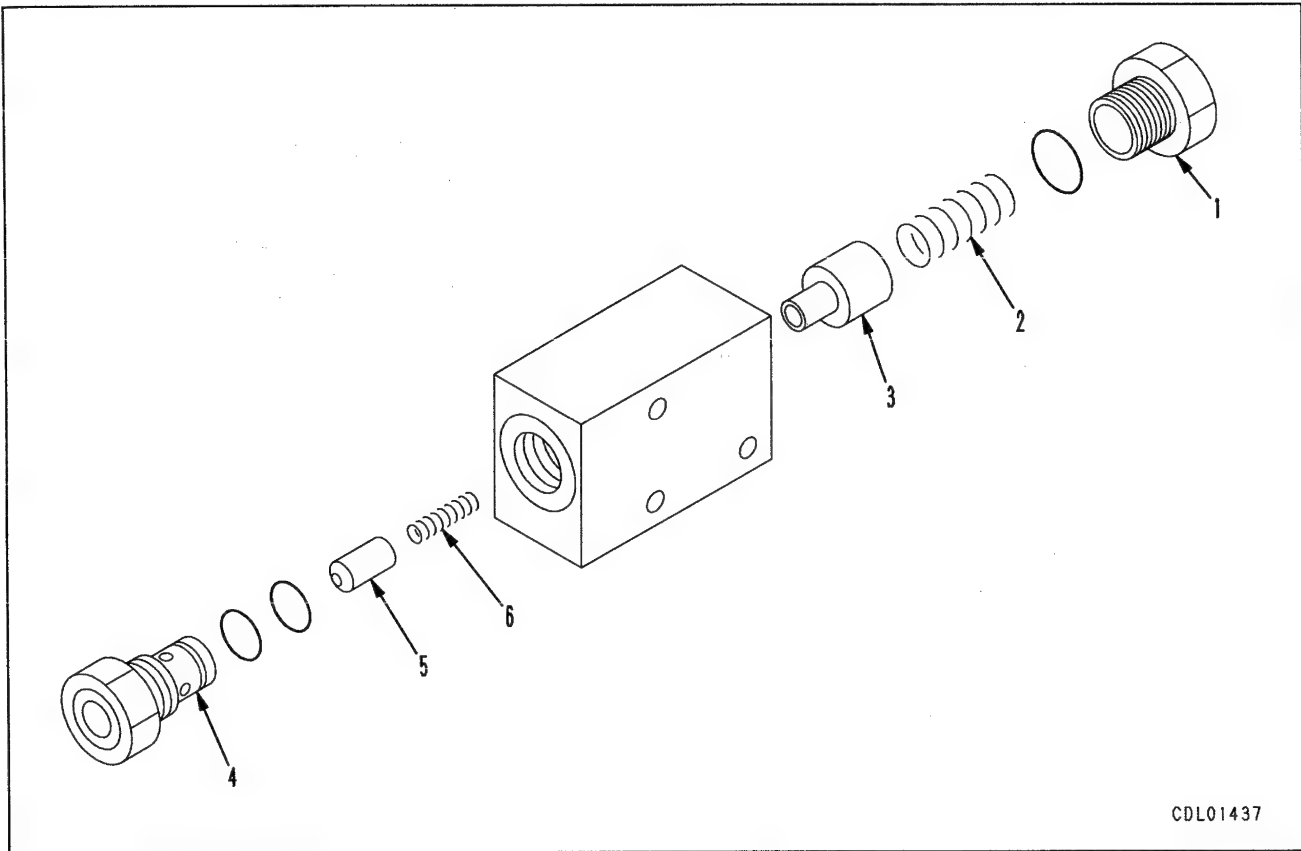
⚠ Extend the outriggers and raise the machine.

1. Disconnect hoses (1), (2), (3), and (4).
2. Remove outrigger slide pilot check valve (5).

INSTALLATION OF OUTRIGGER SLIDE PILOT CHECK VALVE

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.





DISASSEMBLY OF OUTRIGGER SLIDE PILOT CHECK VALVE

1. Remove plug (1).
2. Remove spring (2) and piston (3).
3. Remove sleeve (4).
4. Remove spool (5) and spring (6).

ASSEMBLY OF OUTRIGGER SLIDE PILOT CHECK VALVE

1. Assemble spring (6) and spool (5).
2. Fit O-ring and install sleeve (4).
Sleeve : 137.2 ± 4.7 Nm { 14 ± 1.5 kgm}
3. Assemble piston (3) and spring (2).
4. Fit O-ring and install plug (1).
Plug : 151.9 ± 24.5 Nm { 15.5 ± 2.5 kgm}

023S02

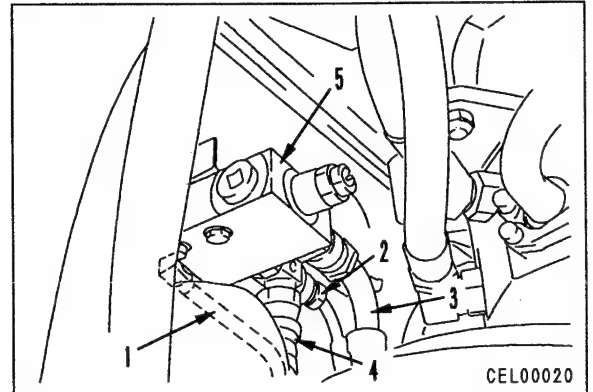
REMOVAL OF PPC RELIEF VALVE

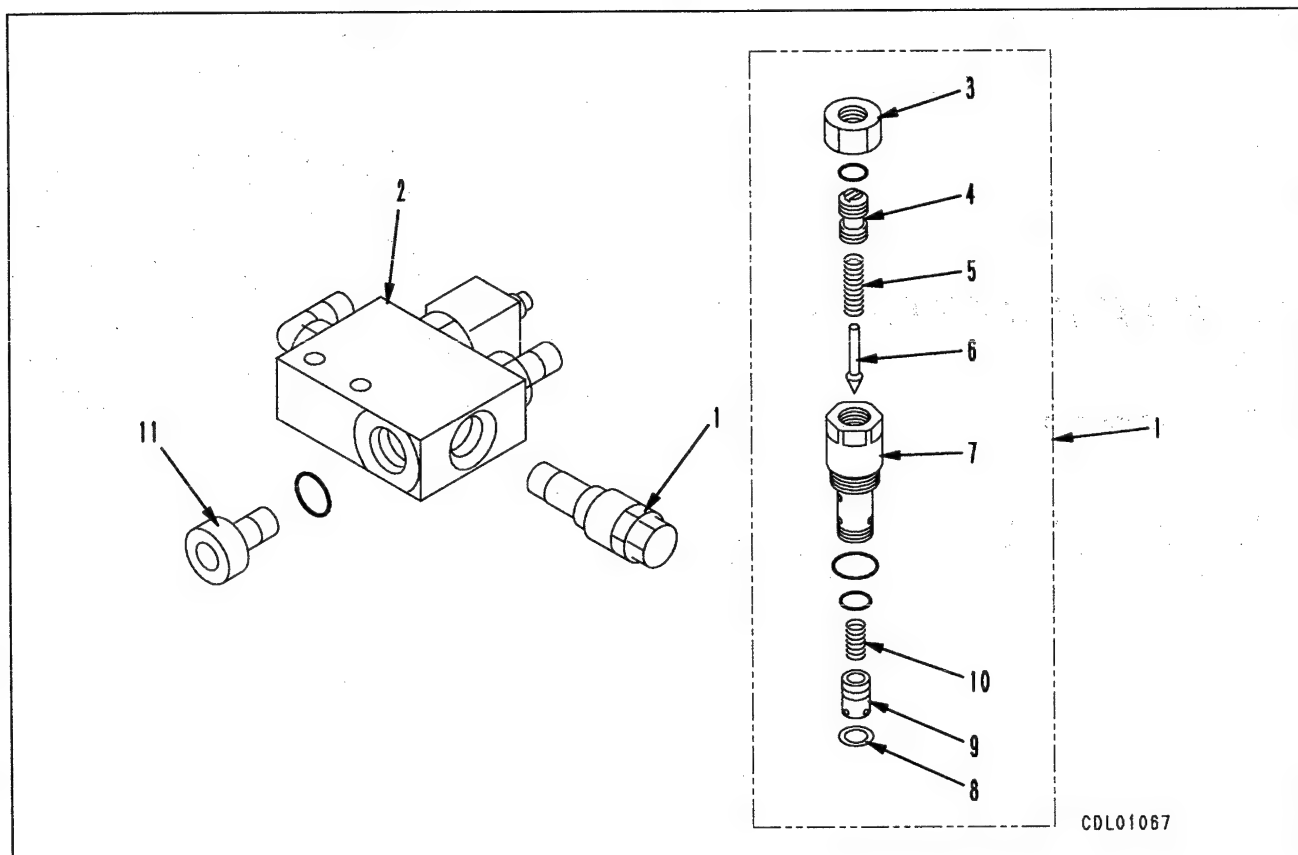
⚠ Extend the outriggers and raise the machine.

1. Disconnect hoses (1), (2), (3), and (4).
2. Remove PPC relief valve (5).

INSTALLATION OF PPC RELIEF VALVE

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.





DISASSEMBLY PPC RELIEF ASSEMBLY VALVE

1. Relief valve assembly

- 1) Remove relief valve assembly (1) from block (2).
- 2) Remove nut (3).
- 3) Remove screw (4).
- 4) Remove spring (5), then remove poppet (6) from sleeve (7).
- 5) Remove snap ring (8).
- 6) Remove valve (9), then remove spring (10).

2. Plug

Remove plug (11) from block (2).

ASSEMBLY PPC RELIEF ASSEMBLY VALVE

1. Plug

Fit O-ring and install plug (11) to block (2).

2. Relief valve assembly

- 1) Assemble spring (10) to valve (9).
- 2) Fit O-ring and valve (9) to sleeve (7).
- 3) Install snap ring (8).
- 4) Assemble poppet (6) and spring (5).
- 5) Fit O-ring and install screw (4).
- 6) Install nut (3).

Nut : $68.6 \pm 9.8 \text{ Nm}$ $\{7 \pm 1 \text{ kgm}\}$

- 7) Fit O-ring and install relief valve assembly (1) to block (2).

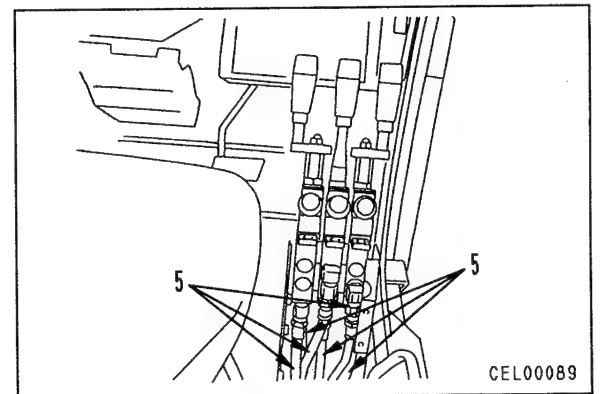
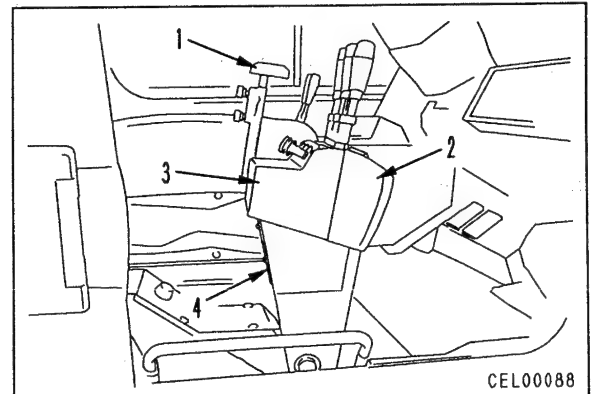
Relief valve assembly :
 $53.9 \pm 4.9 \text{ Nm}$ $\{5 \pm 0.5 \text{ kgm}\}$

- After installing the PPC relief valve assembly to the machine, adjust the PPC relief pressure. For details, see TESTING AND ADJUSTING, Measuring and adjusting oil pressure.

REMOVAL OF BOOM HOIST, MAIN WINCH, AUXILIARY WINCH PPC VALVE ASSEMBLY

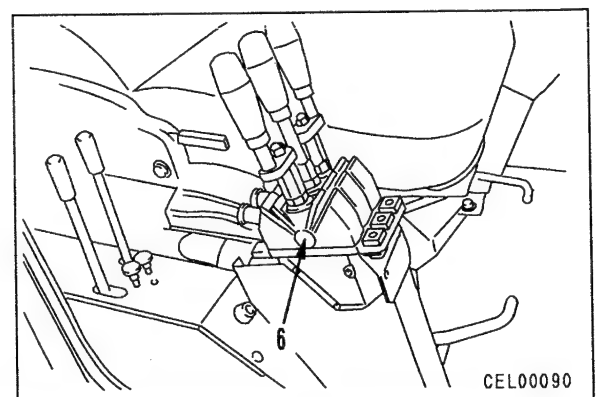
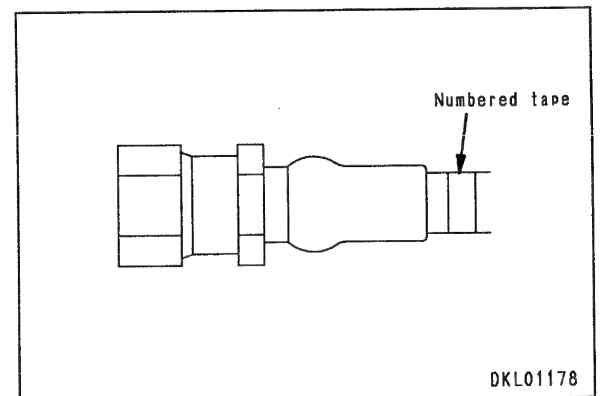
! Set the parking brake switch to PARKING.

1. Remove armrest (1) and covers (2), (3), and (4).
2. Pull out PPC valve from stand, then disconnect 8 PPC hoses (5).
 - ★ There is is numbered tape stuck to the PPC hoses, so fit a tag with the same number to the PPC valve.
3. Remove boom hoist, main winch, and auxiliary winch PPC valve assembly (6).



INSTALLATION OF BOOM HOIST, MAIN WINCH, AUXILIARY WINCH PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

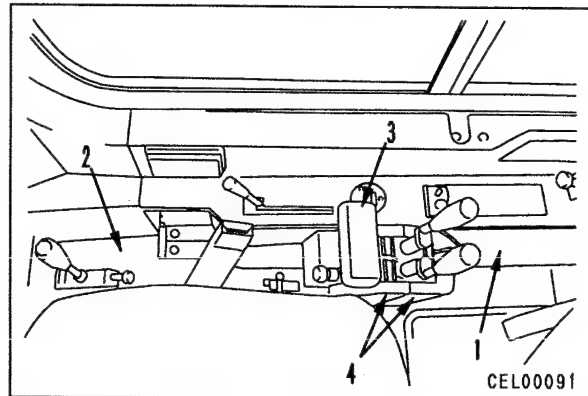


023S02

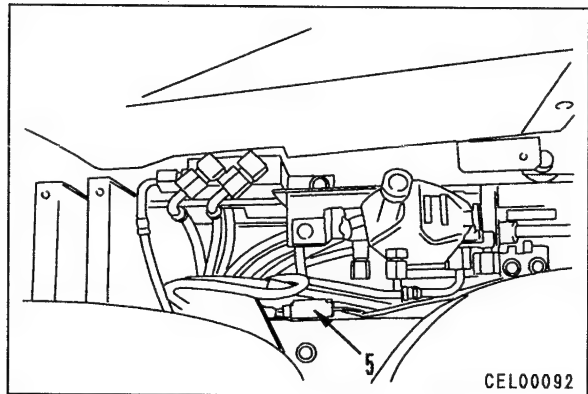
REMOVAL OF JIB POWER TILT, SWING PPC VALVE ASSEMBLY

⚠ Set the parking brake switch to PARKING.

1. Remove covers (1) and (2).
2. Remove 3 covers (4) and armrest (3) from PPC valve assembly.

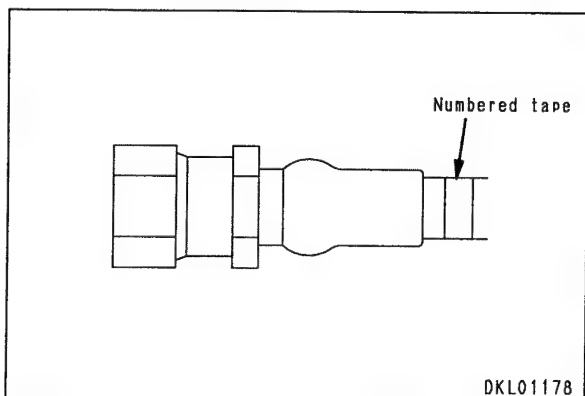
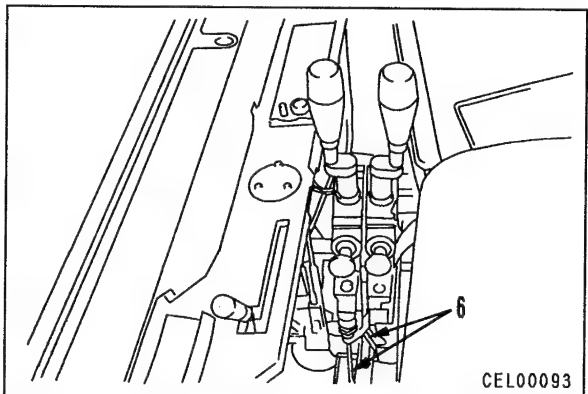


3. Disconnect wiring connector (L110) (5).



4. Pull out PPC valve from stand, and disconnect 6 PPC hoses (6).

★ There is numbered tape stuck to the PPC hoses, so fit a tag with the same number to the PPC valve.

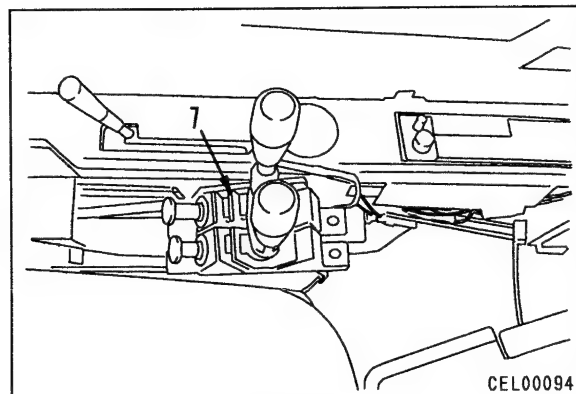


023S02

5. Remove jib power tilt and swing PPC valve assembly (7).

INSTALLATION OF JIB POWER TILT, SWING PPC VALVE ASSEMBLY

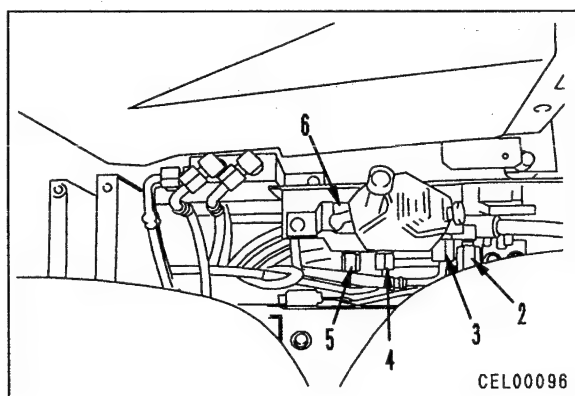
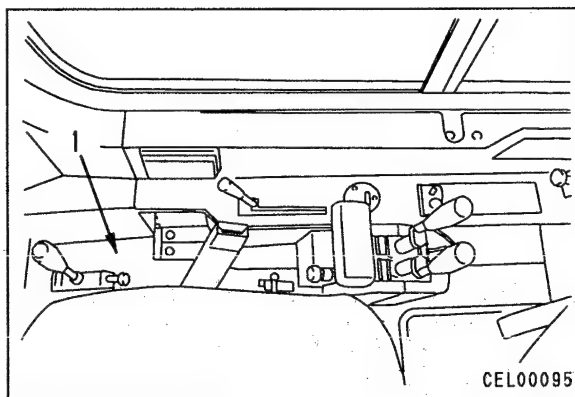
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



REMOVAL OF BOOM TELESCOPE PPC VALVE ASSEMBLY

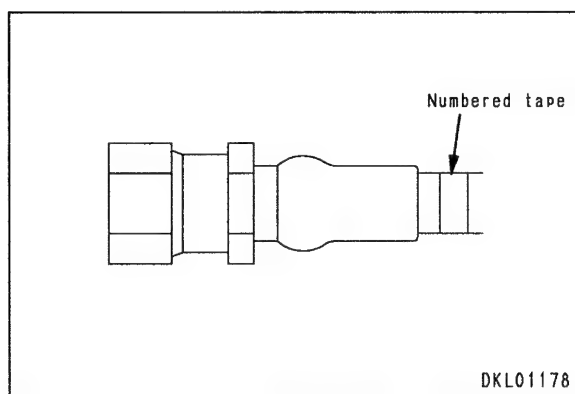
⚠ Set the parking brake switch to PARKING.

1. Remove cover (1).
2. Disconnect PPC hoses (2), (3), (4), and (5). ※ 1
 ★ There is numbered tape stuck to the PPC hoses, so fit a tag with the same number to the PPC valve.
3. Remove boom telescope PPC valve assembly (6).



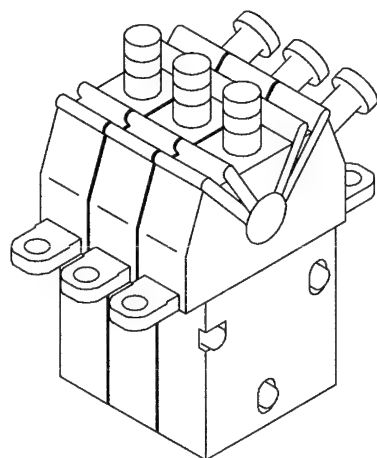
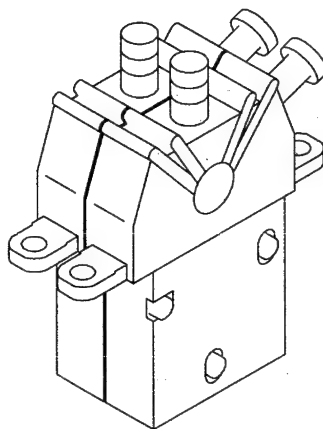
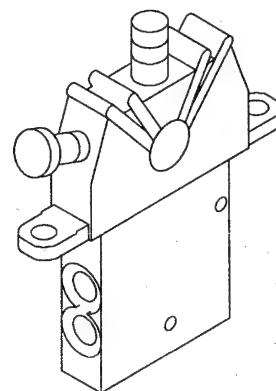
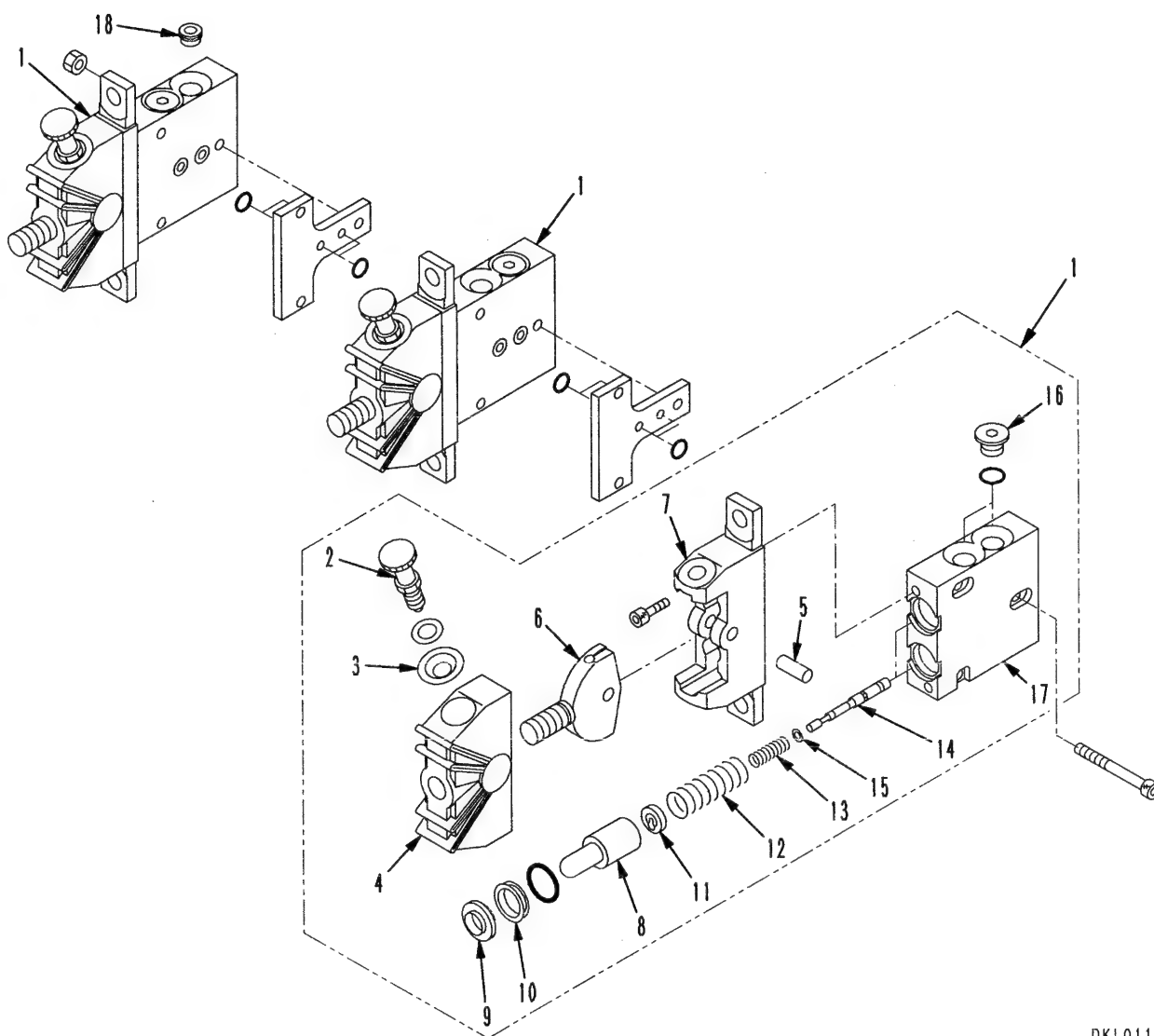
INSTALLATION OF BOOM TELESCOPE PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
 Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S02

DISASSEMBLY OF LEVER CONTROL PPC VALVE ASSEMBLY

Boom hoist, main winch,
auxiliary winch PPC valveJib power tilt, swing
PPC valveBoom telescope
PPC valve

DKL01179

023S02

- ★ The following explanation gives the procedure for the boom hoist, main winch, and auxiliary winch PPC valve assemblies (3-spool PPC valve assemblies).

The jib power tilt and swing PPC valve assemblies (2-spool PPC valve assemblies) and boom telescope PPC valve assembly differ only in the number of PPC valves.

1. Disconnection of valve

Disconnect PPC valve assembly (1).

2. Boot

Remove stopper (2) and washer (3), then remove boot (4).

3. Lever

Remove shaft (5), then remove lever (6).

4. Plate

Remove plate (7).

5. PPC valve

- 1) Remove piston (8).
- 2) Remove seal (9) and collar (10) from piston (8).
- 3) Remove retainer (11).
- 4) Remove outer spring (12) and inner spring (13).
- 5) Remove spool (14).
- 6) Remove shims (15) from spool (14).
 - ★ Check the number and thickness of the shims at each mount, and keep in a safe place.

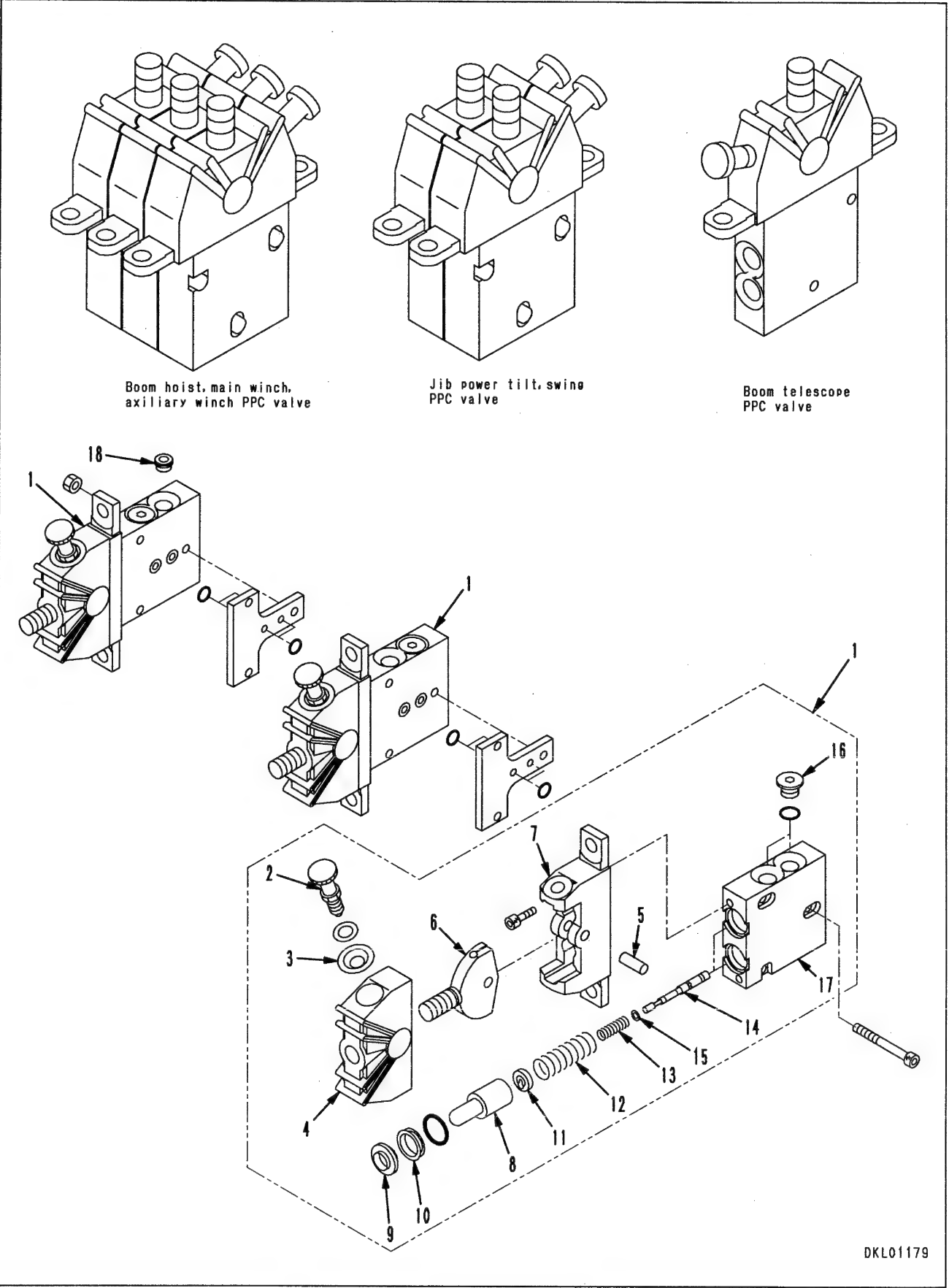
6. Plug

Remove plug (16) from body (17).

7. Filter

Remove filter (18).

ASSEMBLY OF LEVER CONTROL PPC VALVE ASSEMBLY




023S02

DKL01179

1. Filter

Install filter (18).

- ★ Be careful not to tighten the filter too much. If it is tightened to an excessive torque, the output pressure characteristics will become defective.

 Filter :
 $10.29 \pm 1.47 \text{ Nm} \{1.05 \pm 0.15 \text{ kgm}\}$

2. Plug

Fit O-ring and install plug (16) to body (17).

 Plug :
 $22.05 \pm 2.45 \text{ Nm} \{2.25 \pm 0.25 \text{ kgm}\}$

3. PPC valve

- 1) Assemble shims (15) to spool (14).
 - ★ Assemble the same number and thickness of shim (15) as was removed during disassembly.


- 2) Assemble spool (14).

- 3) Assemble inner spring (13) and outer spring (12).

- ★ Inner spring (13) is not symmetrical at the top and bottom, so assemble the end with the small diameter end turn at the shim end.

Diameter of end turn (inside diameter): Small diameter: $\phi 4.9 \text{ mm}$
Large diameter: $\phi 5.3 \text{ mm}$

- 4) Assemble retainer (11).
- 5) Fit O-ring and assemble collar (10) and seal (9) to piston (8).
- 6) Assemble piston (8).

 Outer circumference of piston and inner circumference of body hole :
Grease (G2-LI)

6. Boot

- 1) Install boot (4).

- ★ Align rotation center of boot (4) and lever (6) when installing.


- 2) Install washer (3) and stopper (2).

- ★ Install washer (3) securely in washer groove of plate (7) and be careful not to get boot (4) caught.

 Stopper :
 $17.15 \pm 2.45 \text{ Nm} \{1.75 \pm 0.25 \text{ kgm}\}$


7. Connection of valve

Insert spacer (19) and O-ring between PPC valve assembly (1) and connect.

 Mounting bolt, nut :
 $10.29 \pm 1.47 \text{ Nm} \{1.05 \pm 0.15 \text{ kgm}\}$

4. Plate


Install plate (7).

 Mounting bolt :
 $13.23 \pm 1.47 \text{ Nm} \{1.35 \pm 0.15 \text{ kgm}\}$

5. Lever

Fit lever (6), and press fit shaft (5).

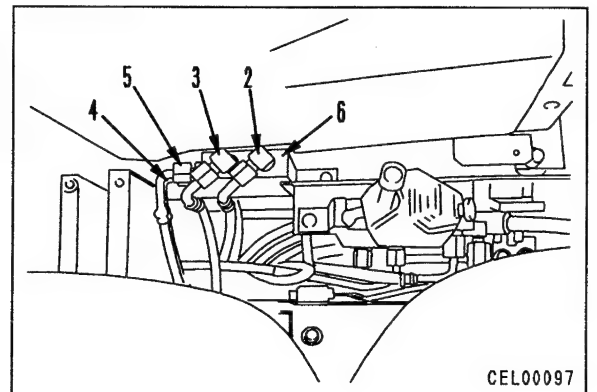
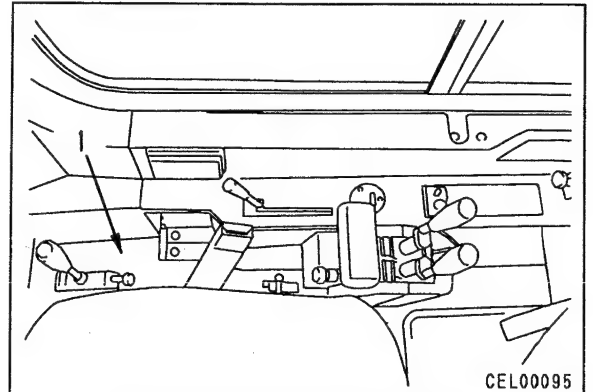
- ★ Press fit shaft (5) slowly with a press.

 Outer circumference of shaft and inner circumference of plate hole:
Grease (G2-LI)

REMOVAL OF PEDAL CONTROL PPC VALVE ASSEMBLY

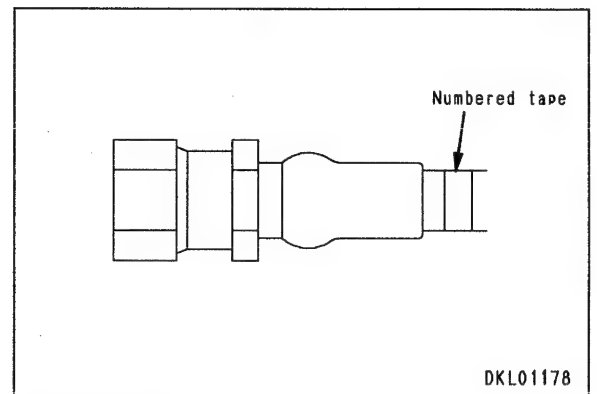
⚠ Set the parking brake switch to PARKING.

1. Remove cover (1).
2. Disconnect PPC hoses (2), (3), (4), and (5).
 - ★ There is numbered tape stuck to the PPC hoses, so fit a tag with the same number to the PPC valve.
3. Remove pedal control PPC valve assembly (6).



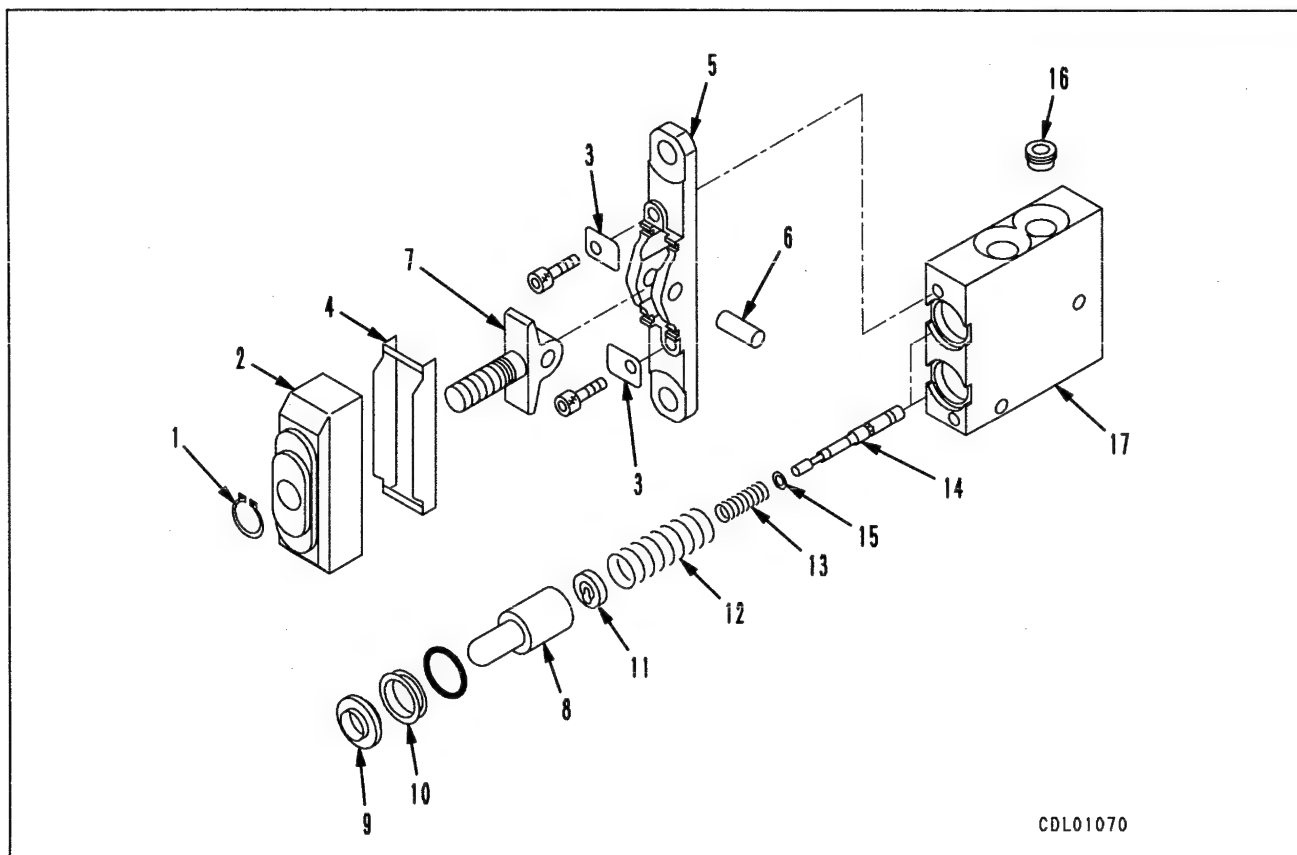
INSTALLATION OF PEDAL CONTROL PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S02

DISASSEMBLY OF PEDAL CONTROL PPC VALVE ASSEMBLY



CDL01070

1. Boot

Remove snap ring (1), then remove boot (3).

2. Plates

Remove plates (3) and (4), then remove plate assembly (5).

3. Lever

Remove shaft (6), then remove lever (7) from plate (5).

4. PPC valve

1) Remove piston (8).

2) Remove seal (9) and collar (10) from piston (8).

3) Remove retainer (11).

4) Remove outer spring (12) and inner spring (13).

5) Remove spool (14).

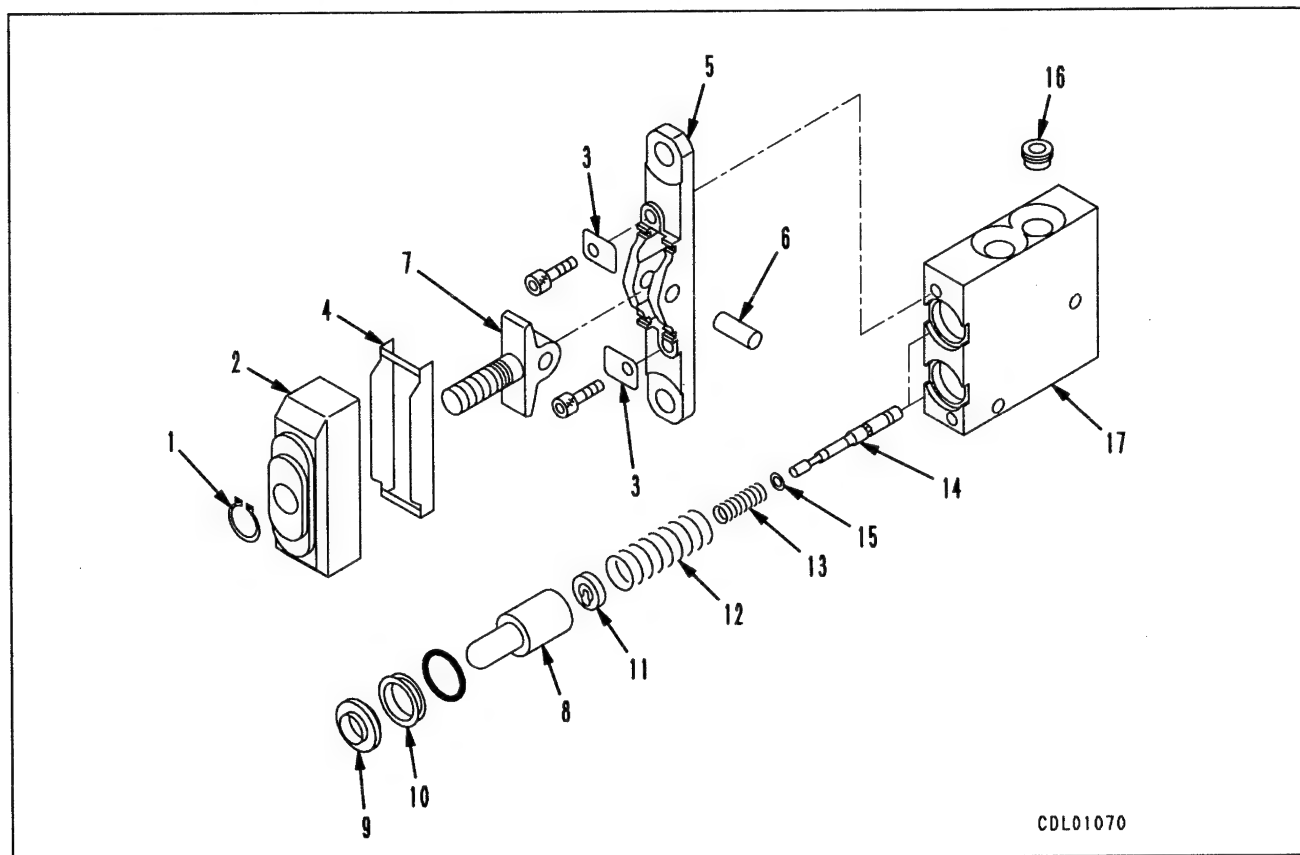
6) Remove shims (15) from spool (14).

★ Check the number and thickness of the shims at each mount, and keep in a safe place.

5. Filter

Remove filter (16) from body (17).

ASSEMBLY OF PEDAL CONTROL PPC VALVE ASSEMBLY




CDL01070

1. Filter

Install filter (16) to body (17).

- ★ Be careful not to tighten the filter too much. If it is tightened to an excessive torque, the output pressure characteristics will become defective.


 Filter :

$10.29 \pm 1.47 \text{ Nm} \{1.05 \pm 0.15 \text{ kgm}\}$

2. PPC valve


- Assemble shims (15) to spool (14).
 - ★ Assemble the same number and thickness of shim (15) as was removed during disassembly.
- Assemble spool (14).
- Assemble inner spring (13) and outer spring (12).
 - ★ Inner spring (13) is not symmetrical at the top and bottom, so assemble the end with the small diameter end turn at the shim end.
Diameter of end turn (inside diameter): Small diameter: $\varnothing 4.9 \text{ mm}$
Large diameter: $\varnothing 5.3 \text{ mm}$
- Assemble retainer (11).
- Fit O-ring and assemble collar (10) and

seal (9) to piston (8).

- Assemble piston (8).
Outer circumference of piston and inner
 circumference of body hole:
Grease (G2-LI)

3. Lever

- Fit lever (7) and press fit shaft (6).
★ Press fit shaft (5) slowly with a press.

-  Outer circumference of shaft and inner circumference of plate hole:
Grease (G2-LI)

4. Plates

- Set plates (4) and (3) in position, and install plate assembly (5).

 Mounting bolt :
 $13.23 \pm 1.47 \text{ Nm} \{1.35 \pm 0.15 \text{ kgm}\}$

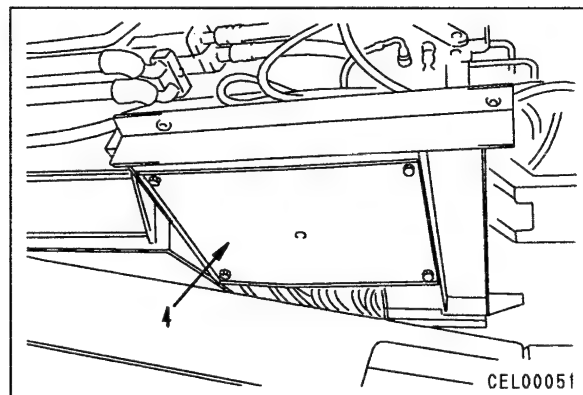
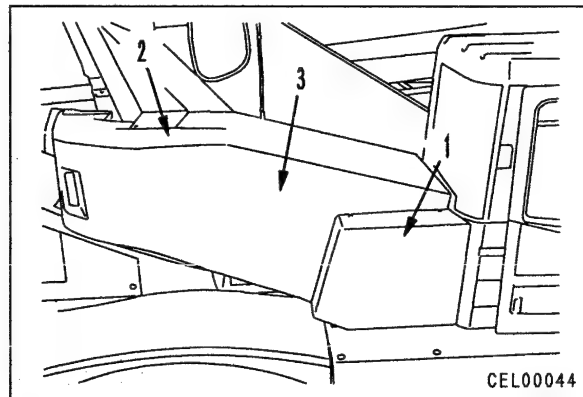
5. Boot

- Fit boot (2) over plate (3).
 - ★ Check that the hooks at both ends of the boot are assembled securely to the plate.
- Install snap ring (1).

REMOVAL OF WINCH BRAKE MASTER CYLINDER ASSEMBLY

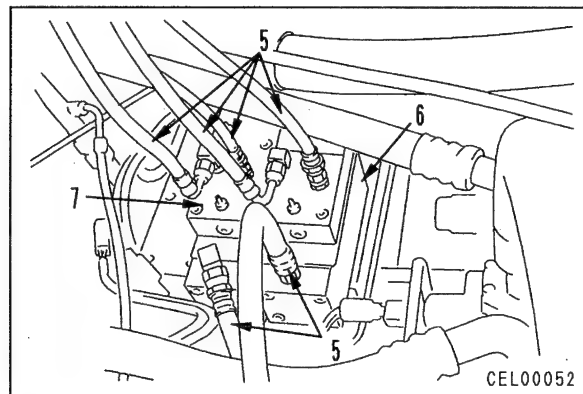
- ⚠ Set the parking brake switch to PARKING.
- ⚠ Release the remaining pressure inside the accumulator.
For details, see TESTING AND ADJUSTING, Testing and adjusting oil pressure.

1. Remove covers (1), (2), and (3) at right side of revolving frame.
★ Disconnect wiring connector (CN-R06) from inside the cover.
2. Remove cover (4) at bottom end of boom and winch control valve.
3. Disconnect 6 hoses (5).
4. Remove mounting bolts from under winch brake master cylinder.
5. Remove auxiliary winch brake master cylinder (6) and main winch brake master cylinder (7).



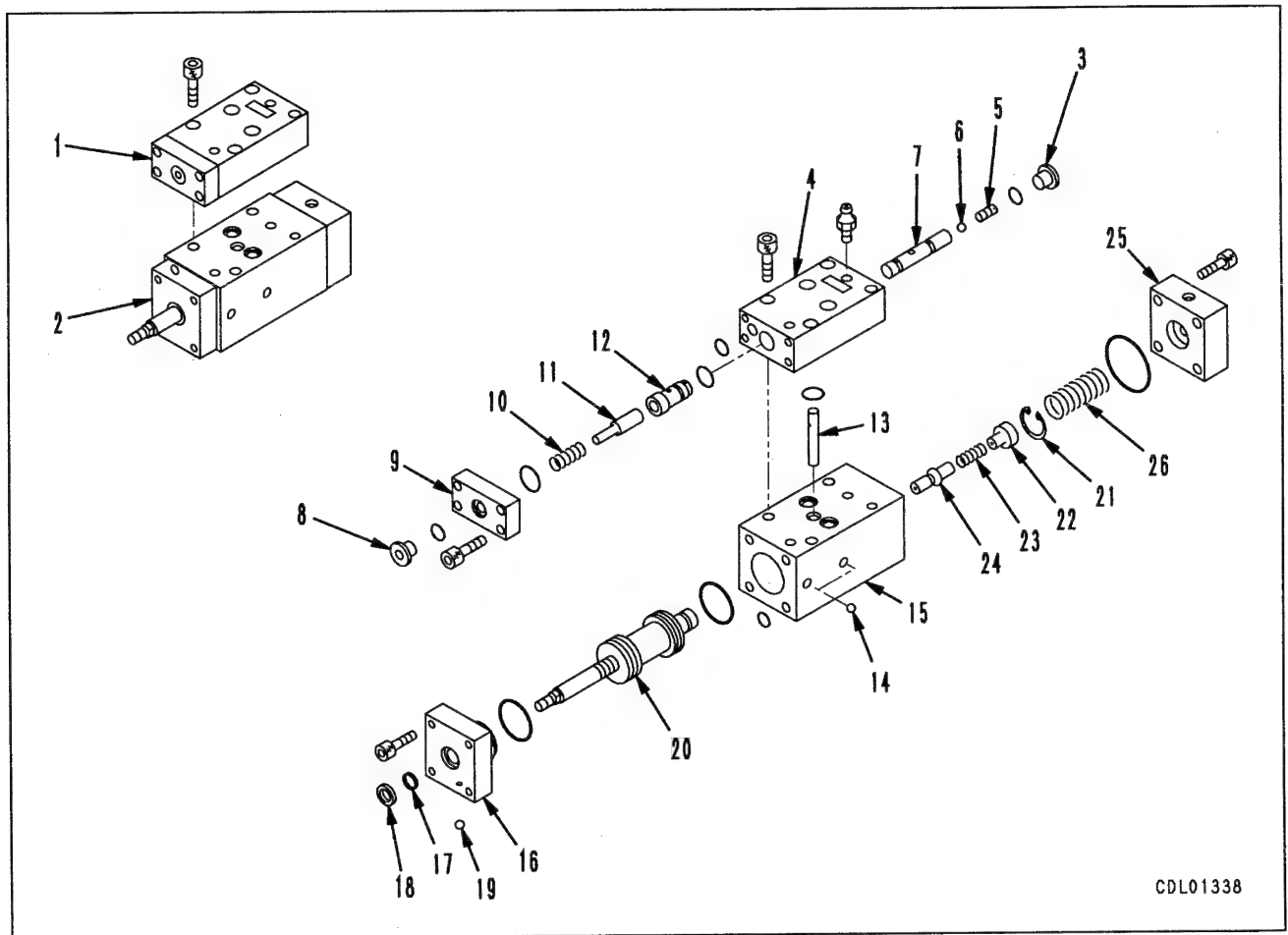
INSTALLATION OF WINCH BRAKE MASTER CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S02

DISASSEMBLY OF WINCH BRAKE MASTER CYLINDER ASSEMBLY

**1. Disconnection of valve assembly**

Disconnect valve assembly (1) and cylinder assembly (2).

2. Valve assembly

- 1) Remove plug (3) from body (4), then remove screw (5) and ball (6).
- 2) Pull out spool (7).
- 3) Remove plug (8) and cover (9).
- 4) Remove spring (10), piston (11), and sleeve (12).
 - ★ If there is any abnormality in the ball, spool, piston, sleeve, or body, replace the whole assembly.

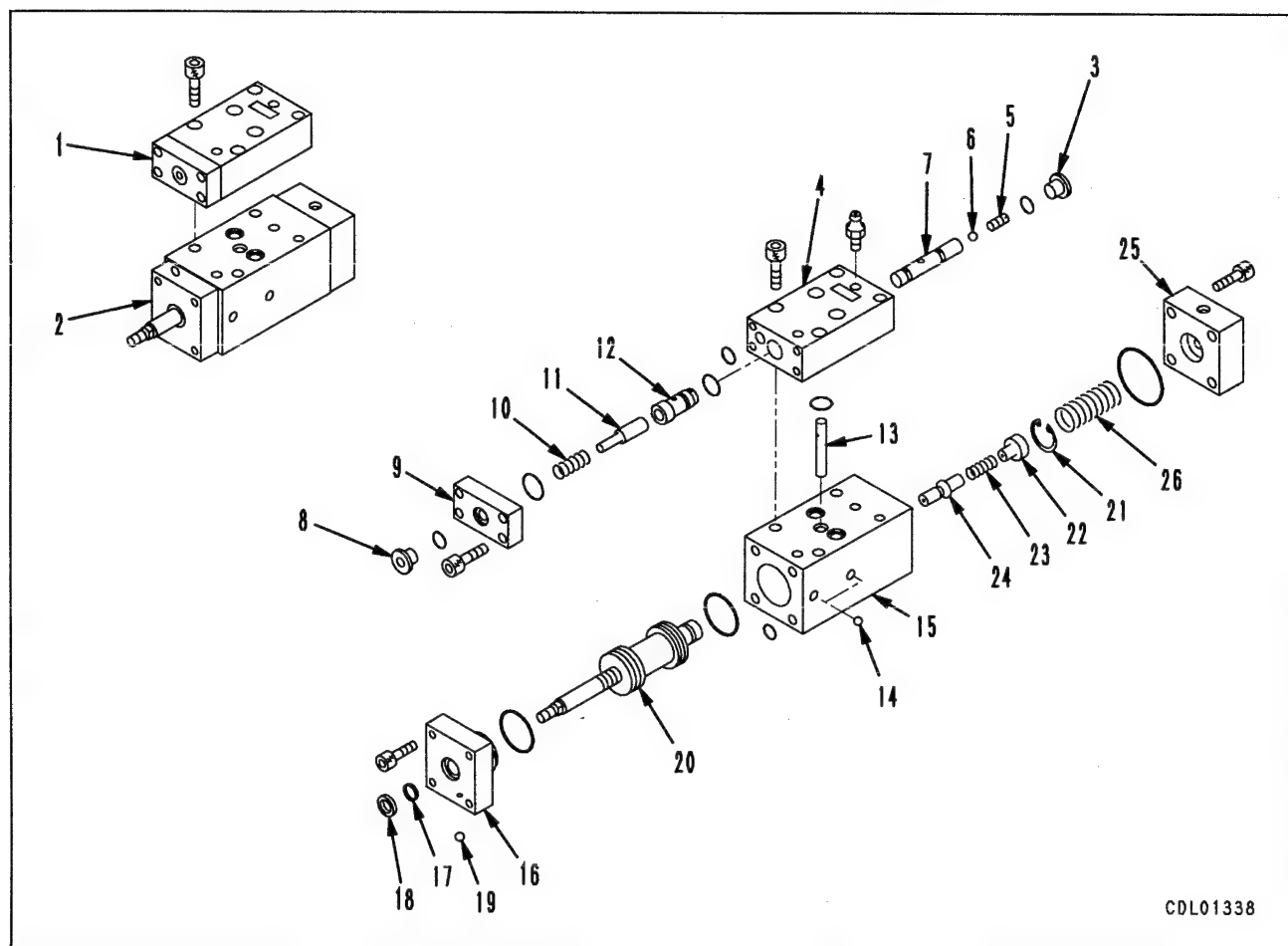
3. Cylinder assembly

- 1) Remove stopper (13) and ball (14) from body (15).
- 2) Remove cover (16).
- 3) Remove seals (17) and (18), and ball (19) from cover (16).
- 4) Remove piston assembly (20).
- 5) Remove snap ring (21), stopper (22), spring (23), and poppet (24) from piston (20).
- 6) Remove cover (25), then remove spring (26).

023S02

CDL01338

ASSEMBLY OF WINCH BRAKE MASTER CYLINDER ASSEMBLY



1. Cylinder assembly

1) Assemble spring (26) to body (15), then fit O-ring and install cover (25).

2) Assemble poppet (24), spring (23), and stopper (22) to piston (20), and install snap ring (21).

3) Fit O-ring and assemble piston assembly (20).

4) Install ball (19), and seals (18) and (17) to cover (16).

5) Install cover (16).

6) Install ball (14) and stopper (13).

2. Valve assembly

1) Fit O-ring and assemble sleeve (12), piston (11), and spring (10) to body (4).

2) Fit O-ring and install cover (9) and plug (8).

3) Assemble spool (7).

4) Assemble ball (6) and screw (5), then fit O-ring and install plug (3).

3. Connection of valve assembly

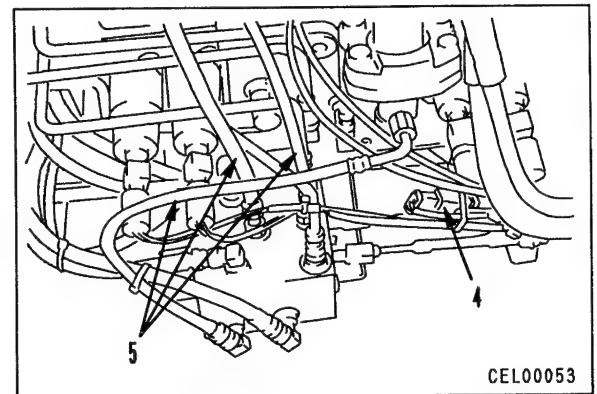
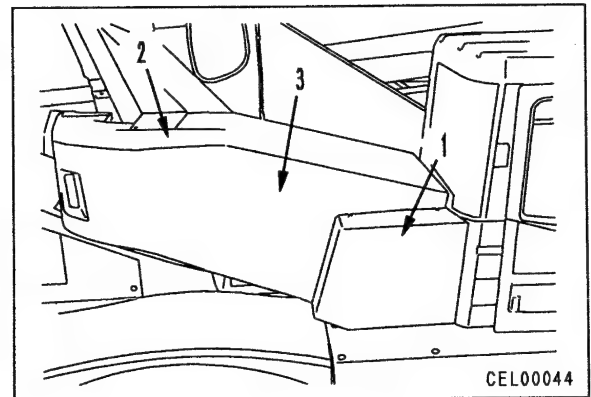
Fit O-ring and connect valve assembly (1) and cylinder assembly (2).

023S02

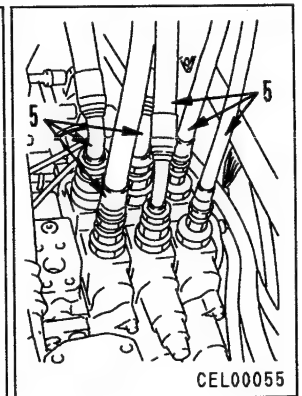
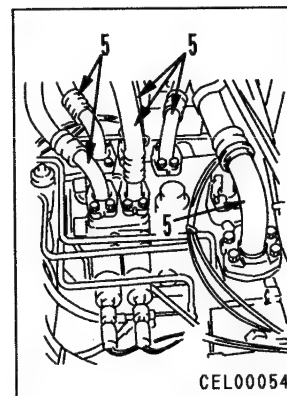
REMOVAL OF BOOM, WINCH CONTROL VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Release the remaining pressure inside the accumulator.
For details, see TESTING AND ADJUSTING, Testing and adjusting oil pressure.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

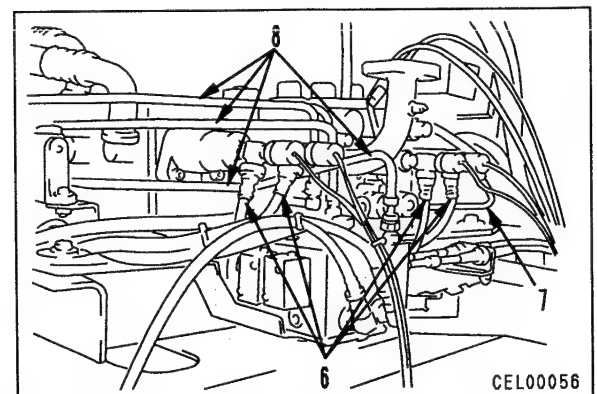
1. Remove covers (1), (2), and (3) at right side of revolving frame.
 - ★ Disconnect wiring connector (R06) from the inside of the cover.
2. Disconnect wiring connectors (R55, R56, R57, R58, R59, R60, R61, R62, R63, and R64) (4) (10 places).
 - ★ After disconnecting the connectors, fit tags to distinguish them.

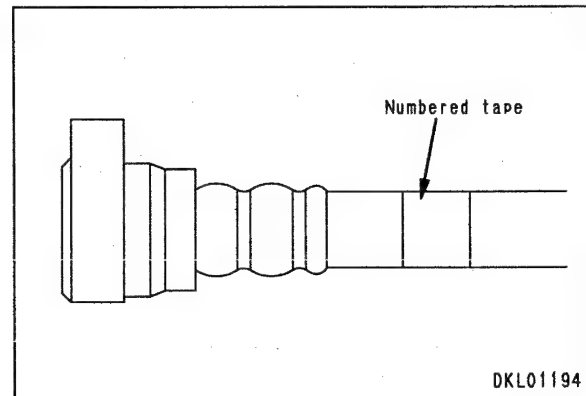


3. Disconnect 16 hoses (5).



4. Disconnect 4 PPC hoses (6) and PPC tube (7).
 - ★ There is numbered tape stuck to the PPC hoses, so fit a tag with the same number to the boom and winch control end.
5. Remove 4 tubes (8).

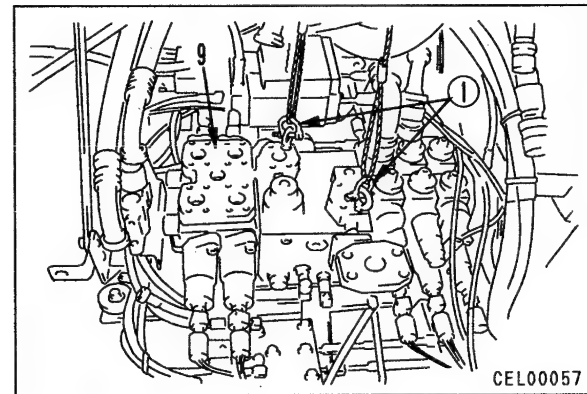




6. Using eyebolts (1), lift off boom and winch control valve assembly (9).



Boom, winch control valve assembly :
100 kg



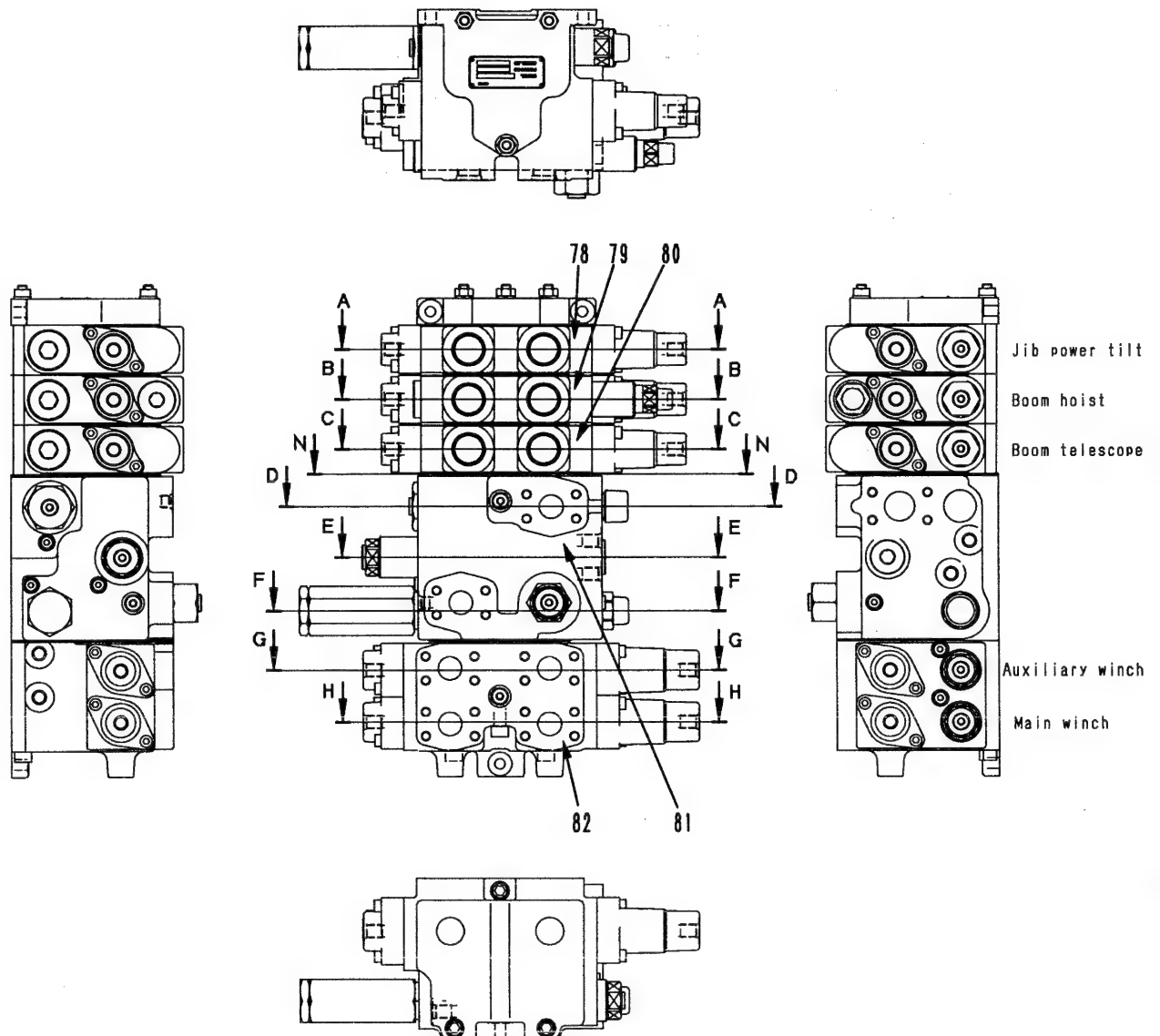
INSTALLATION OF BOOM, WINCH CONTROL VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

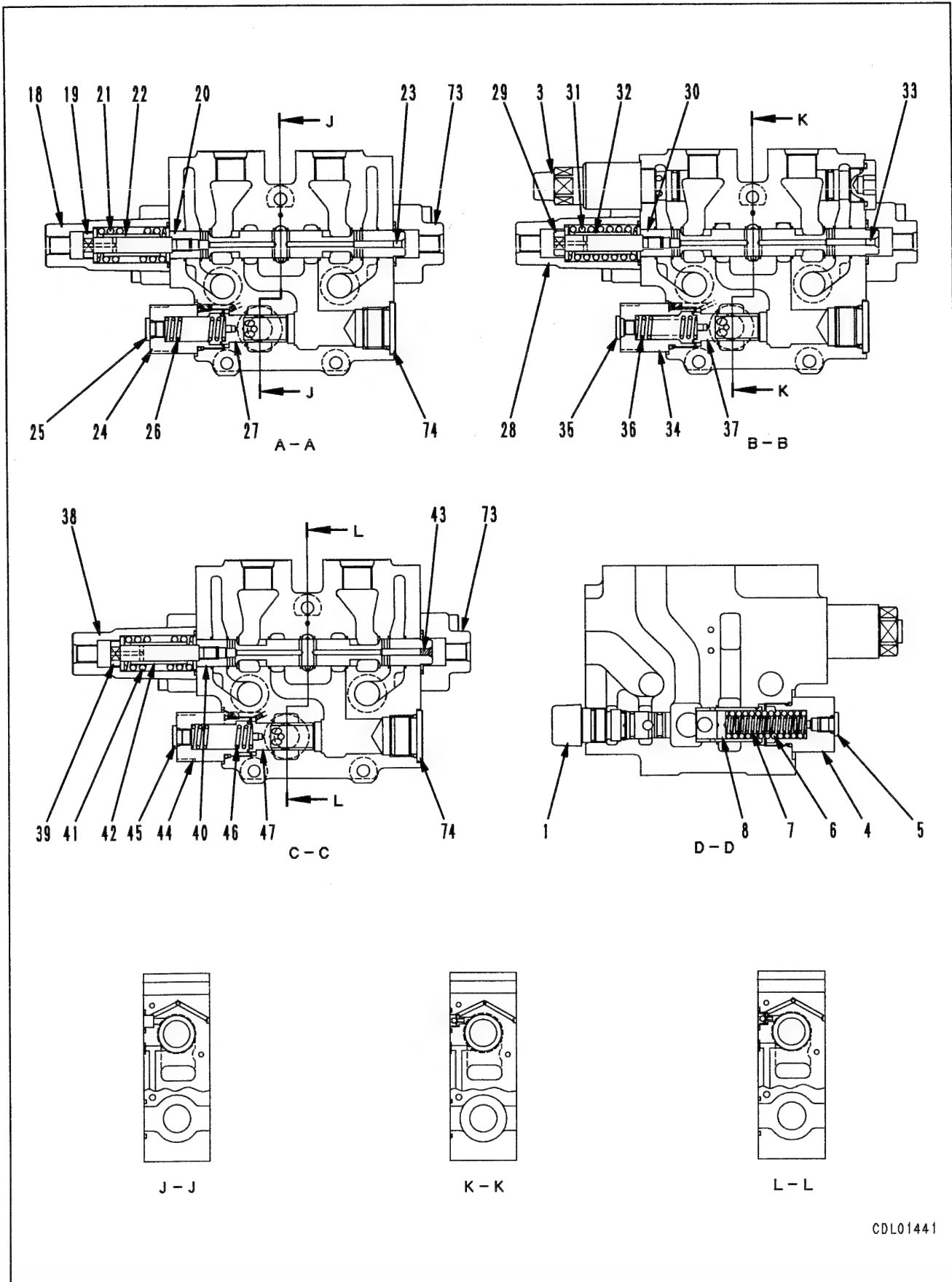
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DISASSEMBLY OF BOOM, WINCH CONTROL VALVE ASSEMBLY

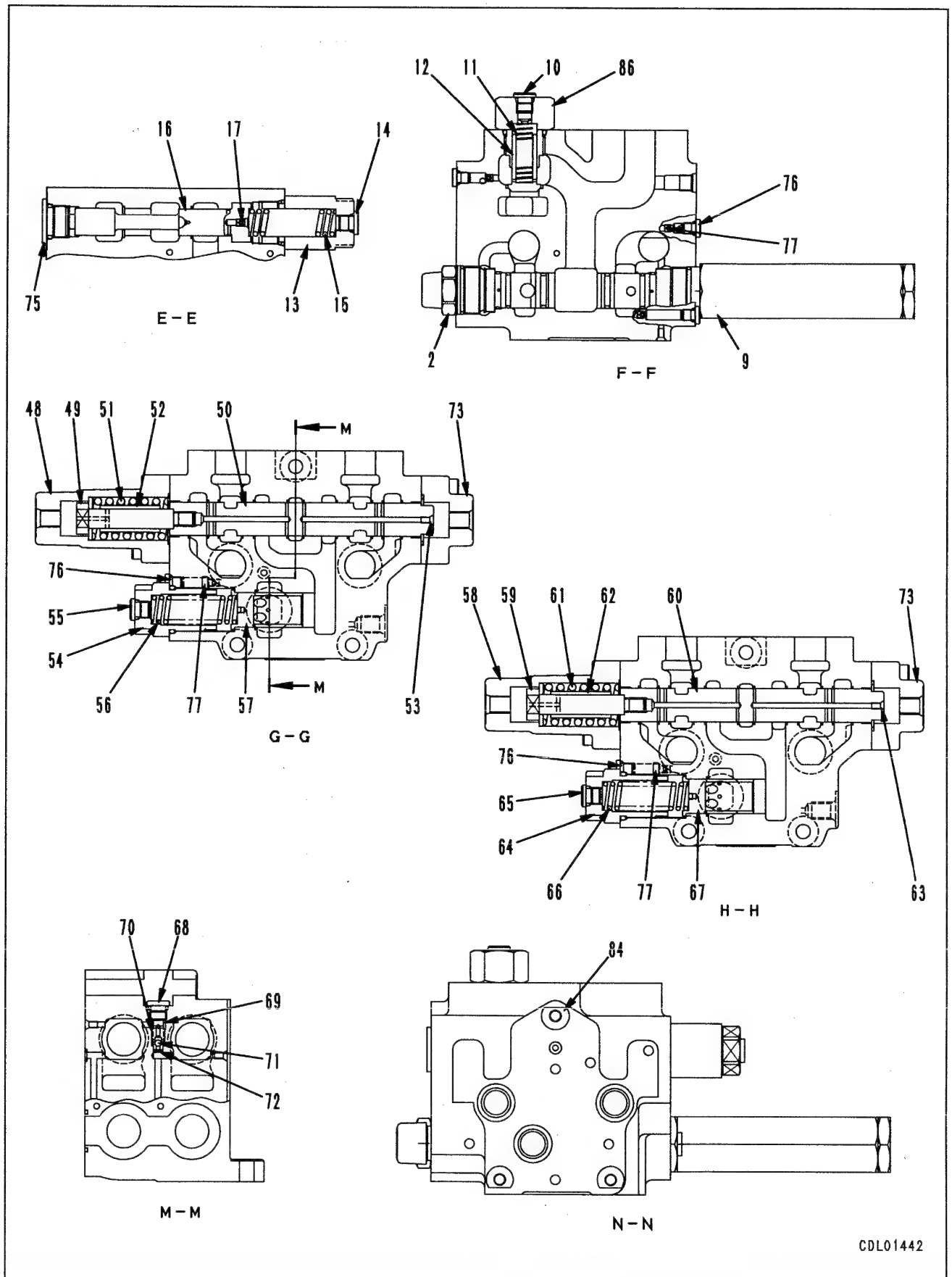
023S02



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023S02



1. Main relief valve

Remove boom main relief valve assembly (1) and winch main relief valve assembly (2).

2. Boom LOWER relief valve

Remove boom LOWER relief valve (3).

3. Boom unload valve

- 1) Remove plug (4).
- 2) Remove plug (5) from plug (4).
- 3) Remove outer spring (6) and inner spring (7).
- 4) Remove plunger (8).

4. Winch unload valve

Remove winch unload valve (9).

5. Check valve

- 1) Remove plug (86).
- 2) Remove plug (10) from plug (86).
- 3) Remove spring (11).
- 4) Remove plunger (12).

6. Pump merge/divider valve

- 1) Remove plug (13).
- 2) Remove plug (14) from plug (13).
- 3) Remove spring (15).
- 4) Remove spool (16).
- 5) Remove orifice (17) from spool (16).

7. Jib power tilt valve

- 1) Remove cover (18).
- 2) Loosen end spool (19).
 - ★ Loosen the end spool with the spool assembled inside the block.
- 3) Remove spool (20).
- 4) Remove end spool (19), spring (21), and bushing (22) from spool (20).
- 5) Remove plug (23).

8. Jib power tilt pressure compensation valve

- 1) Remove plug (24).
- 2) Remove plug (25) from plug (24).
- 3) Remove spring (26) and plunger (27).

9. Boom hoist valve

- 1) Remove cover (28).
- 2) Loosen end spool (29).
 - ★ Loosen the end spool with the spool assembled inside the block.
- 3) Remove spool (30).
- 4) Remove end spool (29), spring (31), and bushing (32) from spool (30).
- 5) Remove plug (33).

10. Boom hoist pressure compensation valve

- 1) Remove plug (34).
- 2) Remove plug (35) from plug (34).
- 3) Remove spring (36) and plunger (37).

11. Boom telescope valve

- 1) Remove cover (38).
- 2) Loosen end spool (39).
 - ★ Loosen the end spool with the spool assembled inside the block.
- 3) Remove spool (40).
- 4) Remove end spool (39), spring (41), and bushing (42) from spool (40).
- 5) Remove plug (43).

12. Boom telescope pressure compensation valve

- 1) Remove plug (44).
- 2) Remove plug (45) from plug (44).
- 3) Remove spring (46) and plunger (47).

13. Auxiliary winch spool

- 1) Remove cover (48).
- 2) Loosen end spool (49).
 - ★ Loosen the end spool with the spool assembled inside the block.
- 3) Remove spool (50).
- 4) Remove end spool (49), spring (51), and bushing (52) from spool (50).
- 5) Remove plug (53).

14. Auxiliary winch pressure compensation valve

- 1) Remove plug (54).
- 2) Remove plug (55) from plug (54).
- 3) Remove spring (56) and plunger (57).

023S02

15. Main winch spool

- 1) Remove cover (58).
- 2) Loosen end spool (59).
 - ★ Loosen the end spool with the spool assembled inside the block.
- 3) Remove spool (60).
- 4) Remove end spool (59), spring (61), and bushing (62) from spool (60).
- 5) Remove plug (63).

16. Main winch pressure compensation valve

- 1) Remove plug (64).
- 2) Remove plug (65) from plug (64).
- 3) Remove spring (66) and plunger (67).

17. Check valve

- 1) Remove plug (68).
- 2) Remove guide (69) and ring (70).
- 3) Remove ball (71) and valve seat (72).

18. Cover

Remove cover (73).

19. Plugs

Remove plugs (74) and (75).

20. Orifice

- 1) Remove plug (76).
- 2) Remove orifice (77).

21. Valve blocks

Remove mounting nuts, and disconnect blocks (78), (79), (80), (81), and (82), cover (83), and shim (84).

023S02

Technical drawing of a hydraulic manifold assembly, showing multiple views and labeled components.

Top View: Shows the manifold from above, with a central label area.

Front View (Left): Shows the manifold from the left side, with ports labeled A, B, C, D, E, F, G, and H.

Front View (Right): Shows the manifold from the right side, with ports labeled A, B, C, D, E, F, G, and H.

Bottom View: Shows the manifold from below, with ports labeled A, B, C, D, E, F, G, and H.

Central View: Shows the manifold from the front, with ports labeled A, B, C, D, E, F, G, and H. It also includes labels 78, 79, 80, 81, and 82.

Labels on the Right:

- Jib power tilt
- Boom hoist
- Boom telescope
- Auxiliary winch
- Main winch

Labels in the Central View:

- A
- B
- C
- D
- E
- F
- G
- H
- 78
- 79
- 80
- 81
- 82

Labels in the Bottom View:

- A
- B
- C
- D
- E
- F
- G
- H

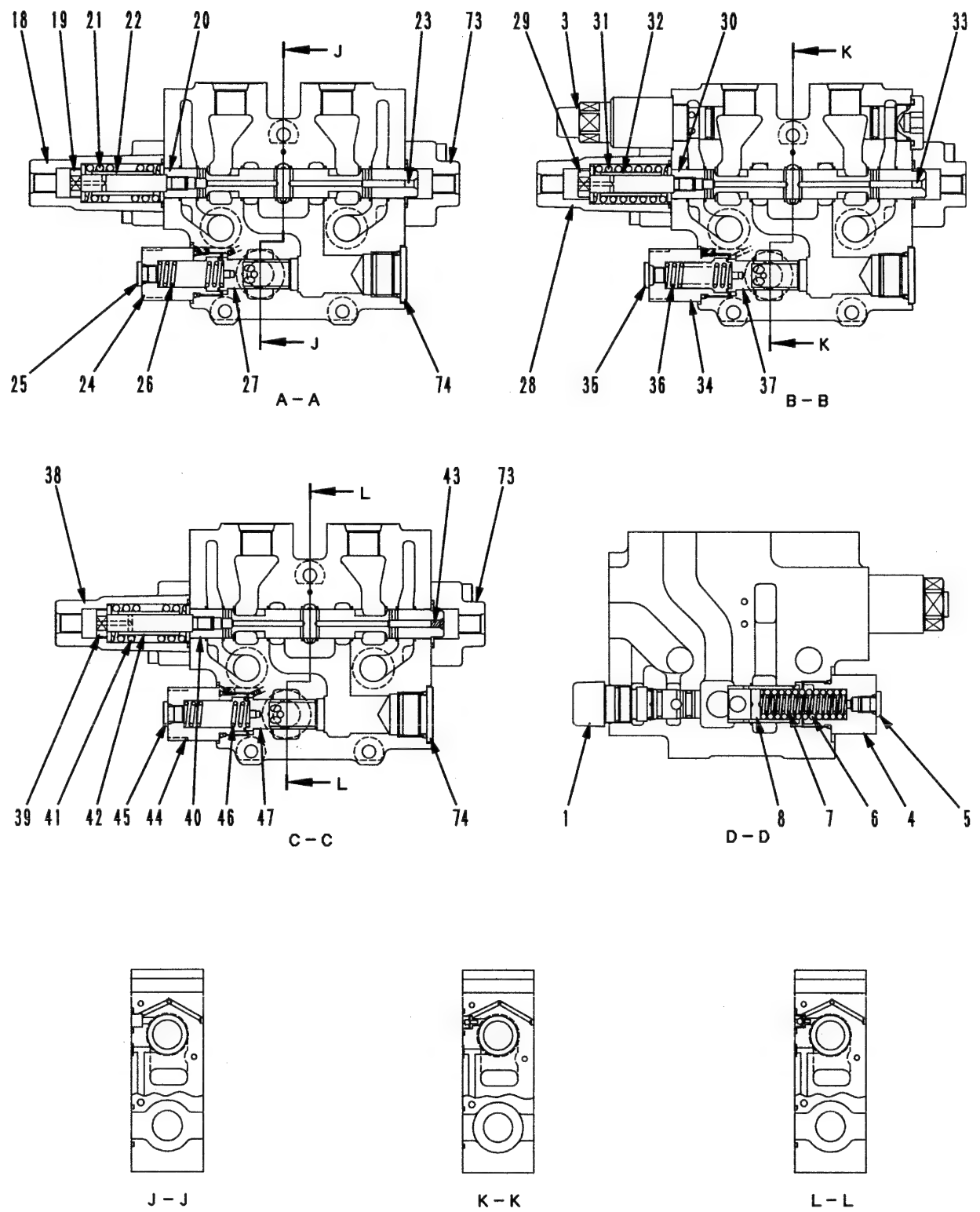
Labels in the Top View:

- A
- B
- C
- D
- E
- F
- G
- H

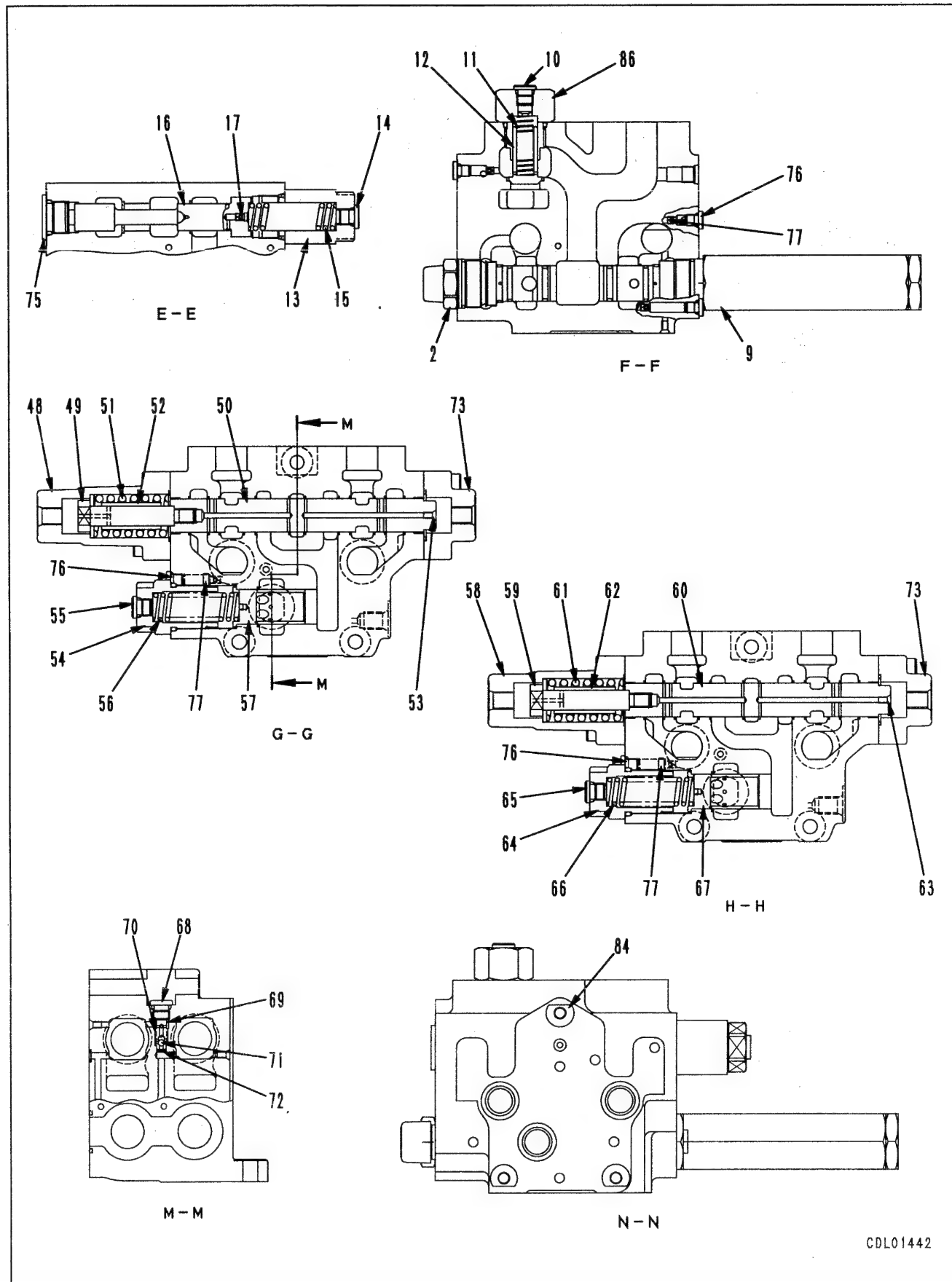
023S02

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CDL01441



023S02

023S02

1. Valve blocks

Fit O-rings, assemble cover (83), blocks (82), (81), (80), (79), and (78), and shim (84) to make assembly, then tighten mounting nuts.

2. Orifice

1) Assemble orifice (77).


2) Fit O-ring and install plug (76).

 Plug :
 $15.44 \pm 9.55 \text{ Nm } \{1.58 \pm 0.26 \text{ kgm}\}$

3. Plugs

Fit O-rings and plugs (75) and (74).

 Plug (75) :
 $246.96 \pm 35.28 \text{ Nm } \{25.2 \pm 3.6 \text{ kgm}\}$

 Plug (74) :
 $411.6 \pm 58.8 \text{ Nm } \{42 \pm 6 \text{ kgm}\}$

4. Cover

Fit O-ring and install cover (73).

5. Check valve

1) Assemble valve seat (72) and ball (71).

2) Assemble ring (70) and guide (69).

3) Fit O-ring and install plug (68).

 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

6. Main winch pressure compensation valve

1) Assemble plunger (67) and spring (66).

2) Fit O-ring and install plug (65) to plug (64).

 Plug:
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

3) Fit O-ring and install plug (64).

 Plug :
 $240.1 \pm 24.5 \text{ Nm } \{24.5 \pm 2.5 \text{ kgm}\}$

7. Main winch valve


1) Install plug (63) to spool (60).

2) Install bushing (62), spring (61), and end spool (59) to spool (60).

★ Tighten the end spool with the spool assembled inside the block.

3) Assemble spool (60).

4) Fit O-ring and install cover (58).

 Mounting bolt :
 $31.85 \pm 3.43 \text{ Nm } \{3.25 \pm 0.35 \text{ kgm}\}$

8. Auxiliary winch pressure compensation valve

1) Assemble plunger (57) and spring (56).

2) Fit O-ring and install plug (55) to plug (54).

 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

3) Fit O-ring and install plug (54).

 Plug :
 $240.1 \pm 24.5 \text{ Nm } \{24.5 \pm 2.5 \text{ kgm}\}$

9. Auxiliary winch valve


1) Install plug (53) to spool (50).

2) Install bushing (52), spring (51), and end spool (49) to spool (50).

★ Tighten the end spool with the spool assembled inside the block.

3) Assemble spool (49).

4) Fit O-ring and install cover (48).

 Mounting bolt :
 $31.85 \pm 3.43 \text{ Nm } \{3.25 \pm 0.35 \text{ kgm}\}$

10. Boom telescope pressure compensation valve

- 1) Assemble plunger (47) and spring (46).
- 2) Fit O-ring and install plug (45) to plug (44).


 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

- 3) Fit O-ring and install plug (44).

 Plug :
 $240.1 \pm 24.5 \text{ Nm } \{24.5 \pm 2.5 \text{ kgm}\}$

11. Boom telescope valve

- 1) Install plug (43) to spool (40).
- 2) Install bushing (42), spring (41), and end spool (39) to spool (40).
 ★ Tighten the end spool with the spool assembled inside the block.
- 3) Assemble spool (40).
- 4) Fit O-ring and install cover (38).

 Mounting bolt :
 $31.85 \pm 3.43 \text{ Nm } \{3.25 \pm 0.35 \text{ kgm}\}$

12. Boom hoist pressure compensation valve

- 1) Assemble plunger (37) and spring (36).
- 2) Fit O-ring and install plug (35) to plug (34).


 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

- 3) Fit O-ring and install plug (34).

 Plug :
 $240.1 \pm 24.5 \text{ Nm } \{24.5 \pm 2.5 \text{ kgm}\}$

13. Boom hoist valve

- 1) Install plug (33).
- 2) Install bushing (32), spring (32), and end spool (29) to spool (30).
 ★ Tighten the end spool with the spool assembled inside the block.
- 3) Assemble spool (30).
- 4) Fit O-ring and install cover (28).

 Mounting bolt :
 $31.85 \pm 3.43 \text{ Nm } \{3.25 \pm 0.35 \text{ kgm}\}$

14. Jib power tilt pressure compensation valve

- 1) Assemble plunger (27) and spring (26).
- 2) Fit O-ring and install plug (25) to plug (24).

 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

- 3) Fit O-ring and install plug (24).


 Plug :
 $240.1 \pm 24.5 \text{ Nm } \{24.5 \pm 2.5 \text{ kgm}\}$

15. Jib power tilt valve

- 1) Install plug (23) to spool (20).
- 2) Install bushing (22), spring (21), and end spool (19) to spool (20).
 ★ Tighten the end spool with the spool assembled inside the block.

- 3) Assemble spool (20).

- 4) Fit O-ring and install cover (18).

 Mounting bolt :
 $31.85 \pm 3.43 \text{ Nm } \{3.25 \pm 0.35 \text{ kgm}\}$

16. Pump merge/divider valve

- 1) Install orifice (17) to spool (16).
- 2) Assemble spool (16).
- 3) Assemble spring (15).
- 4) Fit O-ring and install plug (14) to plug (13).

 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

- 5) Fit O-ring and install plug (13).

 Plug :
 $269.5 \pm 24.5 \text{ Nm } \{27.5 \pm 2.5 \text{ kgm}\}$

17. Check valve

- 1) Assemble plunger (12).
- 2) Assemble spring (11).
- 3) Fit O-ring and install plug (10) to plug (86).

 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

- 4) Fit O-ring and install plug (86).

 Plug :
 $176.4 \pm 19.6 \text{ Nm } \{18 \pm 2 \text{ kgm}\}$

18. Winch unload valve

Fit O-ring and install winch unload valve (9).

 Winch unload valve :
 $269.5 \pm 24.5 \text{ Nm } \{27.5 \pm 2.5 \text{ kgm}\}$

19. Boom unload valve


- 1) Assemble plunger (8).
- 2) Assemble inner spring (7) and outer spring (6).
- 3) Fit O-ring and install plug (5) to plug (4).

 Plug :
 $36.02 \pm 5.15 \text{ Nm } \{3.68 \pm 0.53 \text{ kgm}\}$

- 4) Fit O-ring and install plug (4).


20. Boom LOWER relief valve


Fit O-ring and install boom LOWER relief valve.

 Boom LOWER relief valve :
 $128.25 \pm 14.25 \text{ Nm } \{13.5 \pm 1.5 \text{ kgm}\}$

21. Main relief valve

Fit O-ring and install winch main relief valve (2) and boom main relief valve (1).

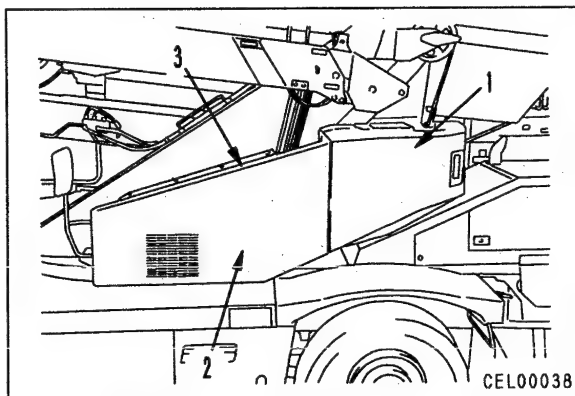
 Winch main relief valve :
 $269.5 \pm 24.5 \text{ Nm } \{27.5 \pm 2.5 \text{ kgm}\}$

 Boom main relief valve :
 $78.4 \text{ Nm } \{8 \text{ kgm}\}$

REMOVAL OF SWING CONTROL VALVE ASSEMBLY

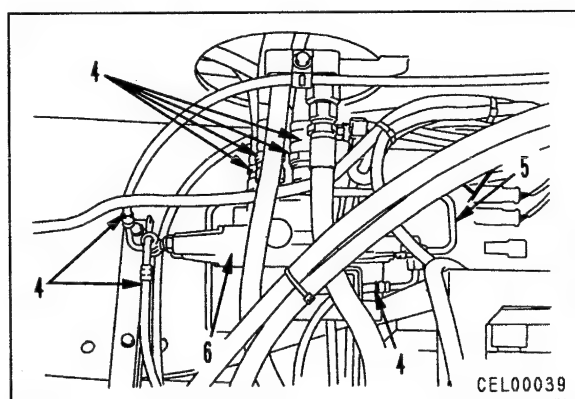
⚠ Set the parking brake switch to PARKING.

1. Remove covers (1), (2), and (3) at left side of revolving frame.
 - ★ Disconnect wiring connectors (R15, R33, R34, R35) from inside the cover.
2. Disconnect 7 hoses (4) and tube (5).
 - ★ After disconnecting the hoses, fit tags to distinguish them.
3. Remove swing valve (6).



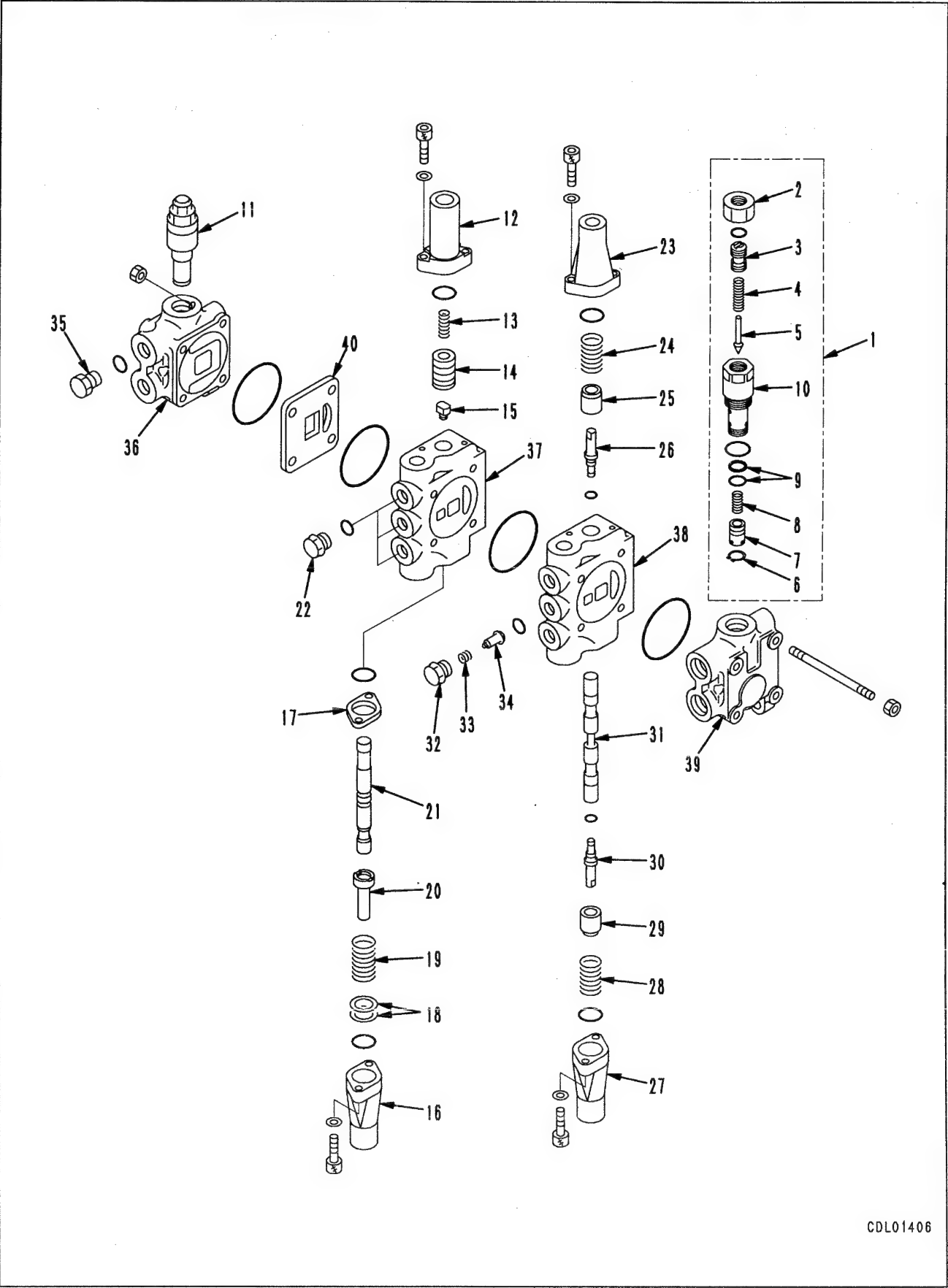
INSTALLATION OF SWING CONTROL VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S02

DISASSEMBLY OF SWING CONTROL VALVE ASSEMBLY



023S02

CDL01406

1. Main relief valve

- 1) Remove main relief valve assembly (1).
- 2) Remove nut (2), then remove screw (3).
- 3) Remove spring (4), then remove poppet (5).
- 4) Remove snap ring (6), then remove valve (7) and spring (8).
- 5) Remove O-ring (9) and back-up ring (9) from body (10).

2. Bleed off relief valve

Remove bleed off relief valve assembly (11).

3. Bleed off valve

- 1) Remove case (12).
- 2) Remove spring (13), piston (14), and plug (15).
- 3) Remove case (16) and spacer (17).
- 4) Remove shim (18), spring (19), and retainer (20).
 - ★ Check the number and thickness of the shims, and keep in a safe place.
- 5) Remove spool (21).

4. Plug

Remove plug (22).

5. Swing selector valve

- 1) Remove case (23).
- 2) Remove spring (24), retainer (25), and joint (26).
- 3) Remove case (27).
- 4) Remove spring (28), retainer (29), and joint (30).
- 5) Remove spool (31).

6. Check valve

- 1) Remove plug (32).
- 2) Remove spring (33) and valve (34).

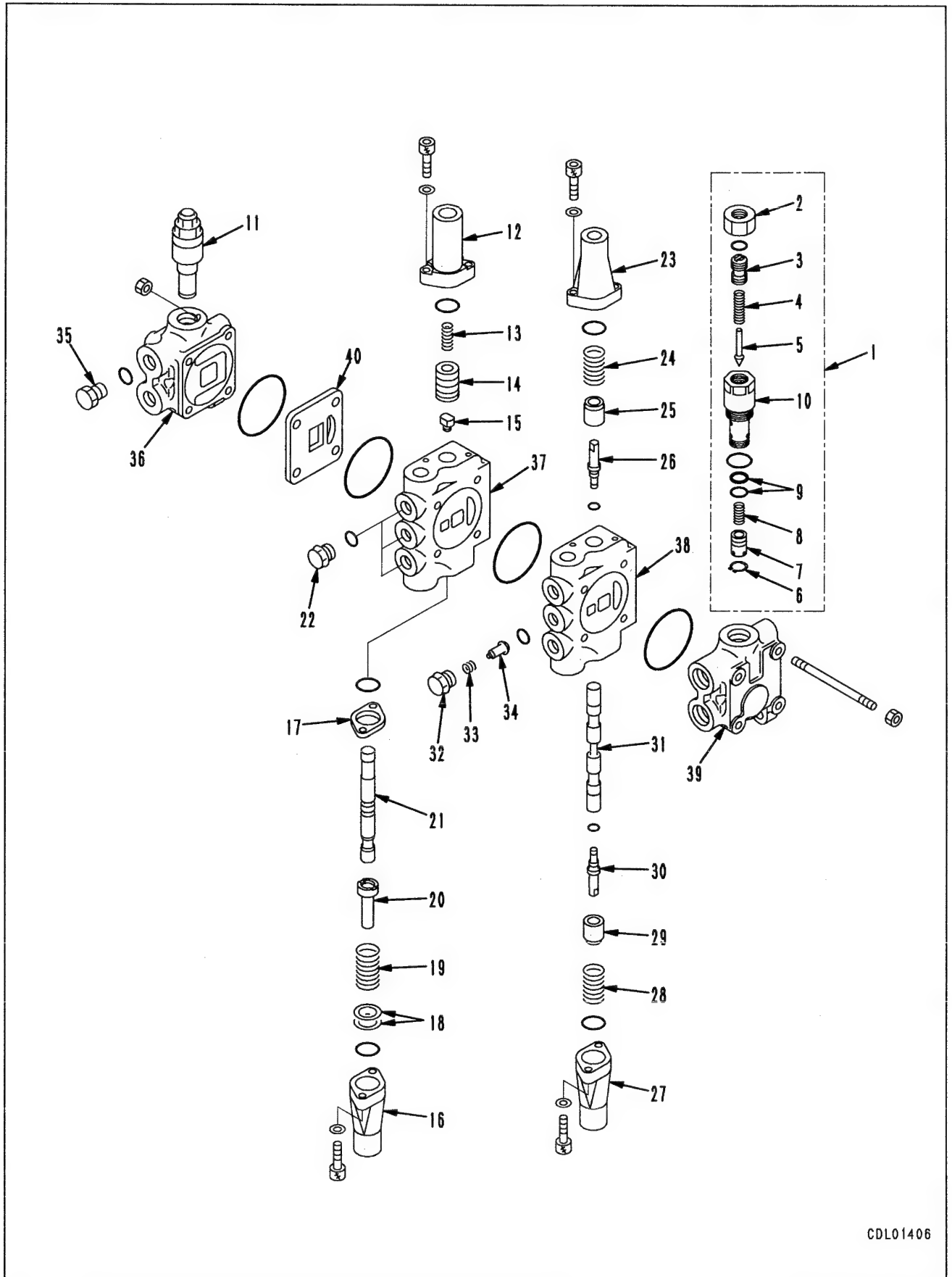
7. Plug

Remove plug (35).

8. Valve blocks

Remove mounting nut, then remove blocks (36), (37), (38), and (39), and plate (40).

ASSEMBLY OF SWING CONTROL VALVE ASSEMBLY




1. Valve blocks

Fit O-rings, assemble blocks (39), (38), (37), and (36), and plate (40) to make assembly, then tighten mounting nuts.

2. Plug

Fit O-ring and install plug (35).

 Plug : $34.3 \pm 4.9 \text{ Nm}$ { $3.5 \pm 0.5 \text{ kgm}$ }

3. Check valve

1) Install valve (34) and spring (33).

2) Fit O-ring and install plug (32).


 Plug :
 $34.3 \pm 4.9 \text{ Nm}$ { $3.5 \pm 0.5 \text{ kgm}$ }

4. Swing selector valve spool

1) Assemble spool (31).


2) Fit O-ring and assemble joint (30), retainer (29), and spring (28).

3) Fit O-ring and install case (27).

 Mounting bolt :
 $11.27 \pm 1.47 \text{ Nm}$ { $1.15 \pm 0.15 \text{ kgm}$ }


4) Fit O-ring and assemble joint (26), retainer (25), and spring (24).

5) Fit O-ring and install case (23).

 Mounting bolt :
 $11.27 \pm 1.47 \text{ Nm}$ { $1.15 \pm 0.15 \text{ kgm}$ }

5. Plug

Fit O-ring and install plug (22).


 Plug : $34.3 \pm 4.9 \text{ Nm}$ { $3.5 \pm 0.5 \text{ kgm}$ }

6. Bleed off valve

1) Assemble spool (21).


2) Assemble retainer (20), spring (19), and shim (18).

3) Fit O-ring and install case (16) and spacer (17).

 Mounting bolt :
 $11.27 \pm 1.47 \text{ Nm}$ { $1.15 \pm 0.15 \text{ kgm}$ }


4) Assemble plug (15), piston (14), and spring (13).

5) Fit O-ring and install case (12).

 Mounting bolt :
 $11.27 \pm 1.47 \text{ Nm}$ { $1.15 \pm 0.15 \text{ kgm}$ }

7. Bleed off relief valve

Fit O-ring and install bleed off relief valve assembly (11).

 Bleed off relief valve assembly :
 $49 - 59 \text{ Nm}$ { $5 - 6 \text{ kgm}$ }


8. Main relief valve

1) Install back-up ring (9) and O-ring (9) to body (10).


2) Assemble spring (8) and valve (7), and install snap ring (6).

3) Assemble poppet (5) and spring (4).

4) Fit screw (3) and tighten nut (2).

 Nut : $58.8 - 78.4 \text{ Nm}$ { $6 - 8 \text{ kgm}$ }

5) Fit O-ring and install main relief valve assembly (1).

 Main relief valve assembly :
 $49 - 59 \text{ Nm}$ { $5 - 6 \text{ kgm}$ }

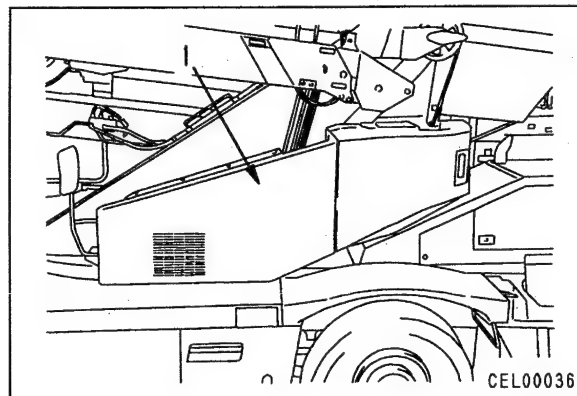
- After installing the main relief valve assembly to the machine, adjust the main relief valve pressure. For details, see TESTING AND ADJUSTING, Measuring and adjusting oil pressure.

023S02

REMOVAL OF SWING PPC SHUTTLE VALVE ASSEMBLY

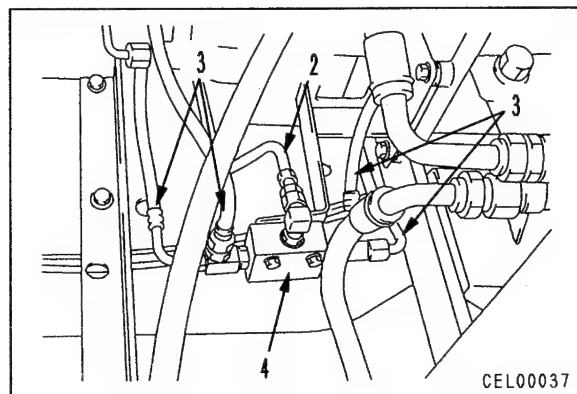
⚠ Set the parking brake switch to PARKING.

1. Remove side cover (1) at left side of revolving frame.
2. Disconnect tube (2) and 4 hoses (3).
★ After disconnecting the hoses, fit tags to distinguish them.
3. Remove swing PPC shuttle valve (4).





INSTALLATION OF SWING PPC SHUTTLE VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

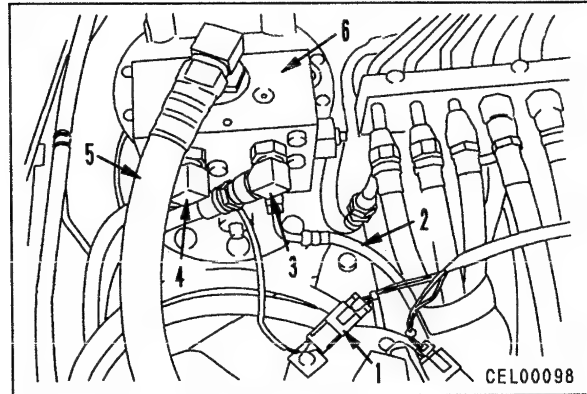


023S02

REMOVAL OF SWING BRAKE SOLENOID VALVE ASSEMBLY

-  Extend the outriggers and set securely in contact with the ground.
-  Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (R42) (1).
2. Disconnect hoses (2), (3), (4), and (5).
3. Remove swing brake solenoid valve assembly (6).



INSTALLATION OF SWING BRAKE SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

REMOVAL OF SWING MOTOR, SWING MACHINERY ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Raise the boom to the maximum height.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.

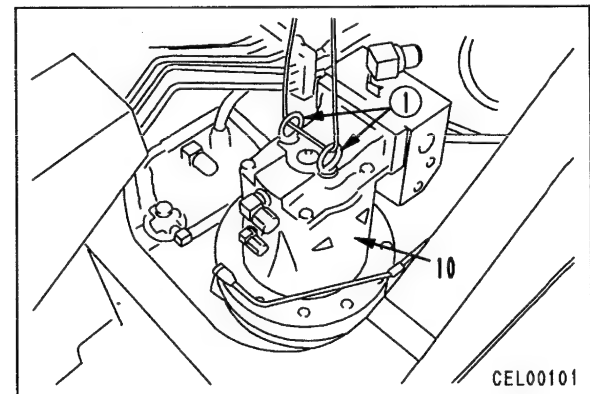
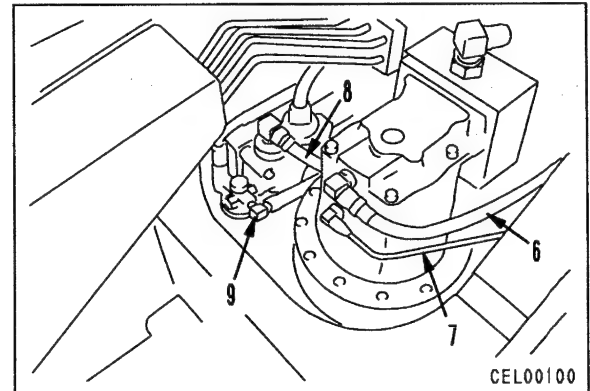
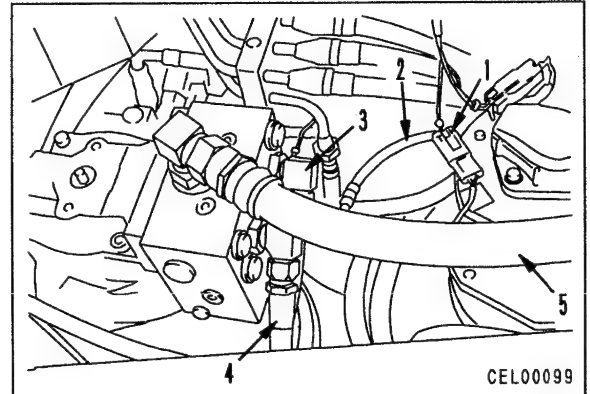
1. Disconnect wiring connector (R42) (1).
2. Disconnect hoses (2), (3), (4), (5), and (6).
3. Remove tube (7).
 - ★ Disconnect the tube clamp.
4. Disconnect hoses (8) and (8) from air regulator valve and steering priority valve.
 - ★ This is to make it easier to remove the mounting bolts of the swing motor and swing machinery assembly.
5. Using eyebolts (1), lift off swing motor and swing machinery assembly (10).

※ 1

 - ★ Be careful not to damage the tube and the elbow of the air regulator valve portion.



Swing motor assembly : 130 kg



INSTALLATION OF SWING MOTOR, SWING MACHINERY ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1



Swing motor, swing machinery mounting bolt : **Thread tightener (LT-2)**



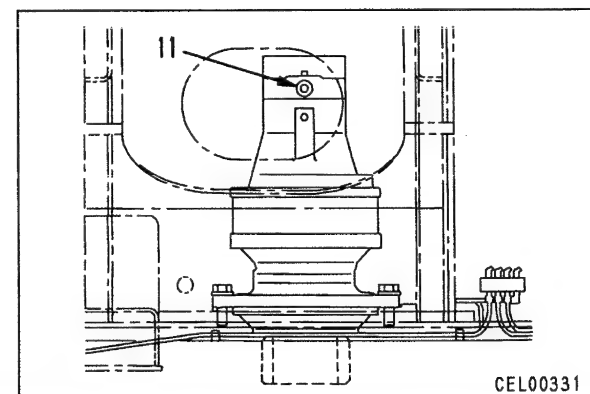
Swing motor, swing machinery mounting bolt : **548.8 ± 58.8 Nm {56 ± 6 kgm}**

- ★ Before operating, add hydraulic oil through drain por (11) to fill the case.



Swing motor case : **Approx. 0.45 ℓ**

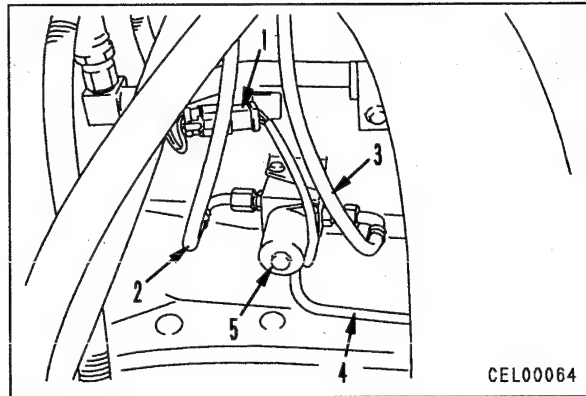
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



REMOVAL OF SWING FREE SOLENOID VALVE ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Raise the boom to the maximum height.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (R38) (1).
2. Disconnect hoses (2) and (3), and tube (4).
3. Remove swing free solenoid valve (5).



INSTALLATION OF SWING FREE SOLENOID VALVE ASSEMBLY

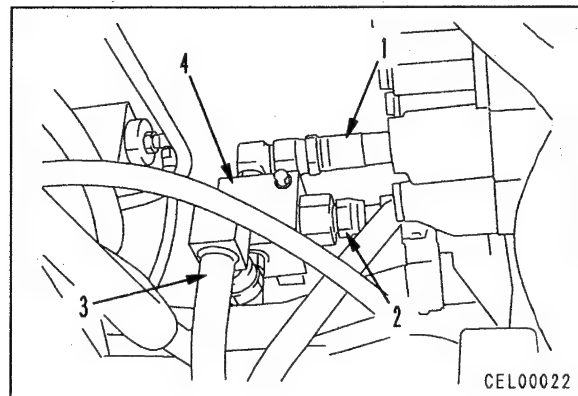
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

REMOVAL OF SWING, OUTRIGGER MERGE VALVE

⚠ Extend the outriggers and raise the machine.

1. Disconnect hose (1) and tubes (2) and (3).
2. Remove swing and outrigger merge valve (4).



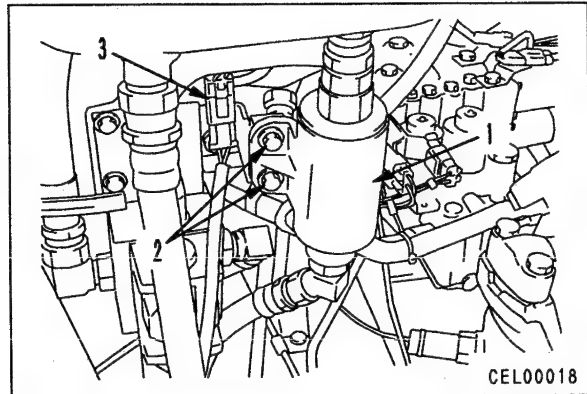
INSTALLATION OF SWING, OUTRIGGER MERGE VALVE

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

REMOVAL OF SWING, OUTRIGGER MERGE SELECTOR SOLENOID VALVE

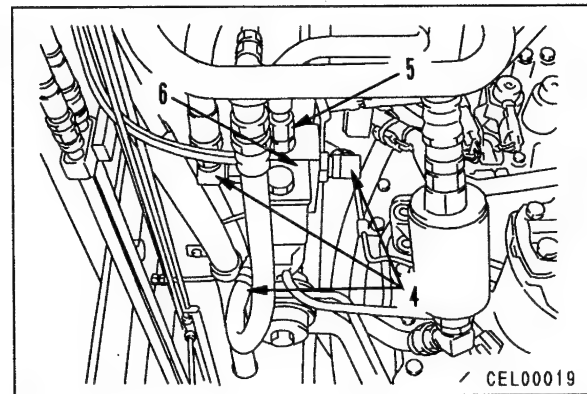
- ⚠ Extend the outriggers and raise the machine.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove mounting bolts (2) of line filter (1).
★ Move the line filter towards the side.
2. Disconnect wiring connector (L108) (3).
3. Disconnect 3 hoses (4) and tube (5).
4. Remove swing and outrigger merge selector solenoid valve (6).



INSTALLATION OF SWING, OUTRIGGER MERGE SELECTOR SOLENOID VALVE

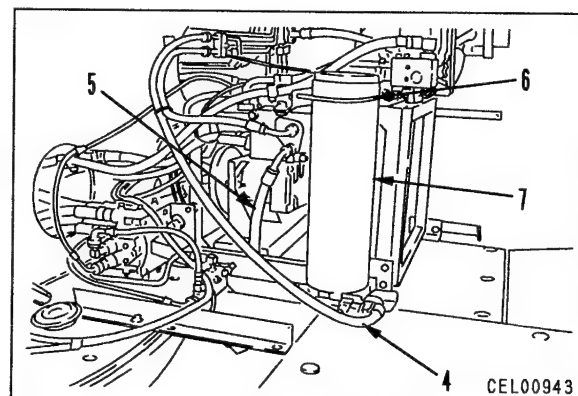
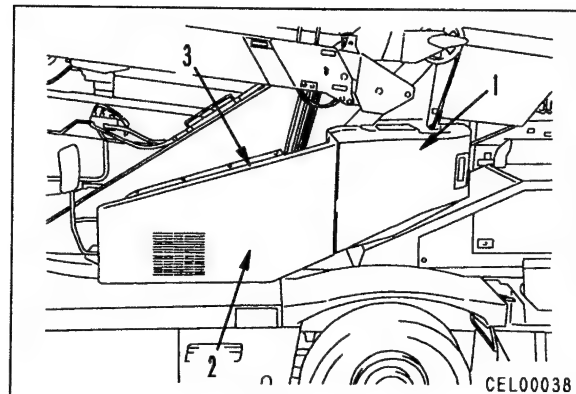
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S02

REMOVAL OF ACCUMULATOR ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
 - ⚠ Release the remaining pressure inside the accumulator.
For details, see TESTING AND ADJUSTING, Measuring and adjusting oil pressure.
 - ⚠ Disconnect the cable from the negative (-) terminal of the battery.
1. Remove covers (1), (2), and (3) at left side of revolving frame.
 - ★ Disconnect wiring connectors (R15, R33, R34, R35) from inside cover.
 2. Disconnect hoses (4) and (5).
 3. Remove U-clamp (6).
 4. Remove accumulator assembly (7).



INSTALLATION OF ACCUMULATOR ASSEMBLY

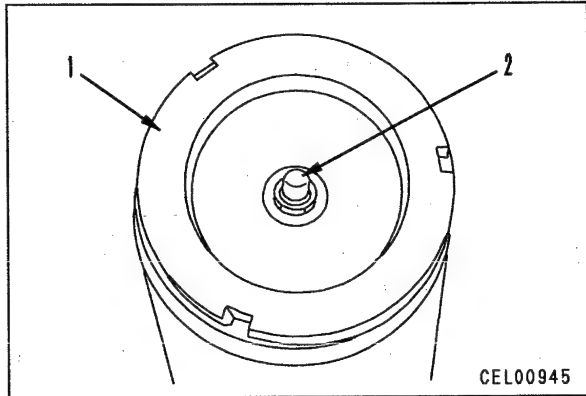
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

DISASSEMBLY OF ACCUMULATOR ASSEMBLY

1. Draining nitrogen gas

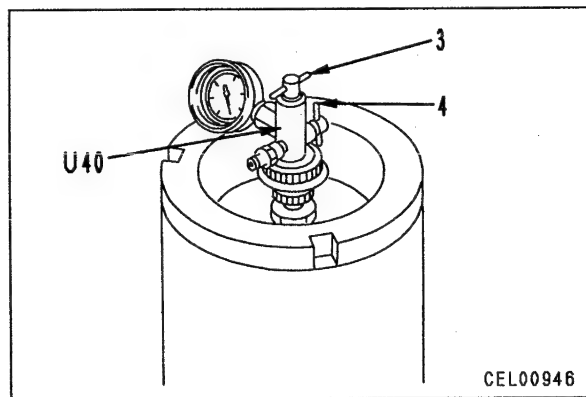
- 1) Remove cap (2) from accumulator assembly (1).



- 2) Install tool **U40**.

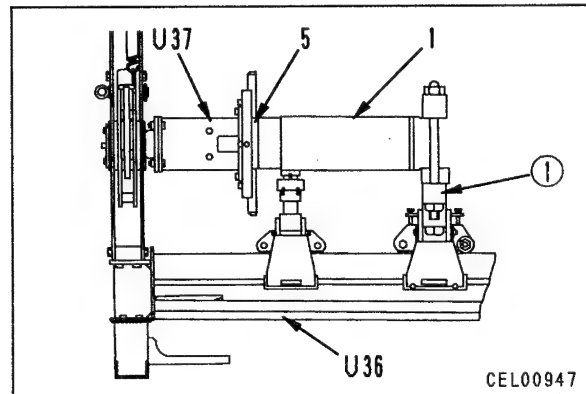
★ Loosen valves (3) and (4) fully.

- 3) Tighten valve (3) slowly and drain nitrogen gas.

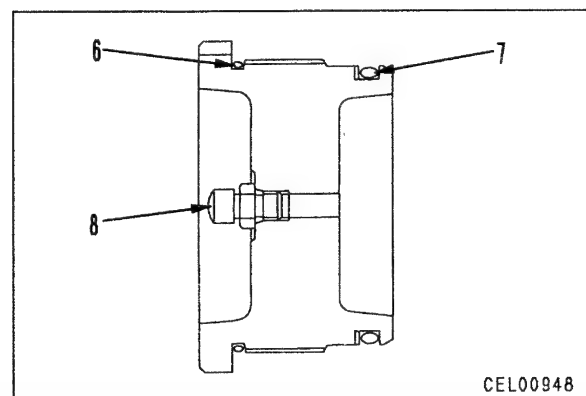


2. Head assembly

- 1) Put accumulator assembly ① on block (1), and set to tool **U36**.
- 2) Using tool **U37**, remove head assembly (5).



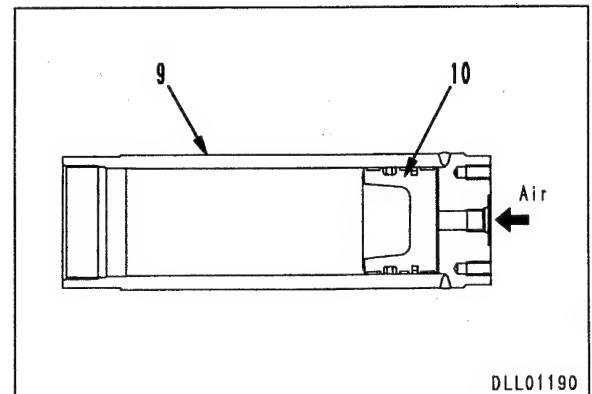
- 3) Disassemble head assembly as follows.
 - i) Remove O-rings (6) and (7).
 - ii) Remove valve (8).



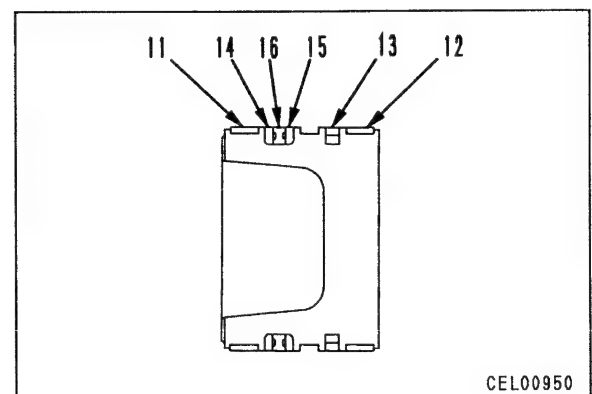
023S02

3. Piston assembly

- 1) Use air gun to blow air from bottom end of body (9) and remove piston assembly (10).



- 2) Disassemble piston assembly as follows.
 - i) Remove wear rings (11) and (12).
 - ii) Remove piston ring (13).
 - iii) Remove back-up rings (14) and (15), and seal ring (16).



023S02

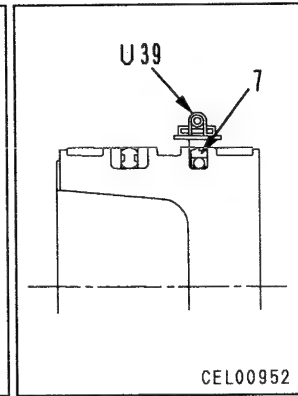
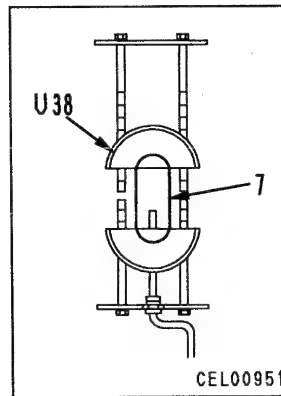
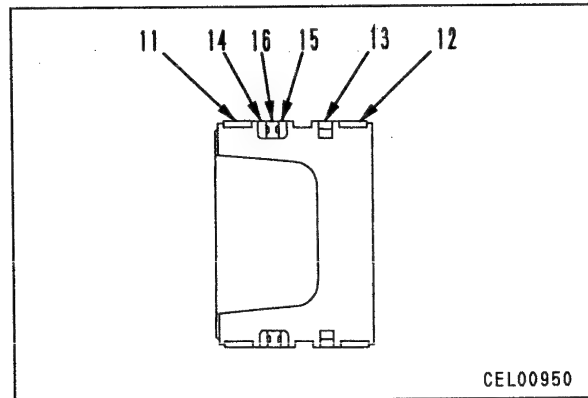
ASSEMBLY OF ACCUMULATOR ASSEMBLY

- ★ Coat the sliding surfaces of all parts with engine oil before installing. Be careful not to damage the O-rings and seal rings when installing.

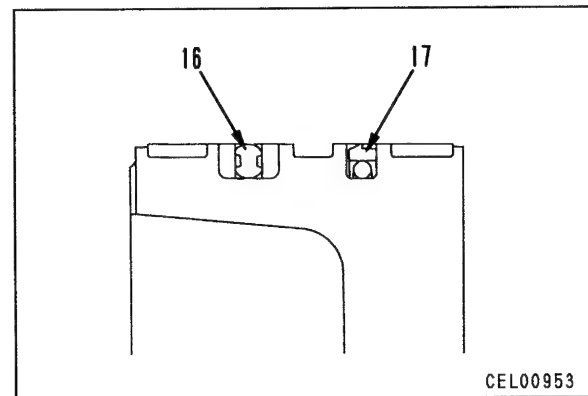
1. Piston assembly

- 1) Assemble piston assembly as follows.
 - i) Install seal ring (16) and back-up rings (15) and (14).
 - ii) Using tool **U38**, expand piston ring (7).

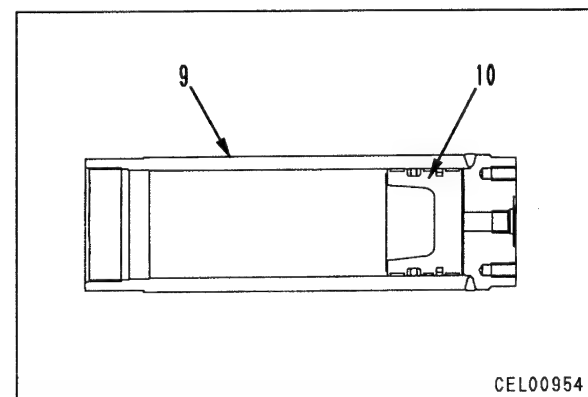
★ Set the piston ring on the tool and turn the handle 8 – 10 times to expand the ring.
 - iii) Remove piston ring (7) from tool **U38**, and install to piston.
 - iv) Set tool **U39** in position, then compress piston ring (7).



- ★ Install ring (17) on the outside of the piston ring facing the taper side of seal ring (16).



- 2) Install piston assembly (10) to body (9).



023S02

2. Head assembly

- 1) Assemble head assembly as follows.

- i) Install valve (8).



Valve :

$11.27 \pm 4.9 \text{ Nm } \{1.15 \pm 0.15 \text{ kgm}\}$

- ii) Install O-rings (6) and (7).

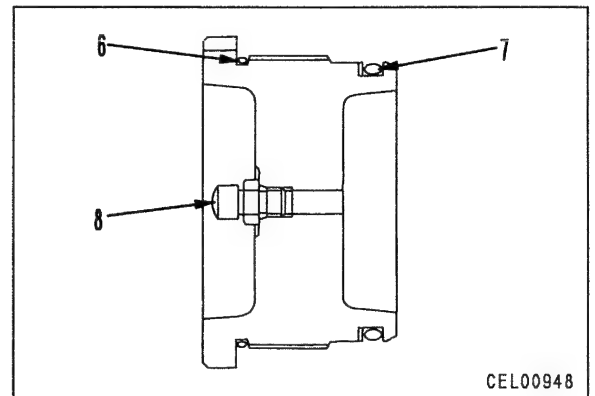
- 2) Put body assembly (9) on block ①, then set to tool U36.

- 3) Using tool U37, install head assembly (5).



Head assembly :

$294 \pm 29.4 \text{ Nm } \{30 \pm 3.0 \text{ kgm}\}$



3. Charging with nitrogen gas

- 1) Install tool U40 to accumulator and tool U41 to nitrogen gas cylinder, then connect tool U40 and tool U41 with hose.

- ★ When installing tool U40, loosen valves (3) and (4) fully.

- 2) Open valve (18) of nitrogen gas cylinder slowly, discharge gas at approx. 0.2–0.3 MPa {2–3 kg/cm²}, then tighten valve (4).



If the system is suddenly charged with high-pressure gas, the plug will suddenly expand, and this may damage the plug. To avoid this problem, charge with nitrogen gas gradually.

- 3) Turn valve (3) to a point where light resistance is felt by hand.

- 4) Slowly open valve (18) of nitrogen gas cylinder further and charge accumulator with nitrogen gas.

- ★ Close valve (18) of the nitrogen gas cylinder from time to time, and read pressure gauge (10) of the charging valve assembly at a point where the reading remains stable.

- 5) When nitrogen gas is charged to specified pressure, tighten valve (18) of nitrogen gas cylinder securely.

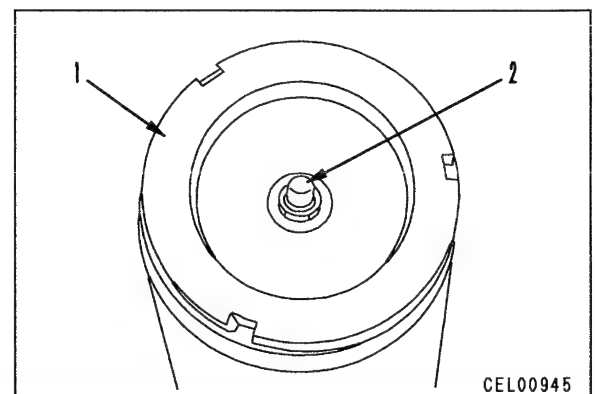
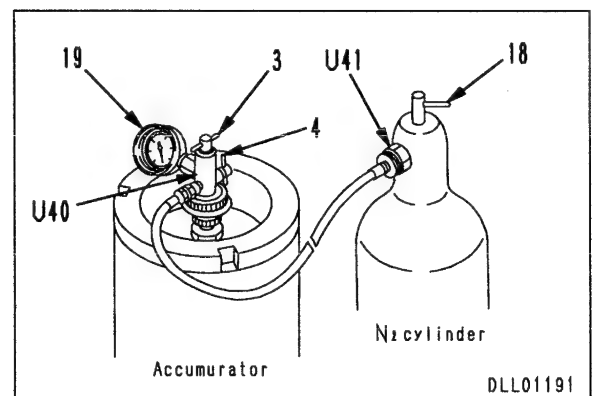
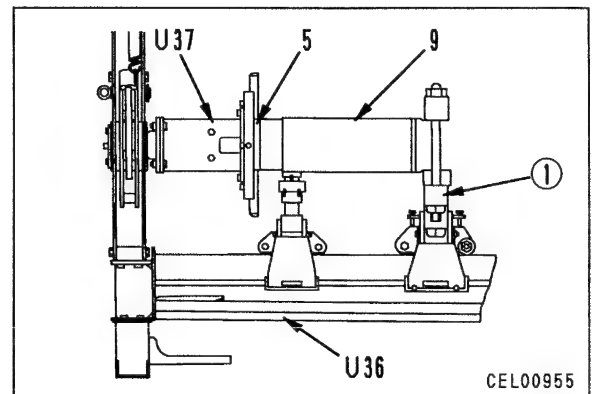
- ★ Set pressure: $5.9 \pm 0.15 \text{ MPa}$

$\{60 \pm 1.5 \text{ kg/cm}^2\} \text{ (at } 20 \pm 5^\circ\text{C)}$




- ★ If the nitrogen gas pressure goes above the set pressure, tighten valve (18) securely, then gradually loosen valve (4) and discharge gas to reduce to the set pressure.

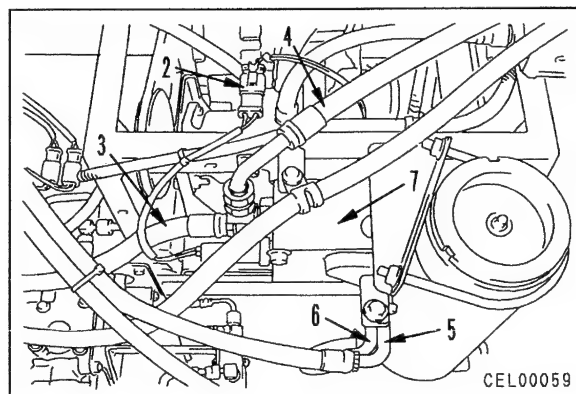
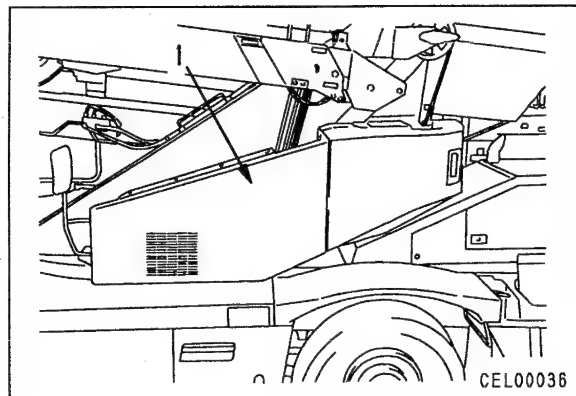
- 6) After completely loosening valve (3), loosen valve (4) and discharge nitrogen gas remaining inside tool U40 and hose.

- 7) Remove tool U40 from accumulator assembly, then install cap (2).



REMOVAL OF ACCUMULATOR CHARGE VALVE ASSEMBLY

-  Set the parking brake switch to PARKING.
 -  Release the remaining pressure inside the accumulator.
For details, see TESTING AND ADJUSTING, Measuring and adjusting oil pressure.
 -  Disconnect the cable from the negative (-) terminal of the battery.
1. Remove side cover (1) at left side of revolving frame.
 2. Disconnect wiring connector (R24) (2).
 3. Disconnect hoses (3), (4), (5), and (6).
 4. Remove accumulator charge valve assembly (7).

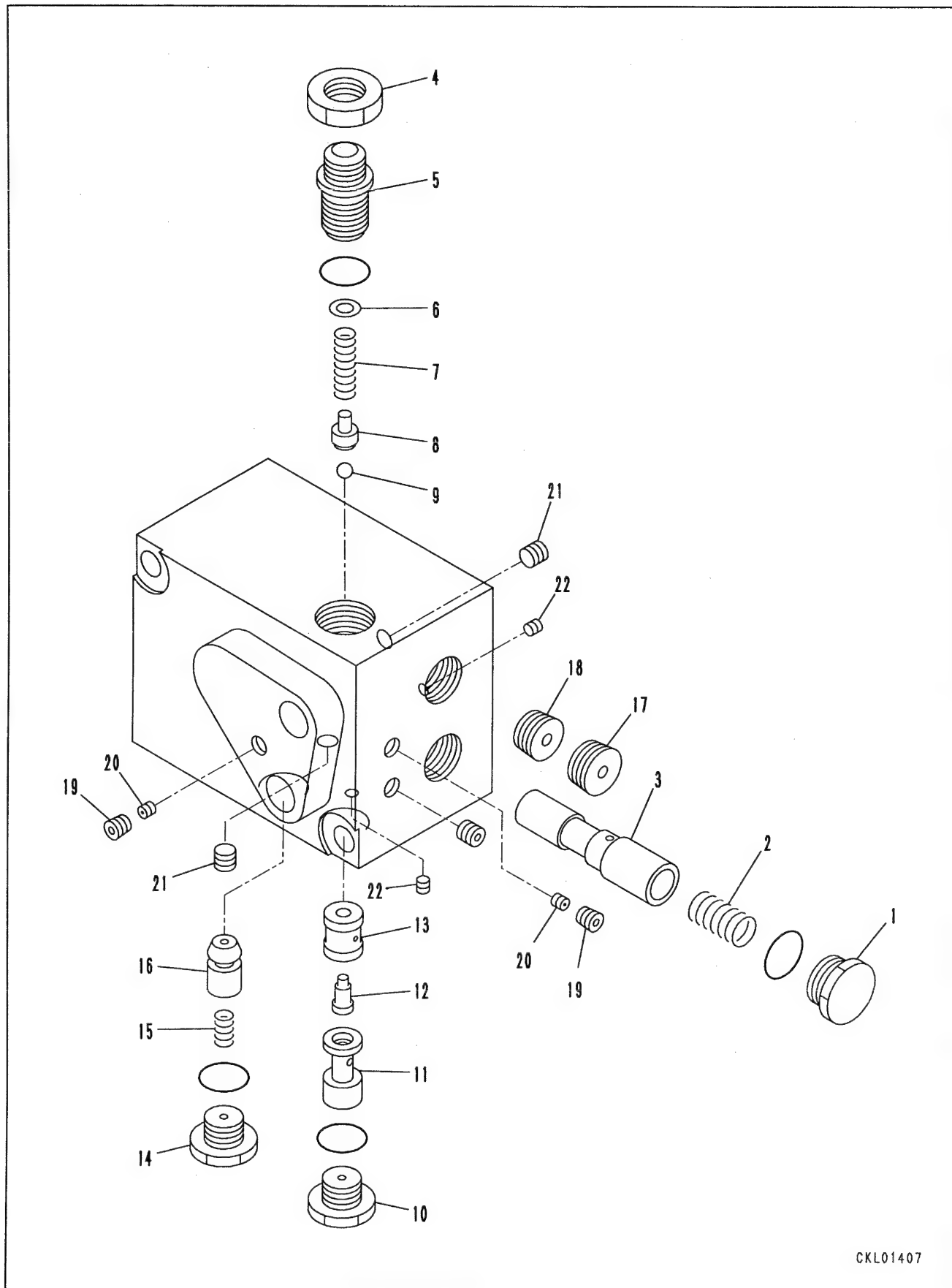


INSTALLATION OF ACCUMULATOR CHARGE VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

DISASSEMBLY OF ACCUMULATOR CHARGE VALVE ASSEMBLY



023S02

1. Unload valve

- 1) Remove plug (1).
- 2) Remove spring (2) and spool (3).

2. Pilot valve

- 1) Loosen locknut (4) and remove plug (5).
- 2) Remove shims (6) and spring (7).
 - ★ Check the number and thickness of the shims, and keep in a safe place.
- 3) Remove retainer (8) and ball (9).
- 4) Remove plug (10).
- 5) Remove retainer (11).
- 6) Remove piston (12) and plunger (13).

3. Check valve

- 1) Remove plug (14).
- 2) Remove spring (15) and plunger (16).

4. Valve body

- 1) Remove plug (17), then remove plug (18).
- 2) Remove 2 plugs (19), then remove 2 orifices (20).
- 3) Remove 2 plugs (21) and 3 plugs (22).

ASSEMBLY OF ACCUMULATOR CHARGE VALVE ASSEMBLY

1. Valve body

- 1) Install 2 plugs (22) and 3 plugs (22) to body (23).



Plug : **Thresad tightener (Three Bond 241 or equivalent)**

- 2) Fit orifices (20) to plugs (19).



Orifice : **Thread tightener (Loctite 1305 or equivalent)**

- 3) Fit plug (18) and install plug (17).

2. Check valve

- 1) Assemble plunger (16) and spring (15).
- 2) Fit O-ring and install plug (14).



Plug :
 $33.9 \pm 3.5 \text{ Nm}$ { $3.45 \pm 0.35 \text{ kgm}$ }

3. Pilot valve

- 1) Assemble plunger (13) and piston (12).
- 2) Assemble retainer (11).
- 3) Fit O-ring and install plug (10).



Plug :
 $33.9 \pm 3.5 \text{ Nm}$ { $3.45 \pm 0.35 \text{ kgm}$ }

- 4) Assemble ball (9) and retainer (8).
- 5) Assemble spring (7).
- 6) Assemble shims (6) to plug (5), then fit O-ring and install plug (5).
- 7) Secure with locknut (4).

4. Unload valve

- 1) Assemble spool (3) and spring (2).
- 2) Fit O-ring and install plug (1).

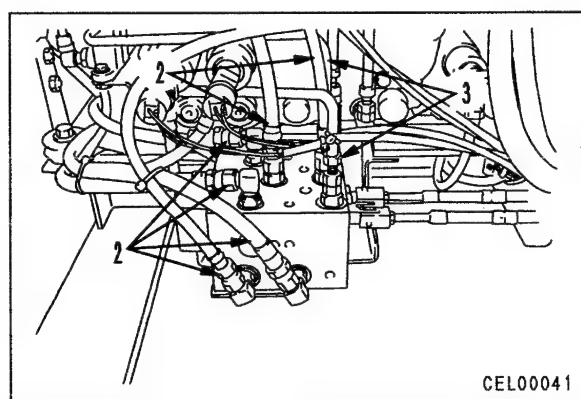
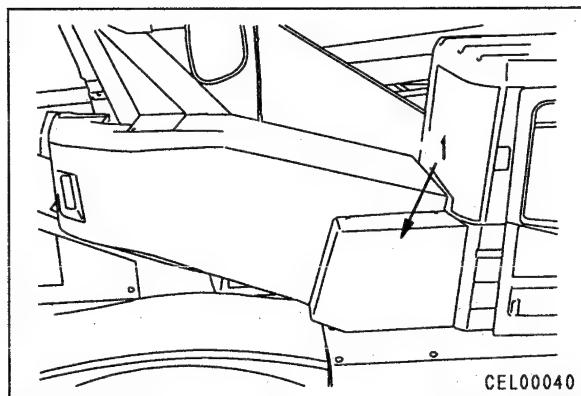


Plug :
 $61.25 \pm 7.45 \text{ Nm}$ { $6.25 \pm 0.75 \text{ kgm}$ }

- ★ If the pilot valve has been disassembled and assembled again, install it on the machine, then adjust the accumulator charge pressure. For details, see TESTING AND ADJUSTING, Measuring and adjusting oil pressure.

REMOVAL OF WINCH CLUTCH VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
 - ⚠ Release the remaining pressure inside the accumulator.
For details, see TESTING AND ADJUSTING, Measuring and adjusting oil pressure.
1. Remove side cover (1) at right side of revolving frame.
 2. Disconnect 6 hoses (2) and 2 tubes (3).
★ After disconnecting the hoses, fit tags to distinguish them.
 3. Pull out pin of rod (4) and disconnect. ※ 1
 4. Remove winch clutch valve assembly (5).



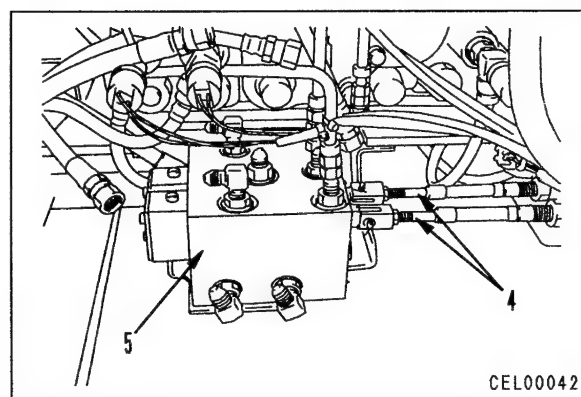
INSTALLATION OF WINCH CLUTCH VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

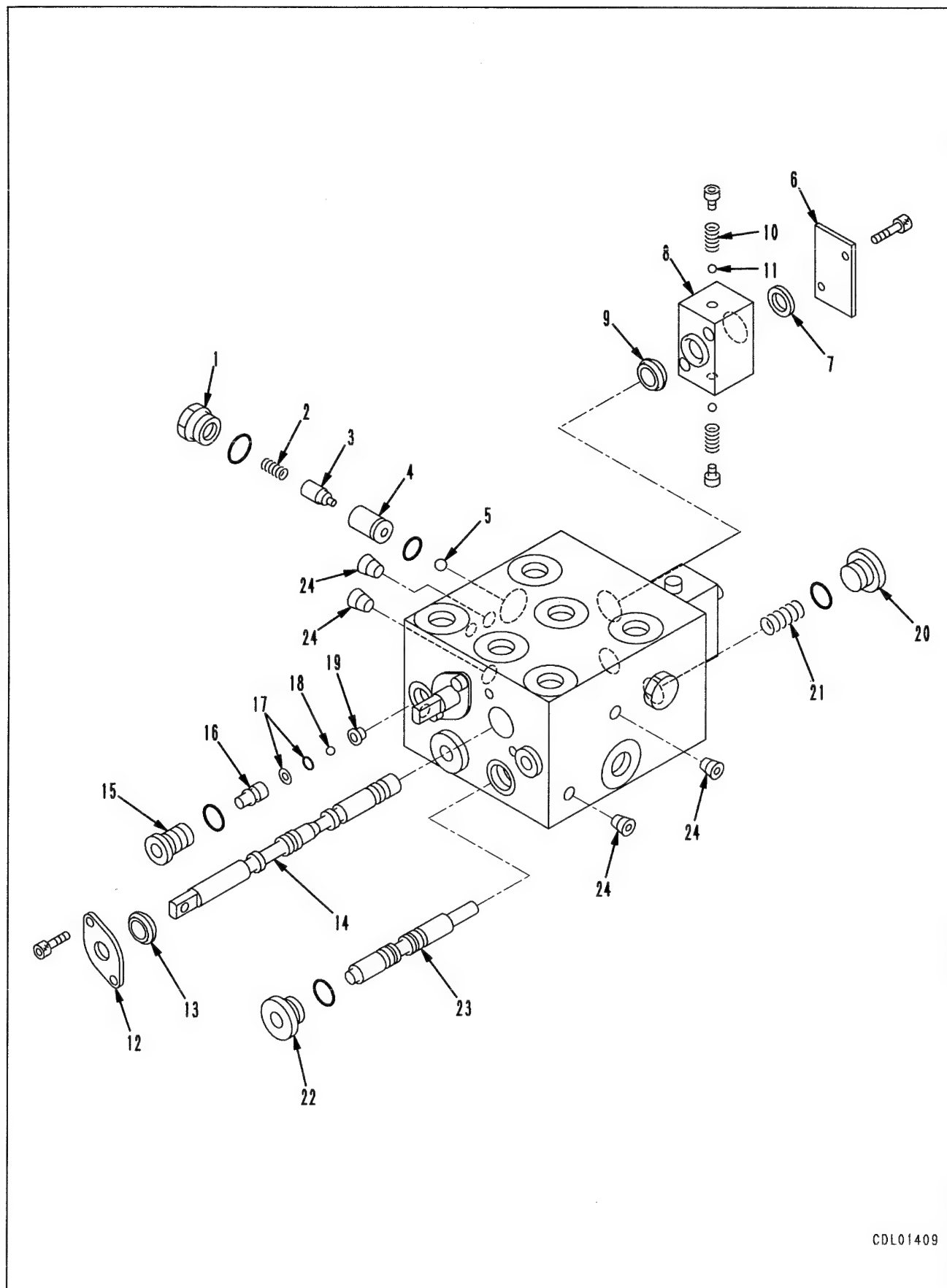
- ★ Bend the cotter pin securely.

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S02

DISASSEMBLY OF WINCH CLUTCH VALVE ASSEMBLY



023S02

CDL01409

1. Check valve

- 1) Remove plug (1).
- 2) Remove spring (2), plunger (3), and valve seat (4).
- 3) Remove steel ball (5).

2. Cover assembly

- 1) Remove plate (6), retainer (7), cover assembly (8), and packing (9).
- 2) Remove bolt, then remove spring (10) and steel ball (11).

3. Clutch valve

- 1) Remove plate (12).
- 2) Remove packing (13).
- 3) Remove spool (14).

4. Check valve

- 1) Remove plug (15).
- 2) Remove guide (16), then remove remove back-up ring (17) and O-ring (17).
- 3) Remove steel ball (18) and valve seat (19).

5. Automatic brake valve

- 1) Remove plug (20).
- 2) Remove spring (21).
- 3) Remove plug (22).
- 4) Remove spool (23).

6. Plug

Remove plug (24).

ASSEMBLY OF WINCH CLUTCH VALVE ASSEMBLY

1. Plug

Install plug (24).



Plug : Thread tightener
(Three Bond 1305 or equivalent)

2. Automatic brake valve

- 1) Assemble spool (23).
- 2) Fit O-ring and install plug (22).



Plug :
 $30.38 \pm 37.24 \text{ Nm } \{3.1 \pm 3.8 \text{ kgm}\}$

- 3) Assemble spring (21).
- 4) Fit O-ring and install plug (20).



Plug :
 $30.38 \pm 37.24 \text{ Nm } \{3.1 \pm 3.8 \text{ kgm}\}$

3. Check valve

- 1) Assemble valve seat (19) and steel ball (18).
- 2) Fit back-up ring (17) and O-ring (17), and install guide (16).
- 3) Fit O-ring and install plug (15).



Plug :
 $18.62 \pm 22.54 \text{ Nm } \{1.9 \pm 2.3 \text{ kgm}\}$

4. Clutch valve

- 1) Assemble spool (14).
- 2) Install packing (13).
- 3) Install plate (12).

5. Cover assembly

- 1) Assemble steel ball (11) and spring (10), and install bolt.



Mounting bolt :
 $11.76 \pm 14.7 \text{ Nm } \{1.2 \pm 1.5 \text{ kgm}\}$

- 2) Install packing (9), cover assembly (8), retainer (7), and plate (6).



Mounting bolt :
 $6.86 \pm 8.33 \text{ Nm } \{0.7 \pm 0.85 \text{ kgm}\}$

6. Check valve

- 1) Assemble steel ball (5).
- 2) Fit O-ring and assemble valve seat (4), plunger (3), and spring (2).
- 3) Fit O-ring and install plug (1).



Plug : $78.4 \pm 98 \text{ Nm } \{8 \pm 10 \text{ kgm}\}$

REMOVAL OF MAIN, AUXILIARY WINCH MOTOR ASSEMBLY

⚠ Set the parking brake switch to PARKING.

1. Remove rear cover (1) at left side of revolving frame.
★ When removing the auxiliary winch motor assembly, remove the cover at the rear right side of the revolving frame.

2. Drain oil from winch motor from oil plug (2).



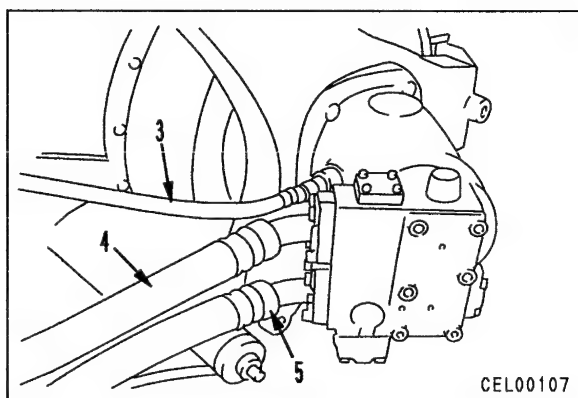
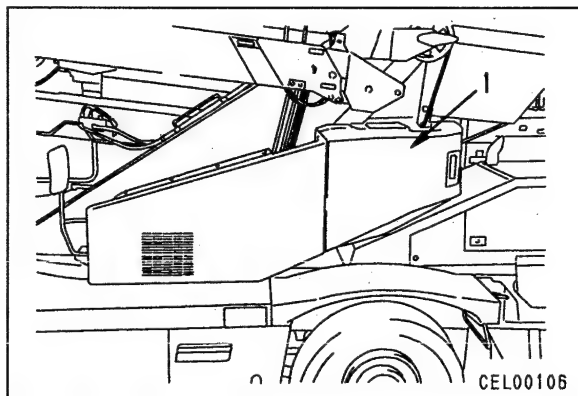
Winch case : **Approx. 7 ℓ**

3. Disconnect hoses (3), (4), and (5).

4. Lift off winch motor assembly (6).

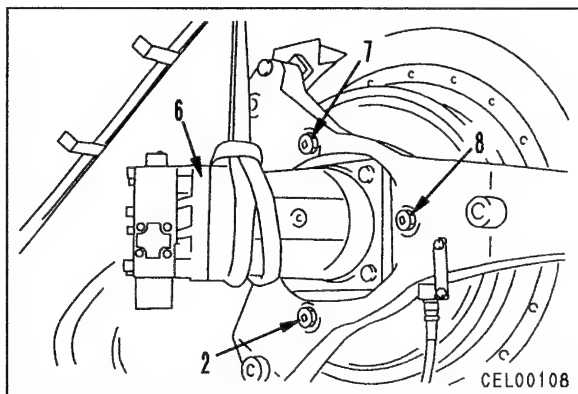


Winch motor assembly : **55 kg**



INSTALLATION OF MAIN, AUXILIARY WINCH MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (winch case)**
Set horizontal, then add hydraulic oil (AX075) through the hole of oil filler plug (7) until the oil reaches the bottom of oil filler plug hole (8).
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the winch motor. For details, see TESTING AND ADJUSTING, Bleeding air.



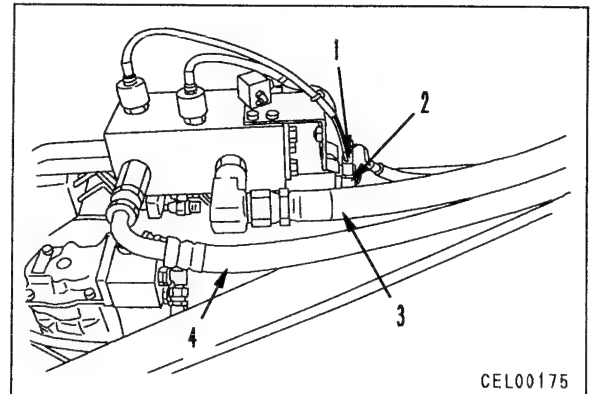
023S02

REMOVAL OF BOOM HOIST CYLINDER ASSEMBLY

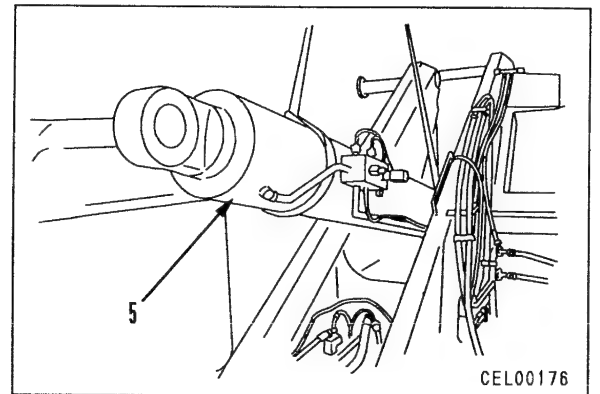
1. Remove boom assembly.
For details, see REMOVAL OF BOOM ASSEMBLY.
2. Disconnect wiring connectors (R36) (1) and (R27) (2).
3. Disconnect hoses (3) and (4).
4. Sling boom hoist cylinder assembly (5), and remove 4 outside mounting bolts (7) of holder (6) from cylinder bottom. ※ 1
5. Pull out pin (8) to point where boom hoist cylinder assembly separates. ※ 2
6. Lift off boom hoist cylinder assembly (5).



Boom hoist cylinder assembly : **600 kg**



CEL00175



CEL00176

INSTALLATION OF BOOM HOIST CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1



Holder mounting bolt :

Thread tightener (LT-2)



Holder mounting bolt :

276.85 ± 31.85 Nm {28.25 ± 3.25 kgm}

※ 2



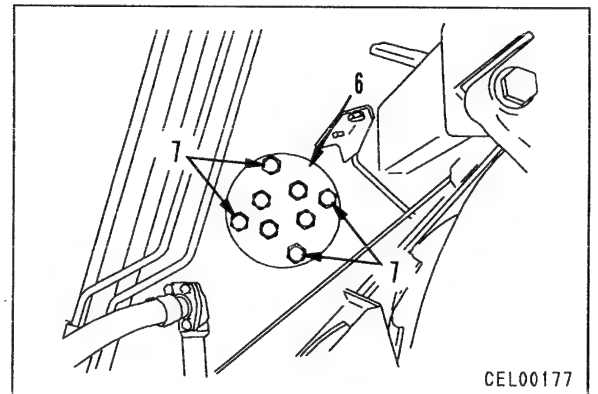
When aligning the position of the pin hole, never insert your fingers in the pin hole.



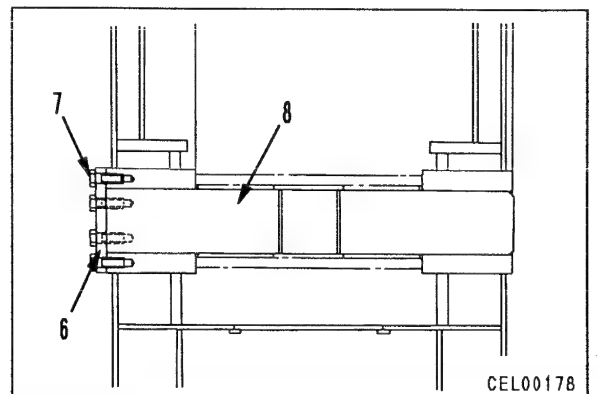
Pin portion :

Molybdenum disulphide lubricant (LM-G)

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.



CEL00177

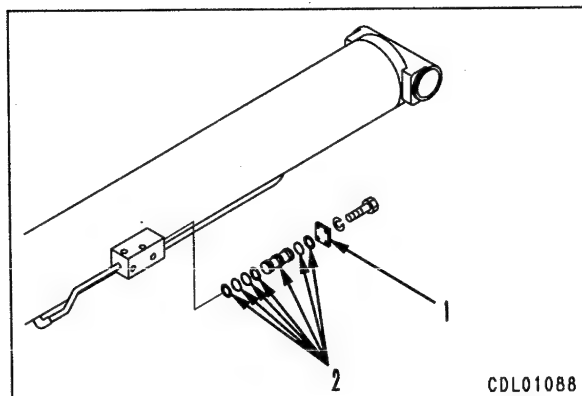


CEL00178

DISASSEMBLY OF BOOM HOIST CYLINDER ASSEMBLY

1. Valve assembly

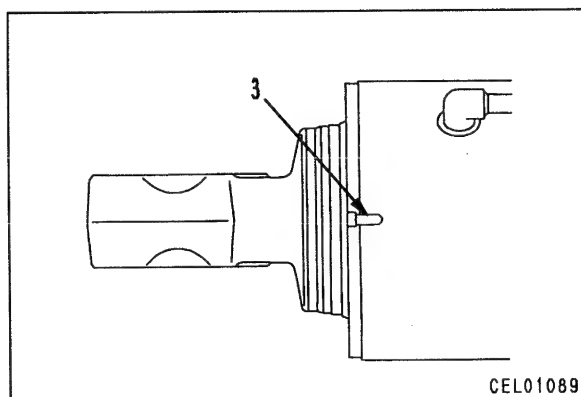
Remove plate (1) and valve assembly (2).



2. Piston rod assembly

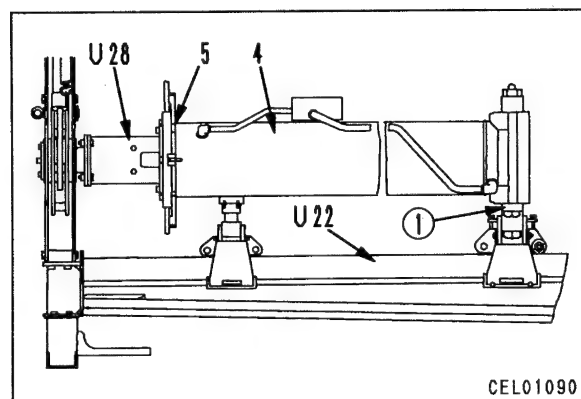
1) Disconnect welding portion of stopper (3).

- ★ Use a chisel or hand grinder to remove the weld.



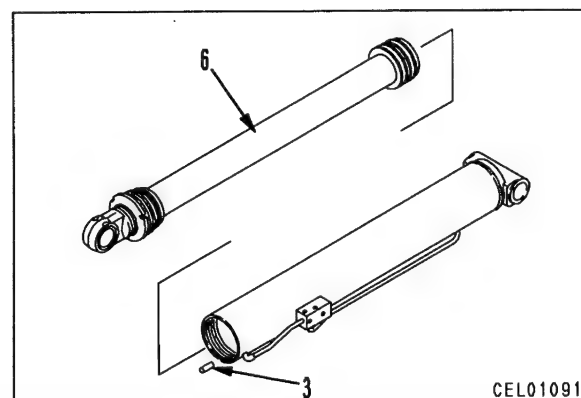
2) Put cylinder assembly (4) on block ①, and set to tool U22.

3) Using tool U28, loosen cylinder head assembly (5).



4) Remove piston rod assembly (6) and stopper (3).

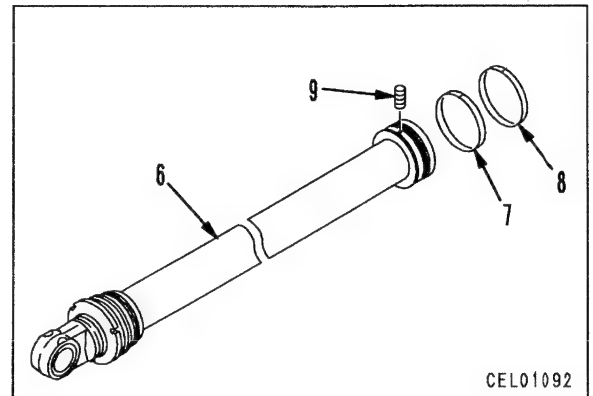
- ★ Put an oil pan under the cylinder to catch the oil.



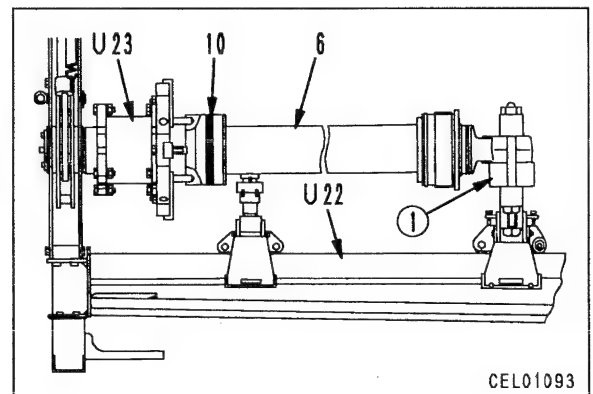
023S02

3. Piston assembly

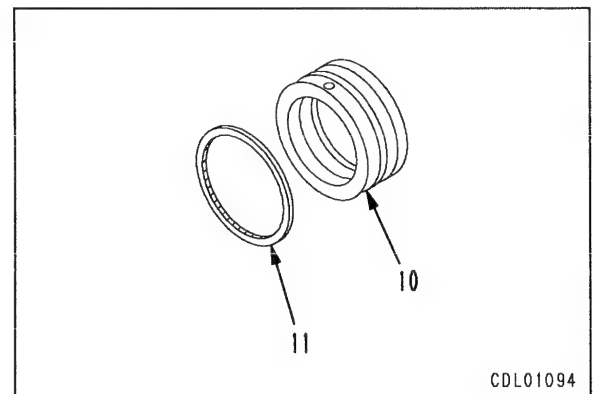
- 1) Remove wear rings (7) and (8).
- 2) Remove set screw (9).
 - ★ Grind off the caulking of the set screw with a hand drill.



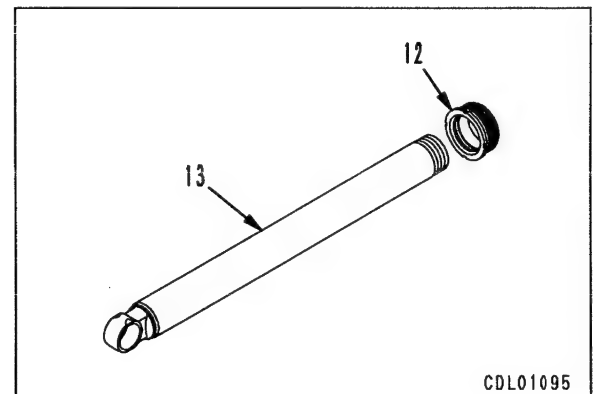
- 3) Put piston rod assembly (6) on block ①, and set to tool U22.
- 4) Using tool U23, remove piston assembly (10).



- 5) Remove piston ring (11) from piston assembly.
- ★ Put a screwdriver in contact with the piston ring, hit with a hammer to cut the ring, then remove the ring.

**4. Cylinder head assembly**

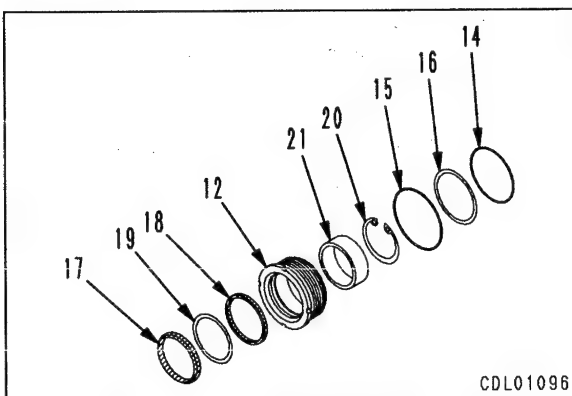
- 1) Remove cylinder head assembly (12) from piston rod (13). 30-118-3



023S02

2) Disassemble cylinder head assembly as follows.

- i) Remove O-rings (14) and (15), and back-up ring (16).
- ii) Remove dust seal (17).
- iii) Remove packing (18) and back-up ring (19).
- iv) Remove snap ring (20), then remove bushing (21).




023S02

ASSEMBLY OF BOOM HOIST CYLINDER ASSEMBLY


- ★ Coat the sliding surfaces of all parts with engine oil before installing. Be careful not to damage the packings, dust seals, and O-rings when installing.

1. Cylinder head assembly

- 1) Assemble cylinder head assembly (12) as follows.
 - i) Using tool **U24**, press fit bushing (19).
 - ★ After press fitting, check that there is no stepped portion on the bushing.
 - ii) Install snap ring (20).
 - iii) Install packing (18) and back-up ring (19).

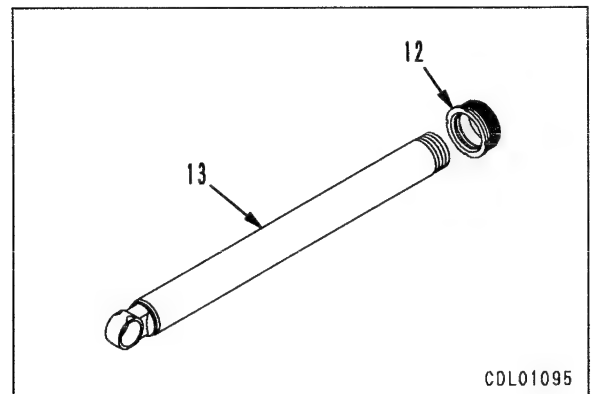
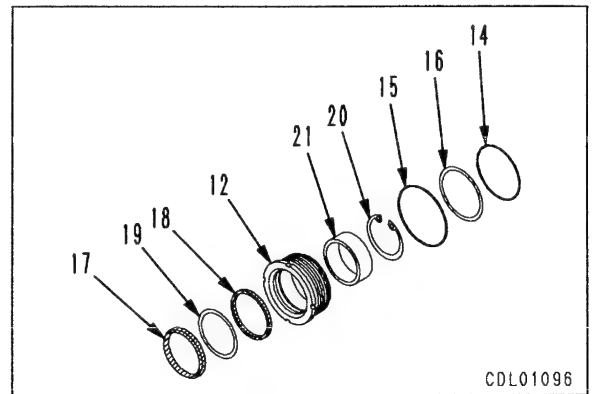
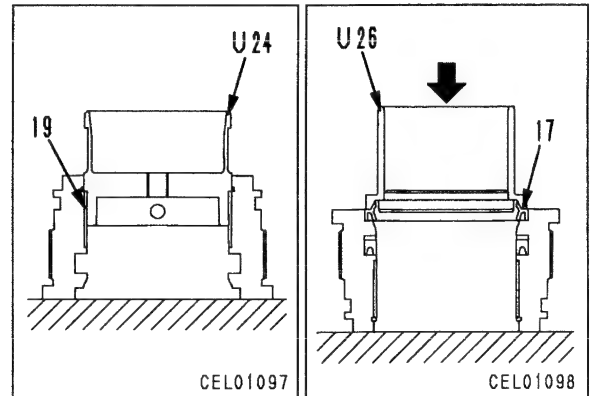
 Packing mount: **Rust prevention oil (P1300 or equivalent)**

- iv) Using tool **U26**, press fit dust seal (17).

 Outside circumference of dust seal : **Gasket sealant (Three Bond 1201 or equivalent)**

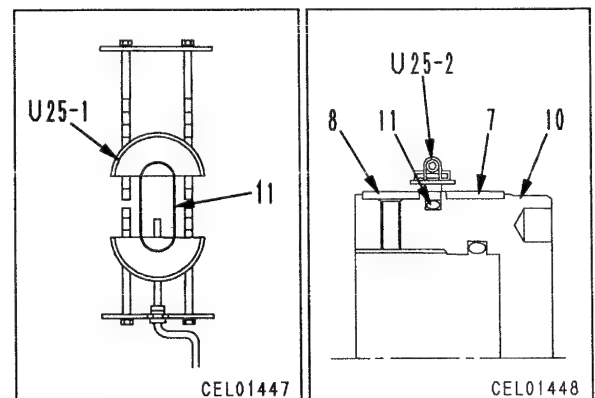
- v) Install back-up ring (16) and O-rings (15) and (14).

- vi) Install cylinder head assembly (12) to piston rod (13).

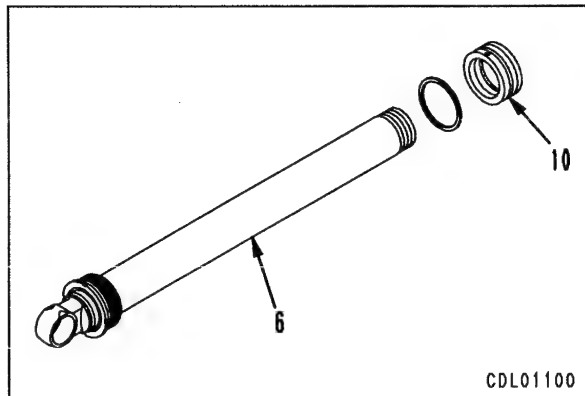


2. Piston assembly

- 1) Using tool **U25-1**, expand piston ring (11).
 - ★ Set the piston ring on the tool and turn the handle 8 – 10 times to expand the ring.
- 2) Remove piston ring (11) from tool, and install to piston (10).
- 3) Using tool **U25-2**, compress piston ring (11).
- 4) Install wear rings (8) and (7).



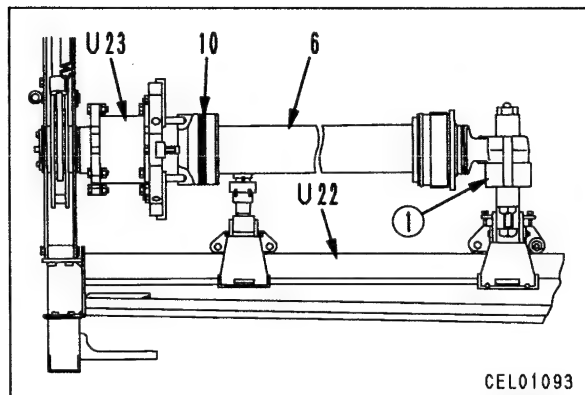
- 5) Fit O-ring and install piston assembly (10) to piston rod (6).




- 6) Put piston rod assembly (6) on block ①, and set to tool U22.

- 7) Using tool U23, tighten piston assembly (10).

 Piston assembly : **2940 Nm {300 kgm}**

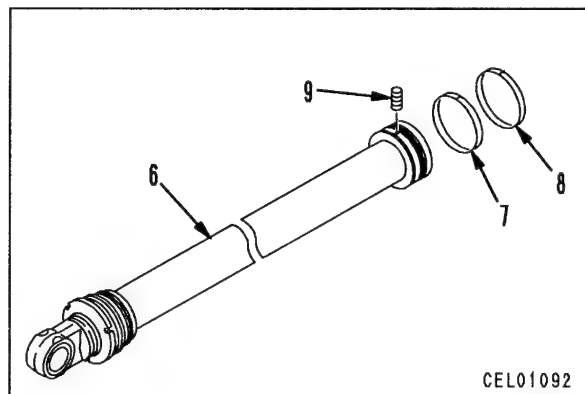


- 8) Install set screw (9).

 Set screw :
 $31.46 \pm 5.88 \text{ Nm} \{3.21 \pm 0.6 \text{ kgm}\}$

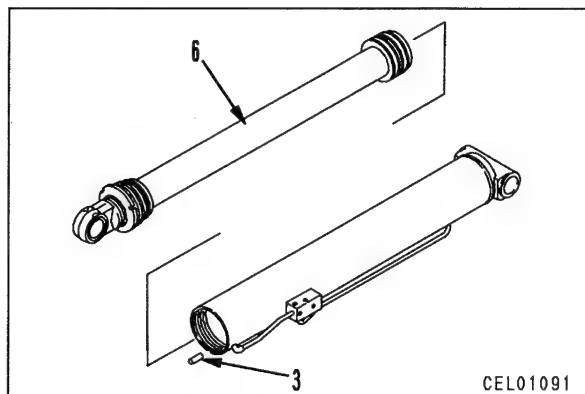
- ★ After tightening, use a punch to caulk at 2 places on the outside circumference of the set screw.

- 9) Install wear rings (8) and (7).



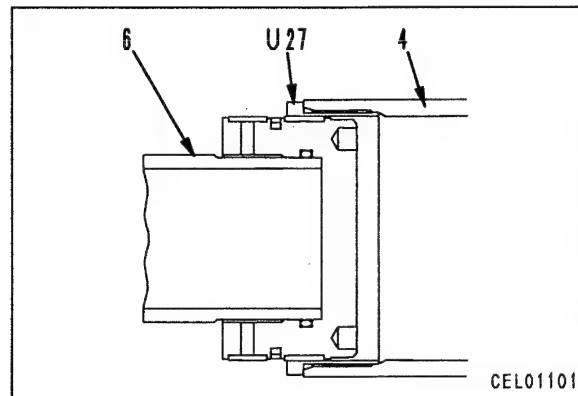
3. Piston rod assembly

- 1) Assemble stopper (3) and piston rod assembly (6) to cylinder (4).




023S02


- 2) Using tool U27, assemble piston rod assembly (6) to cylinder (4).
 ★ Push in the piston rod fully.

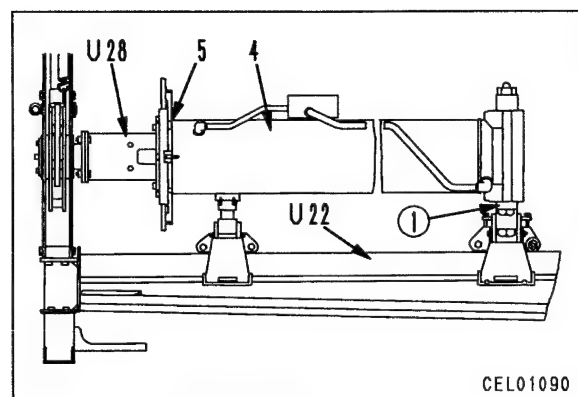


- 3) Put cylinder assembly (4) on block (1), and set to tool U22.

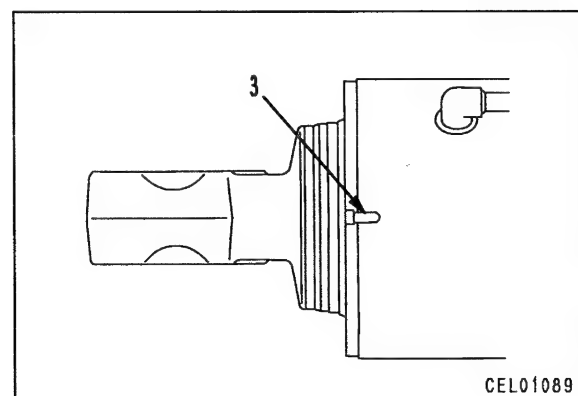
- 4) Using tool U28, tighten cylinder assembly (5).

 Cylinder head thread:
Molybdenum disulphide lubricant
(Three Bond 1901 or equivalent)

 **kgm** Cylinder head assembly :
4900 Nm {500 kgm}




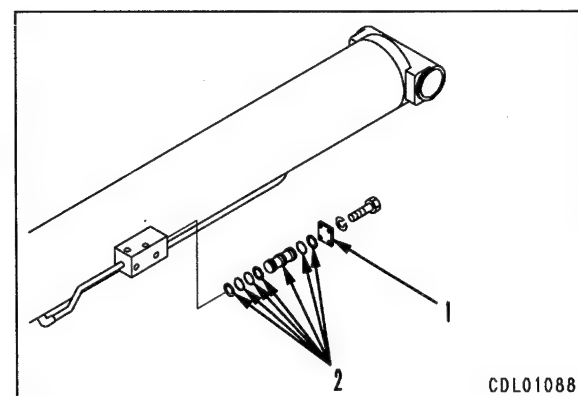
- ★ After tightening, weld stopper (3).



4. Valve assembly

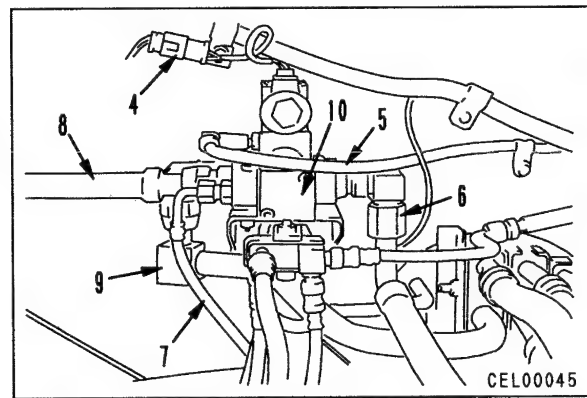
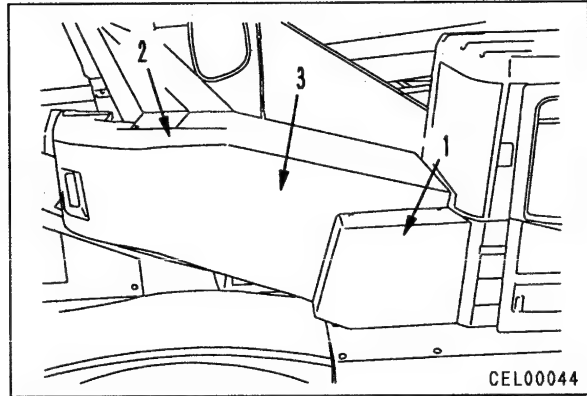
Install valve assembly (2) and plate (1).

 **kgm** Mounting bolt :
 31.36 ± 5.88 Nm { 3.2 ± 0.6 kgm}



REMOVAL OF BOOM TELESCOPE ORDER SELECTOR SOLENOID VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.
- 1. Remove covers (1), (2), and (3) at right side of revolving frame.
 - ★ Disconnect wiring connector (R06) from inside cover.
- 2. Disconnect wiring connector (R48) (4).
- 3. Disconnect hoses (5), (6), and (7).
- 4. Disconnect tubes (8) and (9).
- 5. Remove boom telescope order selector solenoid valve assembly (10).



INSTALLATION OF BOOM TELESCOPE ORDER SELECTOR SOLENOID VALVE ASSEMBLY

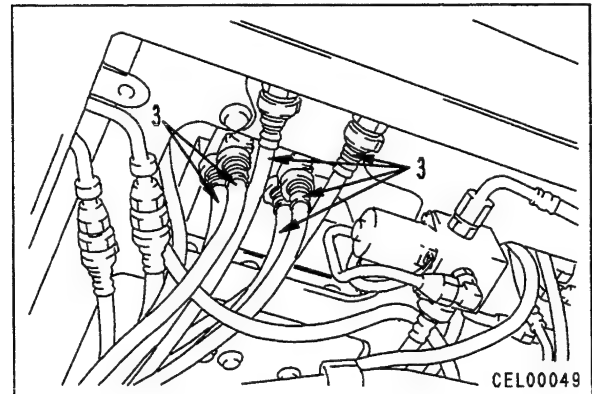
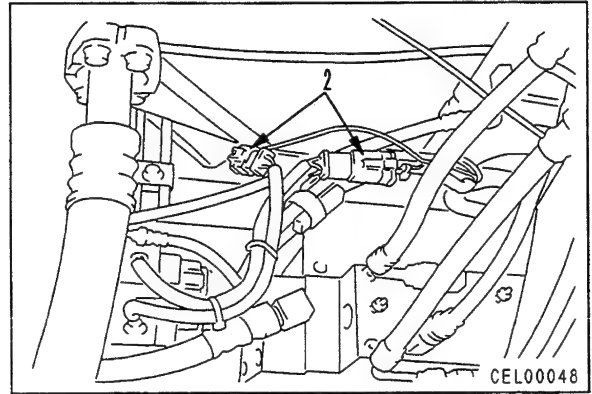
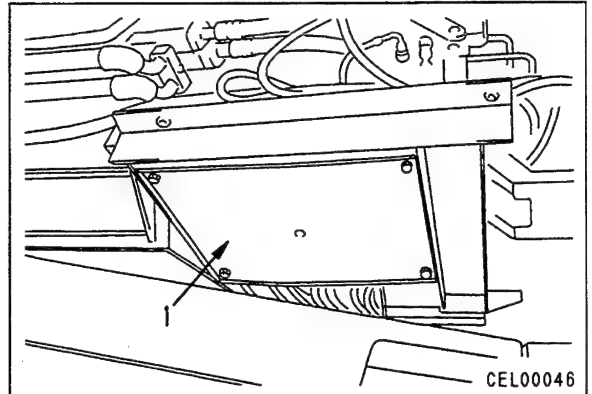
- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

REMOVAL OF PEDAL CONTROL SELECTOR VALVE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.
- 1. Remove cover (1) at bottom of boom and winch control valve.
- 2. Disconnect wiring connectors (R49, R50) (2).
- 3. Remove 11 hoses (3).
 - ★ After disconnecting the hoses, fit tags to distinguish them.
- 4. Remove pedal control selector valve assembly (4).

※ 1




STALLATION OF PEDAL CONTROL SELECTOR VALVE ASSEMBLY

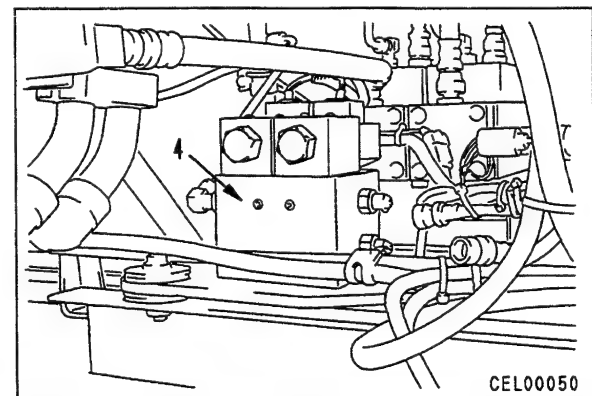
- Carry out installation in the reverse order to removal.

※ 1

- ★ If the solenoid valve has been removed from the pedal control selector valve assembly, be sure to tighten correctly to the tightening torque below.

 **kgm** Solenoid valve mounting bolt
(M5 with hexagonal socket) :
4.90 – 6.86 Nm {0.5 – 0.7 kgm}

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.





REMOVAL OF WINCH BRAKE CALIPER ASSEMBLY

 Set the parking brake switch to PARKING.

1. Remove cover at rear left side of revolving frame.
★ When removing the auxiliary winch brake caliper, remove the cover at the rear right of the revolving frame.


2. Loosen adjustment bolt (2) approx. 10 turns.  1

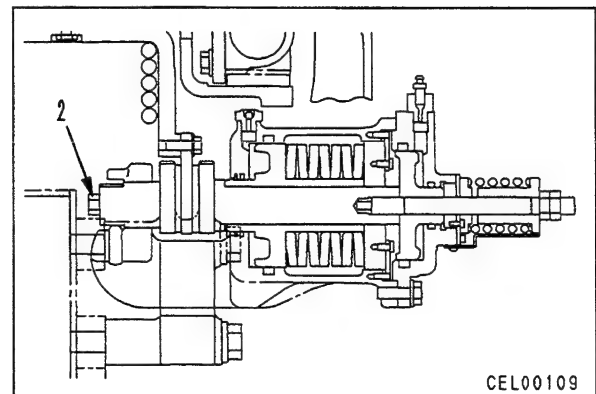
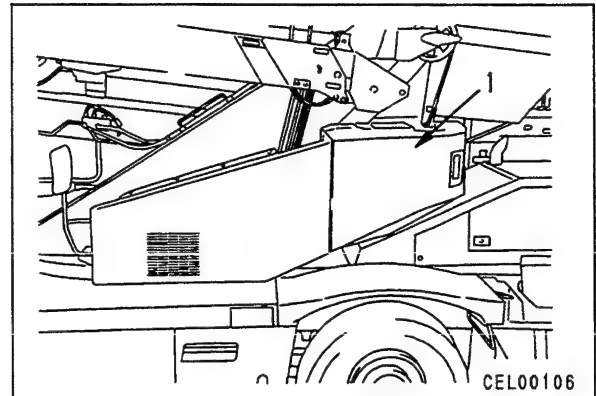
 Set the winch drum lock lever to the LOCK position.

 Set the PTO switch to the Operation 2 position and the winch clutch lever to the OFF position.

3. Disconnect hoses (3), (4), (5), (6), (7), and (8).

4. Lift off winch brake caliper assembly (9).  2

 Winch brake caliper assembly : 50 kg



INSTALLATION OF WINCH BRAKE CALIPER ASSEMBLY

- Carry out installation in the reverse order to removal.

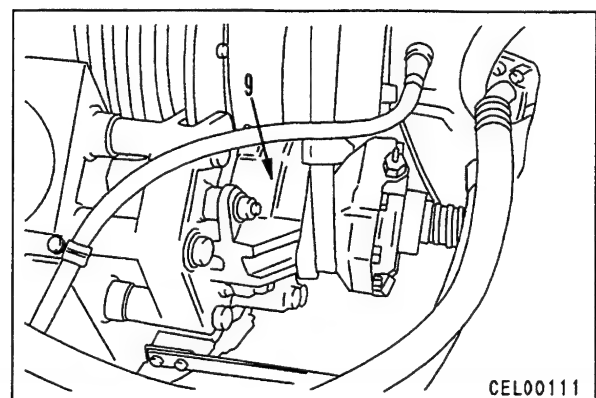
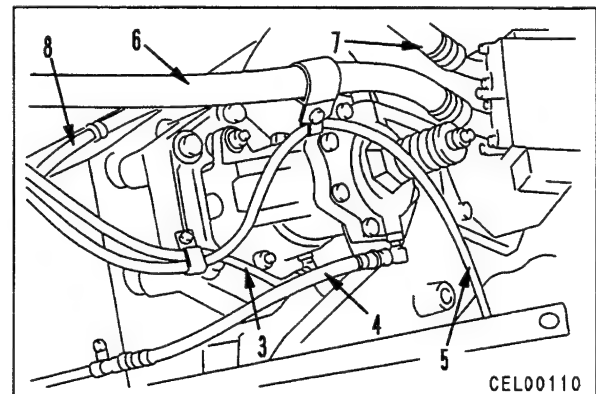
 1

- ★ Adjust the winch brake. For details, see TESTING AND ADJUSTING, Adjusting winch brake.

 2

 Winch brake caliper assembly mounting bolt : $548.8 \pm 58.8 \text{ Nm}$ $\{56 \pm 6 \text{ kgm}\}$

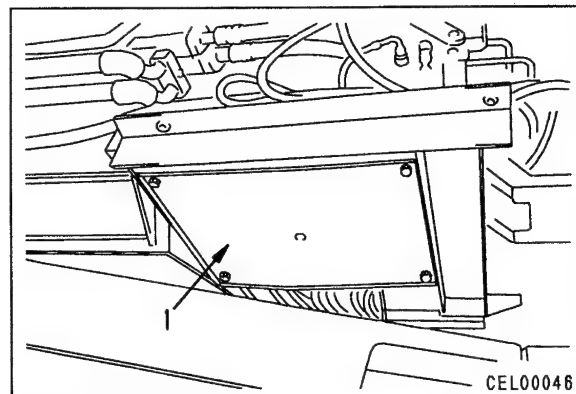
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the winch brake. For details, see TESTING AND ADJUSTING, Bleeding air.



REMOVAL OF PPC UNLOAD SOLENOID VALVE ASSEMBLY

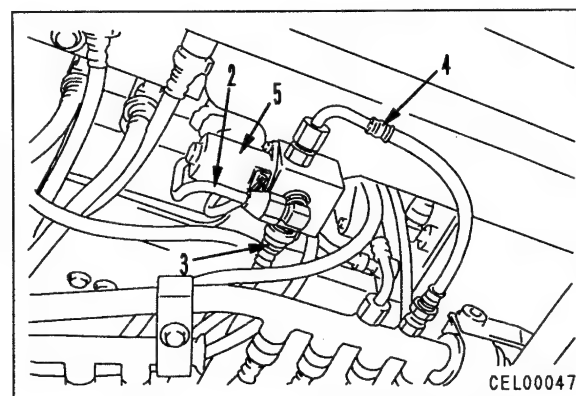
⚠ Set the parking brake switch to PARKING.

1. Remove cover (1) at bottom of boom and winch control valve.
2. Disconnect tube (2) and hoses (3) and (4).
3. Remove PPC unload solenoid valve assembly (5).



INSTALLATION OF PPC UNLOAD SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

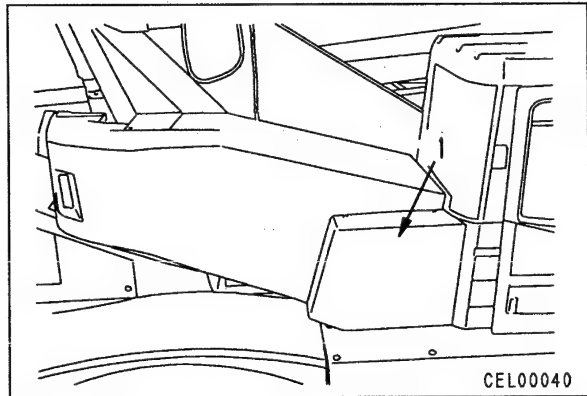


023S02

REMOVAL OF MAIN UNLOAD SOLENOID VALVE ASSEMBLY

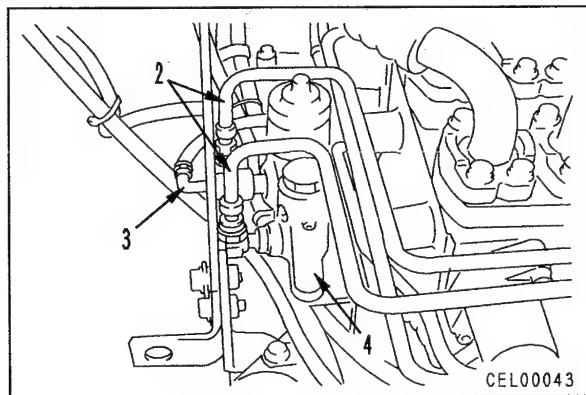
⚠ Set the parking brake switch to PARKING.

1. Remove side cover (1) at right side of revolving frame.
2. Remove 2 tubes (2).
3. Disconnect hose (3).
4. Remove main unload solenoid valve assembly (4).



INSTALLATION OF MAIN UNLOAD SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

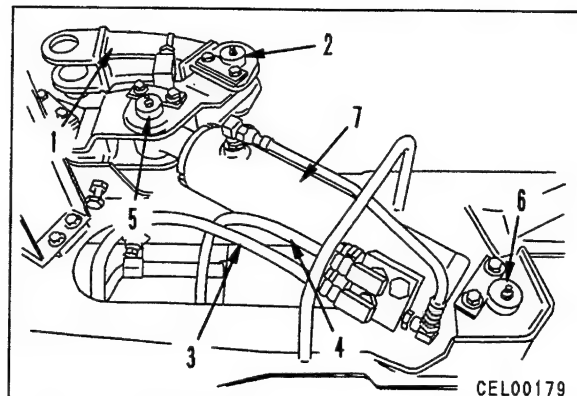


023S02

REMOVAL OF JIB ROTATION CYLINDER ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.

1. Pull out pin (2) of lever (1) and move lever to side. ※ 1
2. Disconnect hoses (3) and (4).
3. Remove pins (5) and (6). ※ 2
 - ★ Remove the shims from the bottom of the cylinder.
4. Remove jib rotating cylinder assembly (7).



INSTALLATION OF JIB ROTATION CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

 Pin portion :
Molybdenum disulphide lubricant (LM-G)

※ 2

- ⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

 portion :
Molybdenum disulphide lubricant (LM-G)

- ★ Insert the shim at the bottom of the cylinder to make the clearance less than 0.5 mm.

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

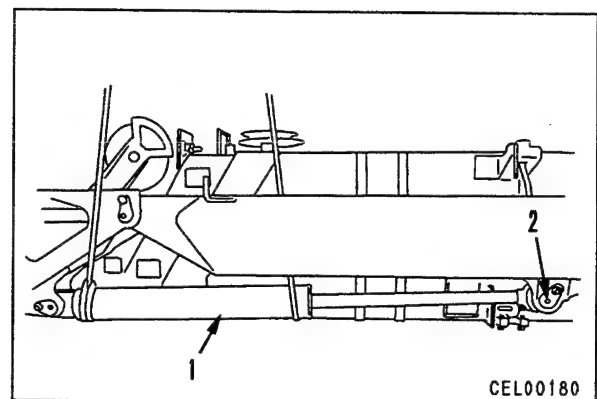
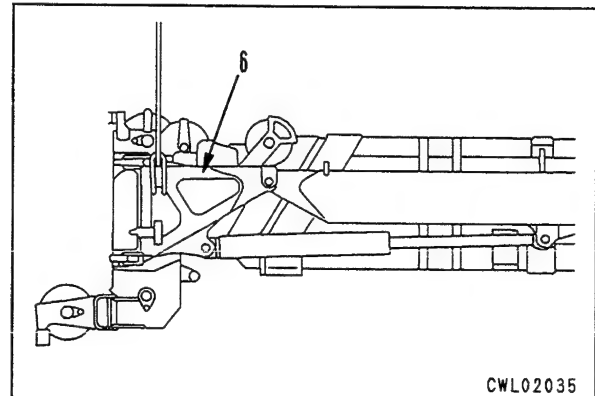
REMOVAL OF JIB POWER TILT CYLINDER ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground.
- ⚠ Check that the jib is stowed.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.

1. Sling jib bracket (6).
2. Sling jib power tilt cylinder assembly (1) and remove head pin (2). ※ 1
3. Run engine and retract cylinder.
 - ★ After retracting the cylinder to the end of its stroke, stop the engine.
4. Disconnect hoses (3) and (4).
5. Remove bottom pin (5), then lift off jib power tilt cylinder assembly (1). ※ 2



Jib power tilt cylinder assembly : 100 kg



INSTALLATION OF JIB POWER TILT CYLINDER ASSEMBLY

. Carry out installation in the reverse order to removal.

※ 1 ※ 2

- ⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.



Pin portion :

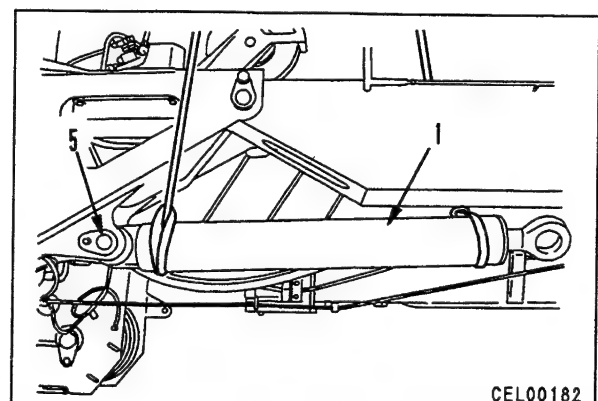
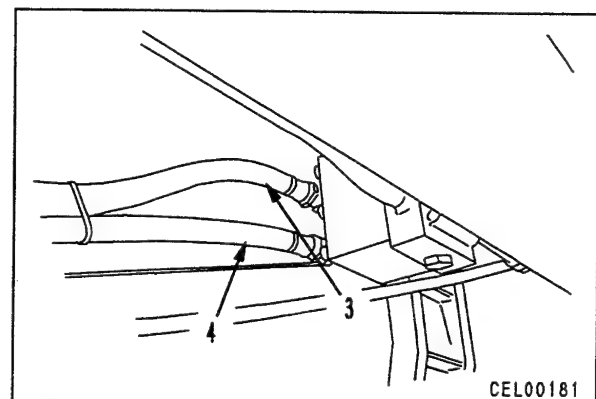
Molybdenum disulphide lubricant (LM-G)



Pin mounting bolt :

105.35 ± 17.15 Nm {10.75 ± 1.75 kgm}

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.



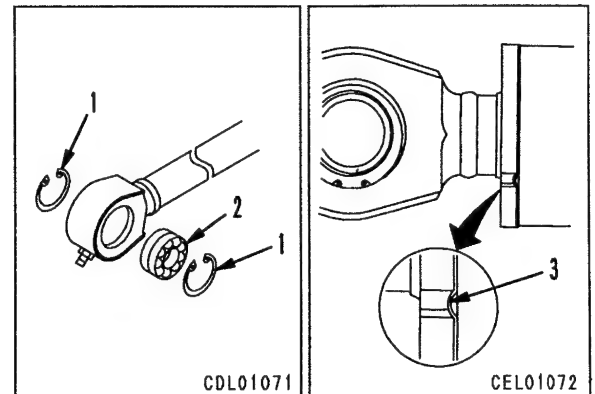
DISASSEMBLY OF JIB POWER TILT CYLINDER ASSEMBLY

1. Bearing

Remove snap ring (1), then remove bearing (2).

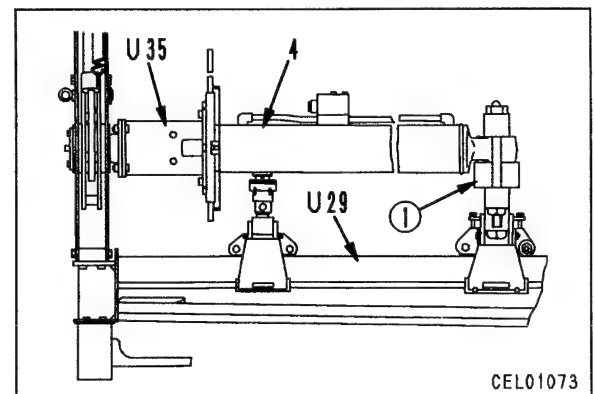
2. Piston rod assembly

1) Raise lock washer (3) and make it flat.



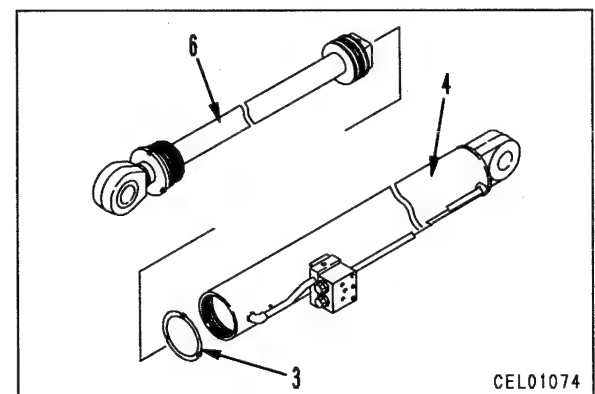
2) Put cylinder assembly (4) on block ①, and set to tool U29.

3) Using tool U35, loosen cylinder head assembly (5).



4) Remove piston rod assembly (6) and lock washer (3).

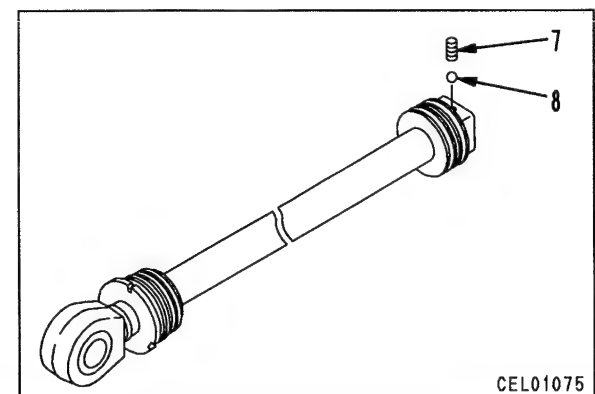
★ Put an oil pan under the cylinder to catch the oil.



3. Piston assembly

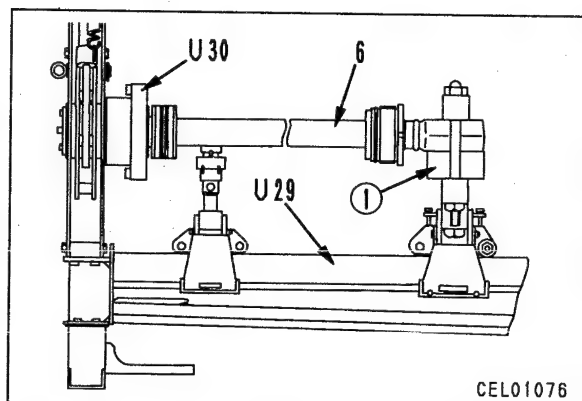
1) Remove set screw (7), then remove ball (8).

★ Grind off the caulking of the set screw with a hand drill.



023S02

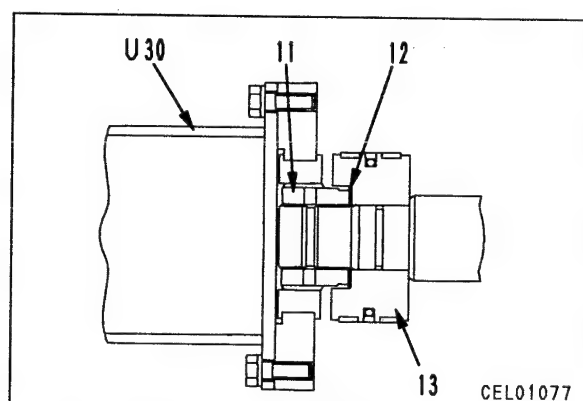
- 2) Put piston rod assembly (6) on block ①, and set to tool **U29**.



- 3) Using tool **U30**, remove nylon nut (11).

- 4) Remove shim (12).

- 5) Remove piston assembly (13).

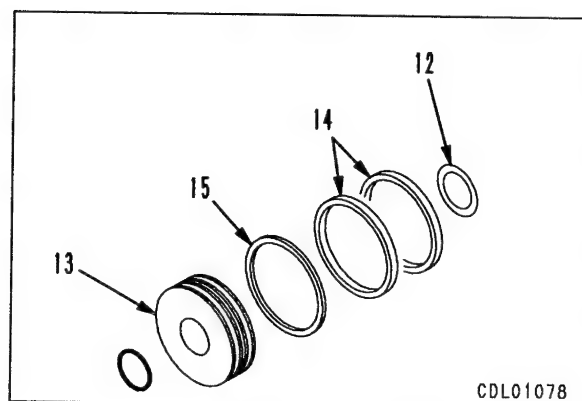


- 6) Disassemble piston assembly as follows.

- i) Remove wear ring (14).

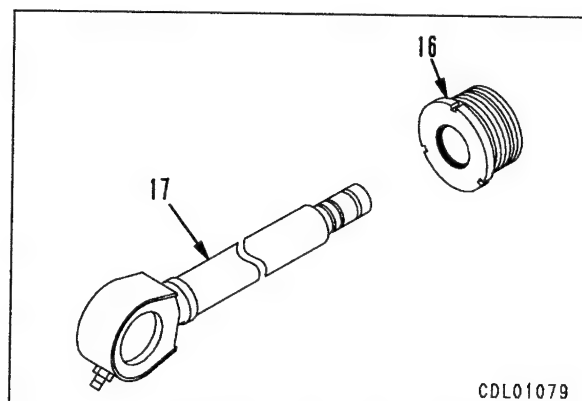
- ii) Remove piston ring (15).

- ★ Put a screwdriver in contact with the piston ring, hit with a hammer to cut the ring, then remove the ring.



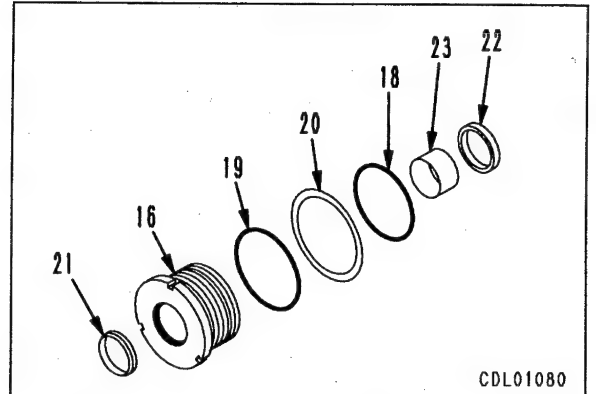
4. Cylinder head assembly

- 1) Remove cylinder head assembly (16) from piston rod (17).



023S02

- 2) Disassemble cylinder head assembly as follows.
- i) Remove O-rings (18) and (19), and back-up ring (20).
 - ii) Remove dust seal (21).
 - iii) Remove packing (22) and bushing (23).



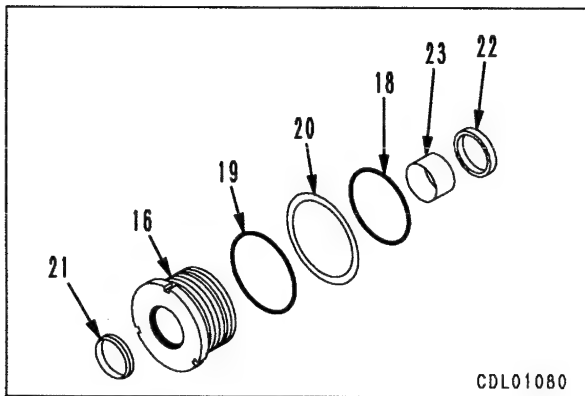
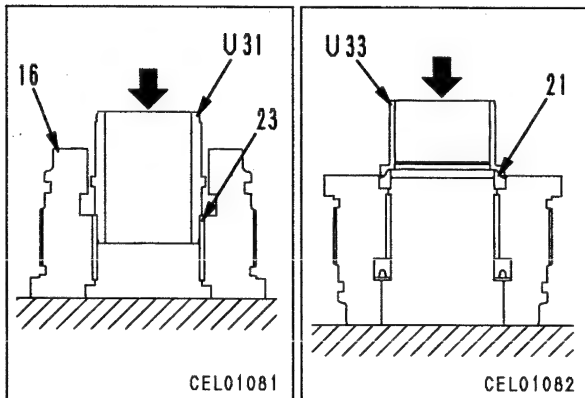
023S02

ASSEMBLY OF JIB POWER TILT CYLINDER ASSEMBLY

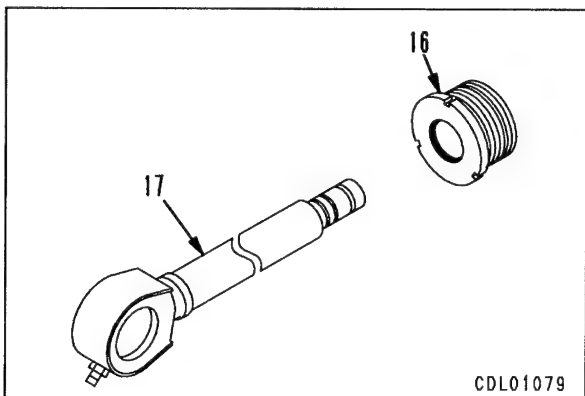
- ★ Coat the sliding surfaces of all parts with engine oil before installing. Be careful not to damage the packings, dust seals, and O-rings when installing.

1. Cylinder head assembly

- 1) Assemble cylinder head assembly (16) as follows.
 - i) Using tool **U31**, press fit bushing (23).
 - ★ After press fitting, check that there is no stepped portion on the bushing.
 - ii) Install packing (22).
 - iii) Using tool **U33**, press fit dust seal (21).
 - v) Install back-up ring (20), and O-rings (19) and (18).

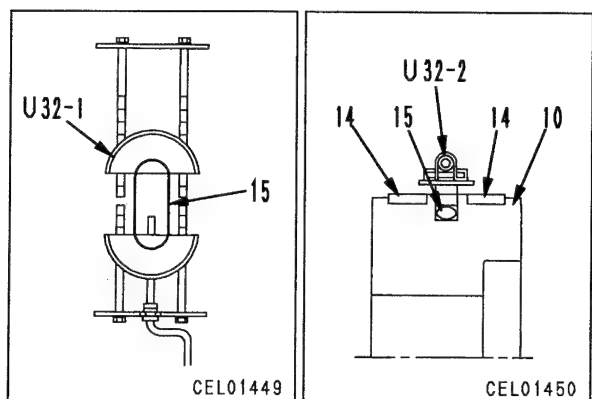


- vi) Install cylinder head assembly (16) to piston rod (17).



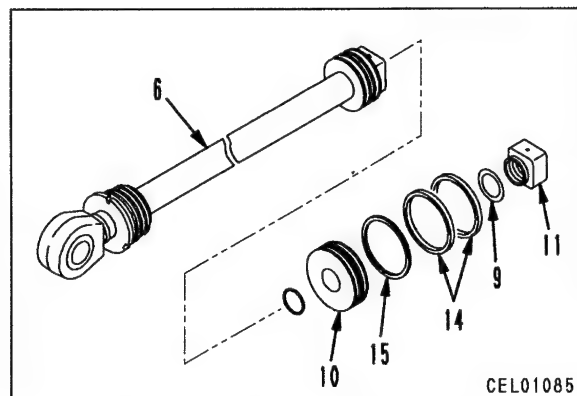
2. Piston assembly

- 1) Using tool **U32-1**, expand piston ring (15).
 - ★ Set the piston ring on the tool and turn the handle 8 – 10 times to expand the ring.
- 2) Remove piston ring (15) from tool, and install to piston (10).
- 3) Using tool **U32-2**, compress piston ring (15).
- 4) Install wear ring (14).

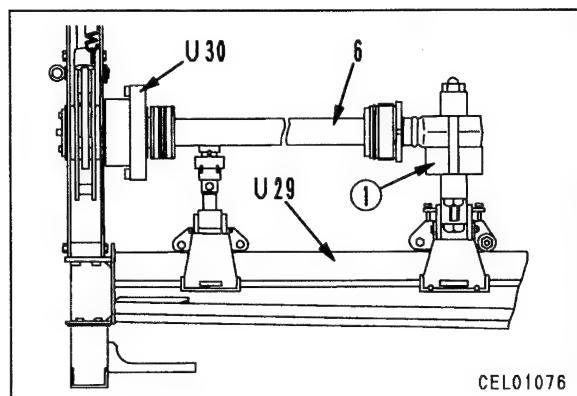


023S02


- 5) Fit O-ring and install piston assembly (10) to piston rod (6).
- 6) Fit shim (9), then fit nylon nut (11) temporarily.

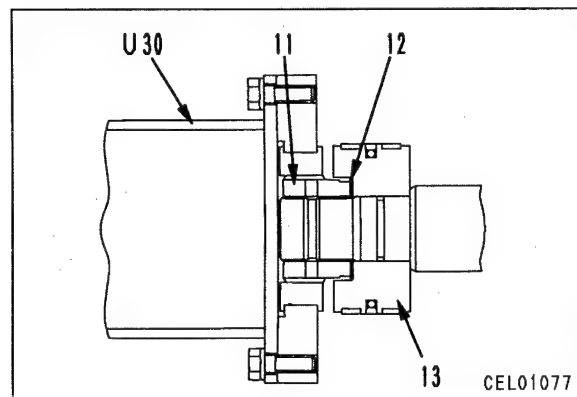


- 7) Put piston rod assembly (6) on block ①, and set to tool U29.



- 8) Using tool U30, tighten nylon nut (11).

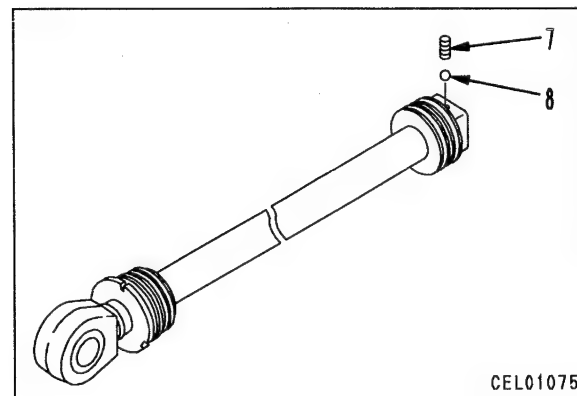
 **Nylon nut :**
 $2714.6 \pm 117.6 \text{ Nm } \{277 \pm 12 \text{ kgm}\}$



- 9) Fit ball (8) and install set screw (7).

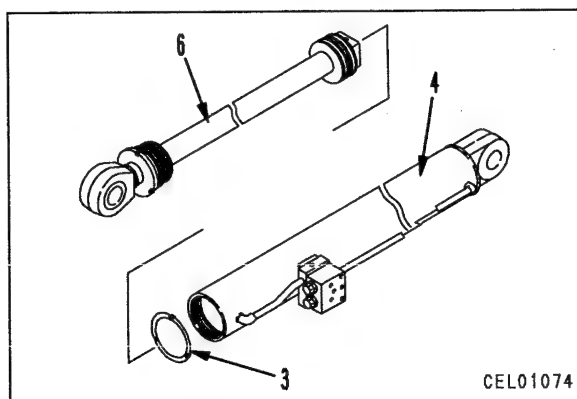
 **Set screw :**
 $31.46 \pm 5.88 \text{ Nm } \{3.21 \pm 0.6 \text{ kgm}\}$

- ★ After tightening, use a punch to caulk at 2 places on the outside circumference of the set screw.



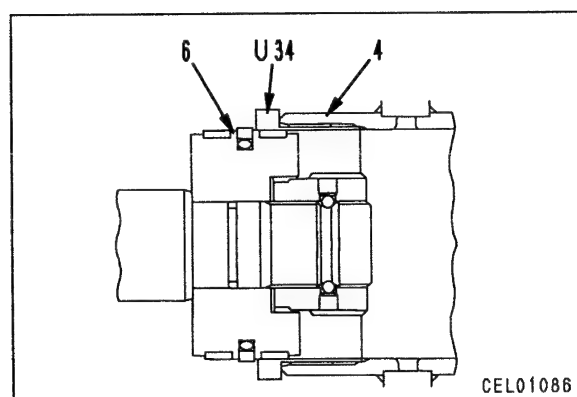
3. Piston rod assembly

- 1) Assemble lock washer (3) to piston rod assembly (6).




- 2) Using tool **U34**, assemble piston rod assembly (6) to cylinder (4).


★ Push the piston rod fully.

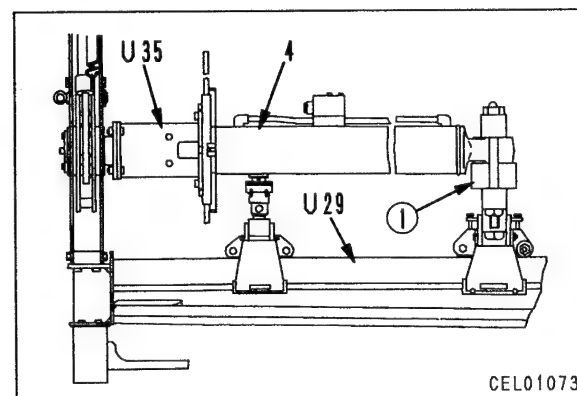


- 3) Put cylinder assembly (4) on block ① and set to tool **U29**.

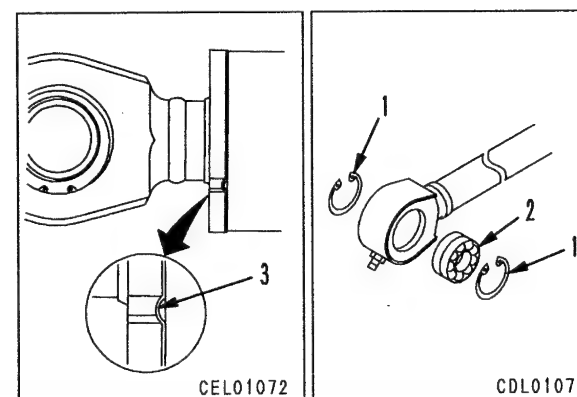
- 4) Using tool **U35**, tighten cylinder head assembly (5).

 Cylinder head assembly :
Molybdenum disulphide lubricant
(Three Bond 1901 or equivalent)

 kgm Cylinder head assembly :
1274 ± 294 Nm {136 ± 30 kgm}



- ★ After tightening, bend lock washers (3) at 2 places (at the cylinder head and cylinder bottom).

**4. Bearing**

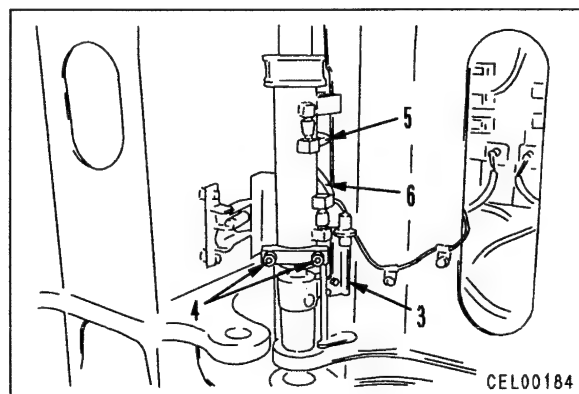
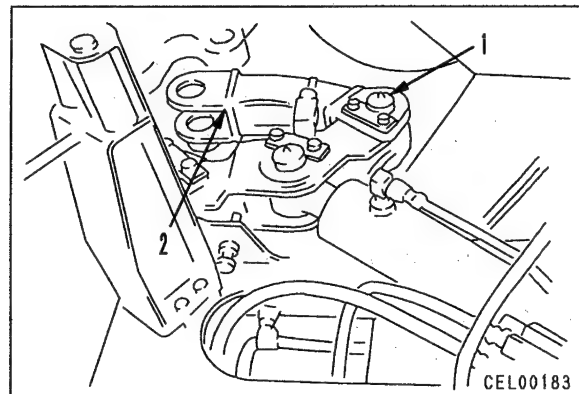
Remove snap ring (1), then remove bearing (2).

REMOVAL OF JIB LOCK CYLINDER ASSEMBLY

⚠ Extend the outriggers and set securely in contact with the ground.

⚠ The operation requires working at high places, so be extremely careful during the operation.

1. Remove pin (1), then remove lever (2). ※ 1
2. Remove proximity sensor bracket (3). ※ 2
3. Remove U-clamp (4).
4. Disconnect tubes (5) and (6).
5. Remove snap ring (7), then remove top pin (8). ※ 3
 - ★ Rotate lever (9) to a point where the pin can be seen.
6. Remove cotter pin (10), then remove bottom pin (11). ※ 4
7. Remove jib lock cylinder assembly (12).



INSTALLATION OF JIB LOCK CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ Adjust the proximity sensor. For details, see TESTING AND ADJUSTING, Adjusting proximity switch.

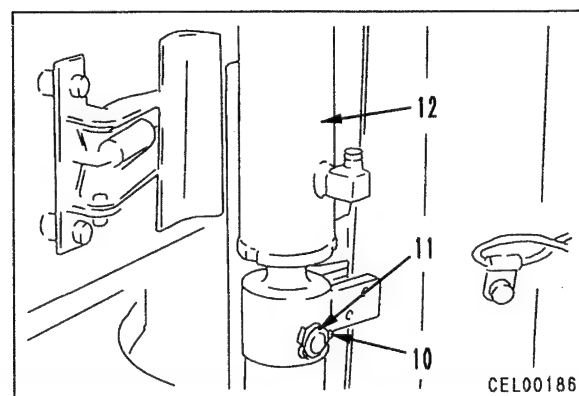
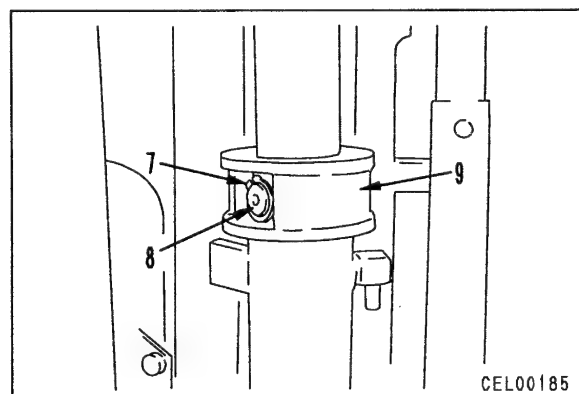
※ 2

 Pin portion : **Molybdenum disulphide lubricant (LM-G)**

- ★ Bend the cotter pin securely.

※ 3 ※ 4

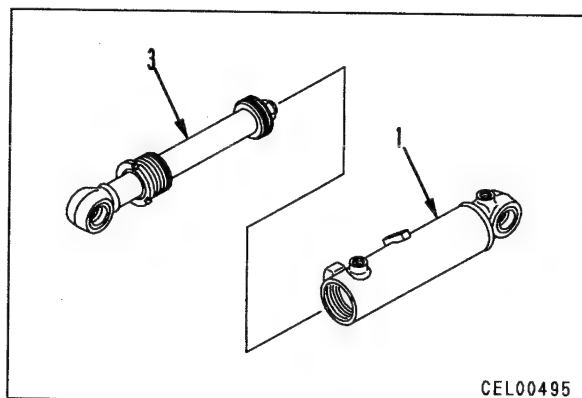
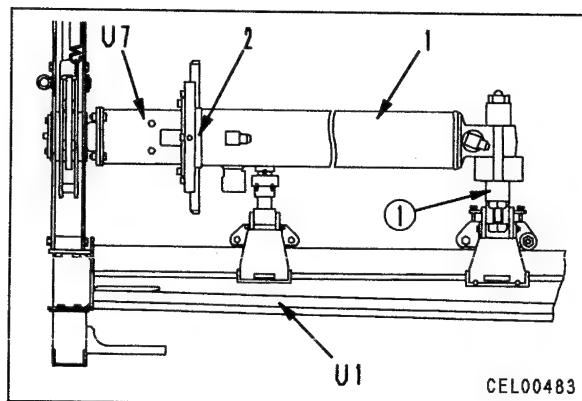
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.



DISASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

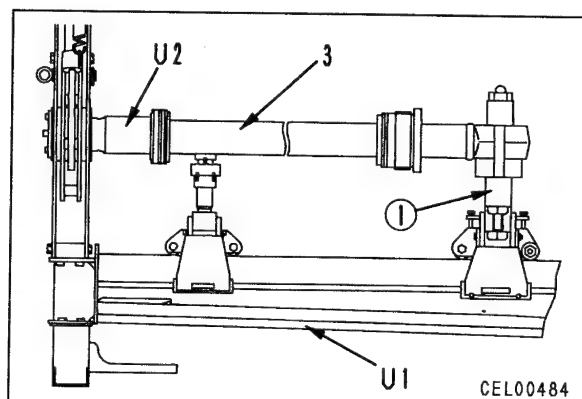
★ This section describes the procedure for disassembly and assembly of the suspension lock cylinder, steering and outrigger slide cylinder (X-shape), jib rotation cylinder, and jib lock cylinder.

1. Cylinder tube (outrigger slide cylinder only)
Remove cylinder tube.
2. Check valve (suspension lock cylinder only)
Remove check valve.
3. Piston rod assembly
 - 1) Put cylinder assembly (1) on block ① and set to tool **U1**.
 - 2) Using tool **U7**, loosen cylinder head assembly (2).
 - 3) Remove piston rod assembly (3).
 - ★ Put an oil pan under the cylinder to catch the oil.

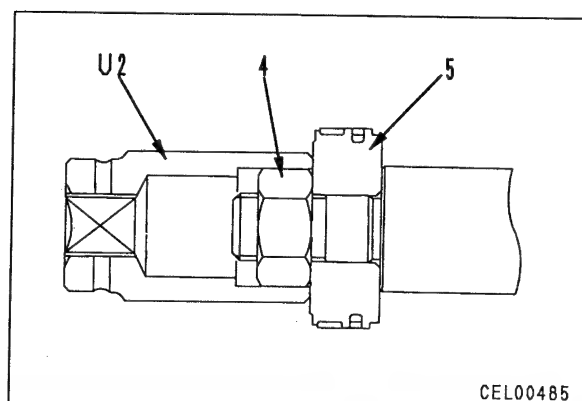


4. Piston assembly

- 1) Put piston rod assembly (3) on block ① and set to tool **U1**.

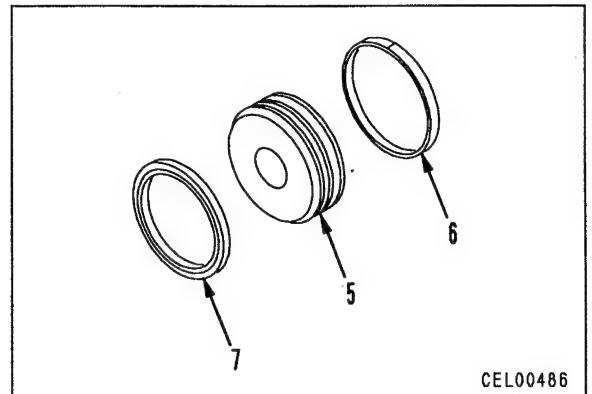


- 2) Using tool **U2**, remove nylon nut (4) (except jib lock cylinder).
- 3) Remove piston assembly (5).



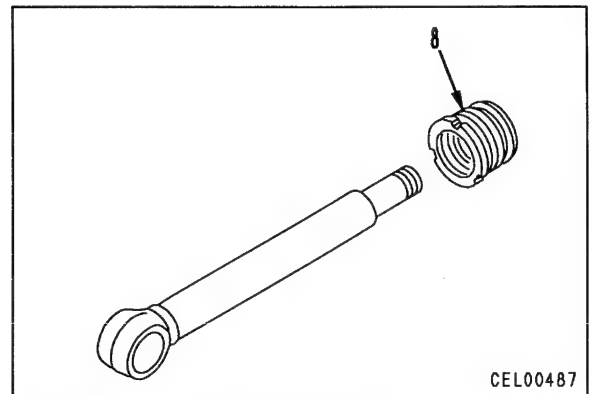
023S02

- 4) Disassemble piston assembly as follows.
- Remove wear ring (6).
 - Remove piston ring (7).

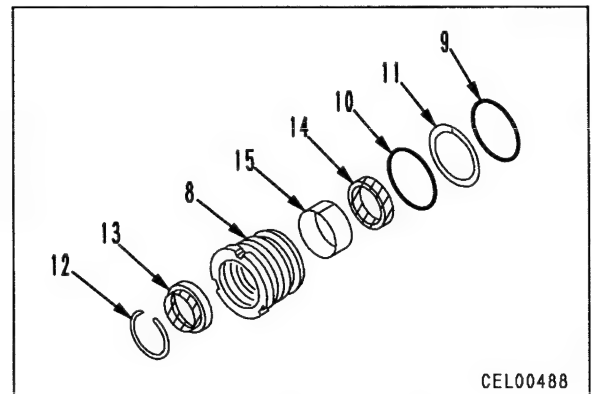


5. Cylinder head assembly

- 1) Remove cylinder head assembly (8) from piston rod.



- 2) Disassemble cylinder head assembly as follows.
- Remove O-rings (9) and (10), and back-up ring (11).
 - Remove snap ring (12), then remove dust seal (13).
 - Remove packing (14), then remove bushing (15).



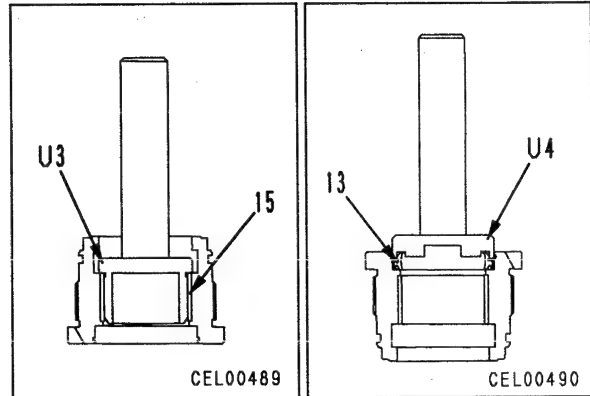
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ASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

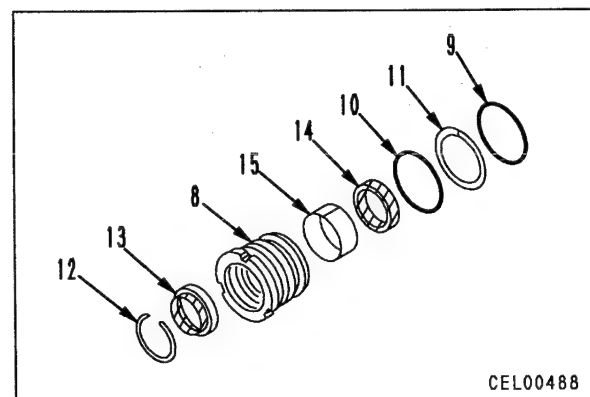
- ★ Coat the sliding surfaces of all parts with engine oil before installing. Be careful not to damage the packings, dust seals, and O-rings when installing.

1. Cylinder head assembly

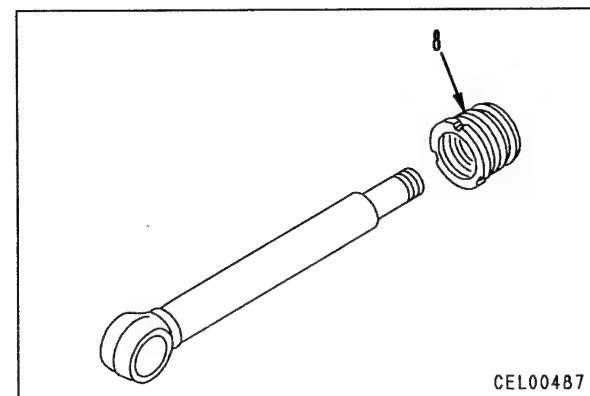
- 1) Assemble cylinder head assembly as follows.
 - i) Using tool **U3**, press fit bushing (15).
 - ii) Install packing (14).
 - iii) Using tool **U4**, press fit dust seal (13).



- iv) Install snap ring (12).
- v) Install back-up ring (11), and O-rings (10) and (9).

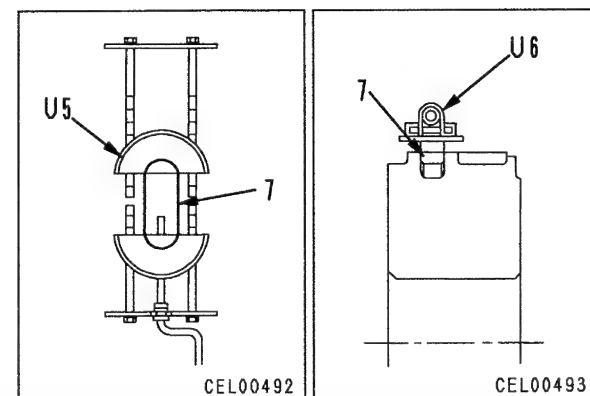


- vi) Install cylinder head assembly (8) to piston rod.



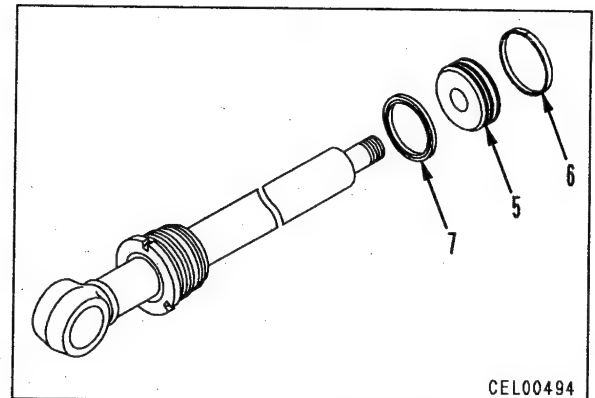
2. Piston assembly

- 1) Assemble piston assembly as follows.
 - i) Using tool **U5**, expand piston ring (7).
 - ★ Set the piston ring on the tool and turn the handle 8 – 10 times to expand the ring.
 - ii) Remove piston ring (7) from tool **U5**, and install to piston (10).
 - iii) Set tool **U6** in position and compress piston ring (7).

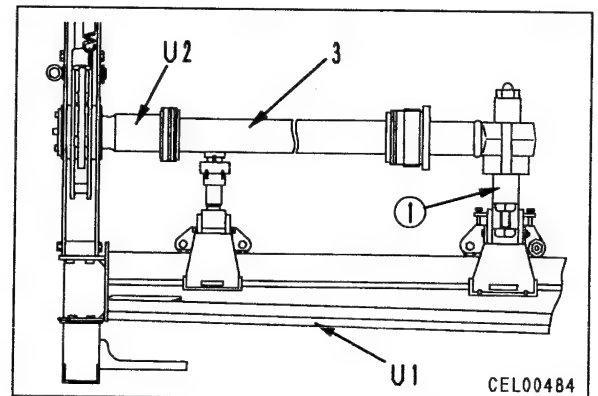


023S02

- iv) Install wear ring (6) to piston.
- 2) Install piston assembly (5).



- 3) Put piston rod assembly (3) on block ①, and set to tool U1.



- 4) Using tool U2, tighten nylon nut (4) (except jib lock cylinder).



Nylon nut :

Thread tightener (Loctite 262)



kgm Steering cylinder nylon nut :

$617.4 \pm 61.74 \text{ Nm}$ { $63 \pm 6.3 \text{ kgm}$ }



kgm Outrigger slide cylinder nut and jib rotation cylinder :

$411.6 \pm 41.16 \text{ Nm}$ { $42 \pm 4.2 \text{ kgm}$ }



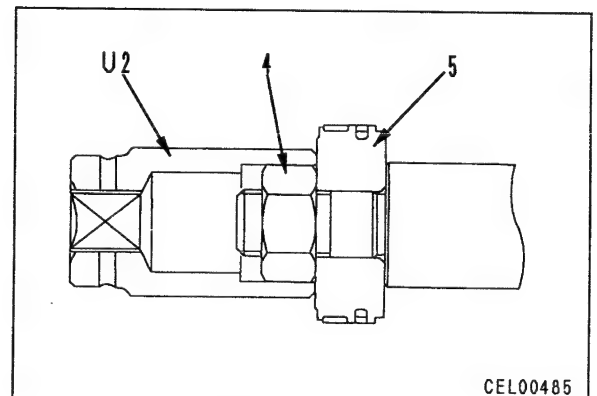
kgm Suspension lock cylinder nylon nut :

$1421 \pm 142.1 \text{ Nm}$ { $145 \pm 14.5 \text{ kgm}$ }



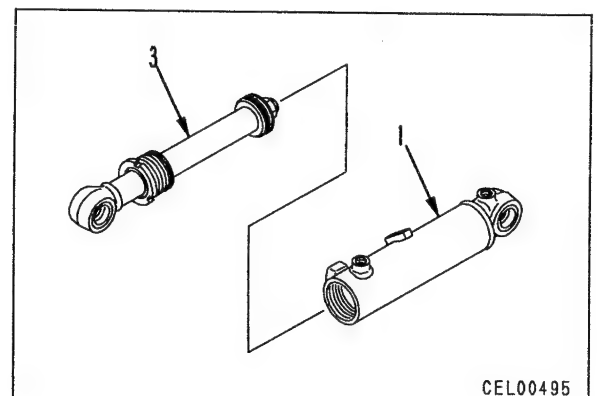
kgm Jib lock cylinder nylon nut :

$156.8 \pm 15.68 \text{ Nm}$ { $16 \pm 1.6 \text{ kgm}$ }




3. Piston rod assembly


- 1) Assemble piston rod assembly (3) to cylinder (1).
- ★ Coat the seal portion of the piston with grease.
 - ★ Push in the piston rod fully.
 - ★ Coat the back-up ring with grease.





2) Put cylinder assembly (1) on block ① and set to too **U1**.

3) Using tool **U7**, tighten cylinder head assembly (2).

 **Steering cylinder head assembly :**
 $588 \pm 58.8 \text{ Nm}$ { $60 \pm 6 \text{ kgm}$ }


 **Outrigger slide cylinder head assembly and jib rotation cylinder head assembly :**
 $539 \pm 53.9 \text{ Nm}$ { $55 \pm 5.5 \text{ kgm}$ }

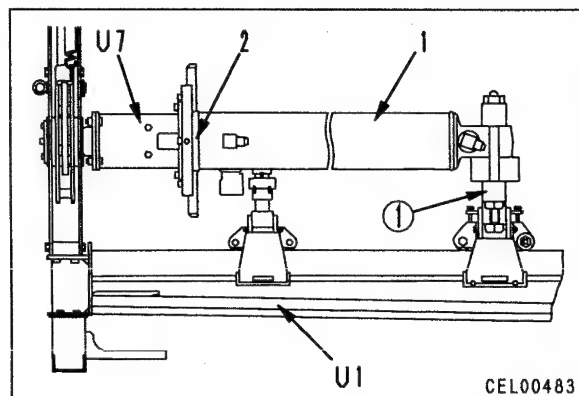
 **Suspension lock cylinder head assembly :**
 $931 \pm 93.1 \text{ Nm}$ { $95 \pm 9.5 \text{ kgm}$ }

 **Jib lock cylinder head assembly :**
 $392 \pm 39.2 \text{ Nm}$ { $40 \pm 4 \text{ kgm}$ }

4. Check valve (suspension lock cylinder only)
Install check valve.

5. Cylinder tube (outrigger slide cylinder only)
Install cylinder tube.

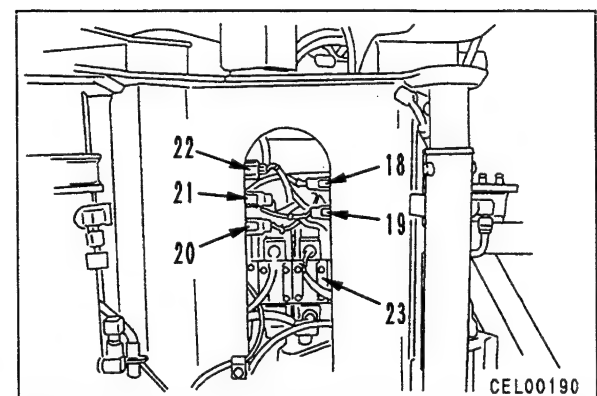
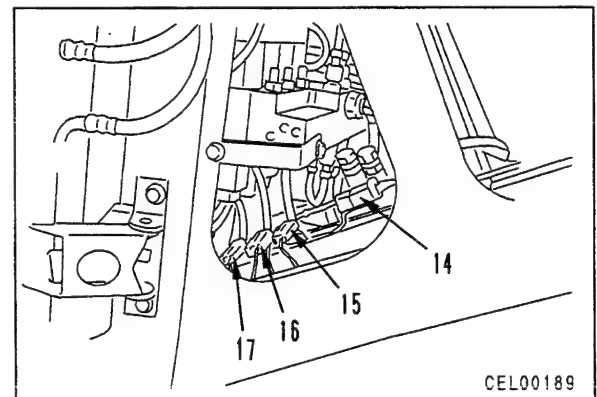
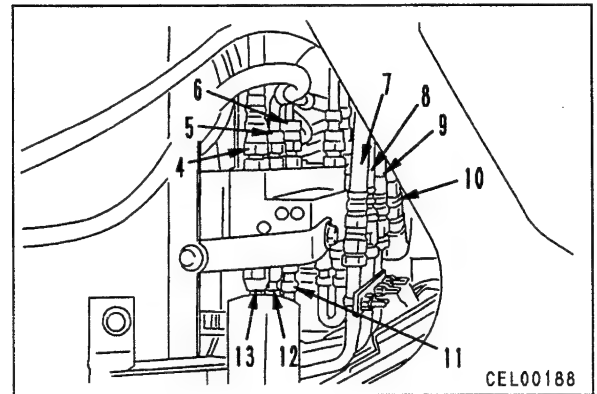
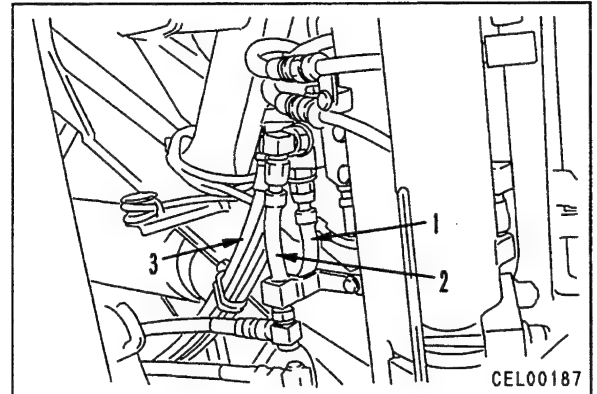
 **Tube sleeve nut :**
 $78.4 \pm 19.6 \text{ Nm}$ { $8 \pm 2 \text{ kgm}$ }



REMOVAL OF JIB EXTEND/STOW SOLENOID VALVE ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect tubes (1) and (2).
2. Disconnect (3), (4), (5), (6), (7), (8), (9), and (10).
★ After disconnecting the hoses, fit tags to distinguish them.
3. Remove tubes (11), (12), and (13) from under valve assembly.
4. Disconnect wiring connectors (BJ1) (14), (J07) (15), (J11) (16), (J09) (17), (J08) (18), (J10) (19), (J06) (20), (J12) (21), and (J13) (22).
★ After disconnecting the connectors, fit tags to distinguish them.
5. Remove jib EXTEND/STOW solenoid valve assembly (23). ※ 1
★ Be careful not to hit other parts when removing.




INSTALLATION OF JIB EXTEND/STOW SOLENOID VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ If the solenoid valve has been removed from the jib extend/stow solenoid valve assembly, be sure to tighten correctly to the tightening torque below.

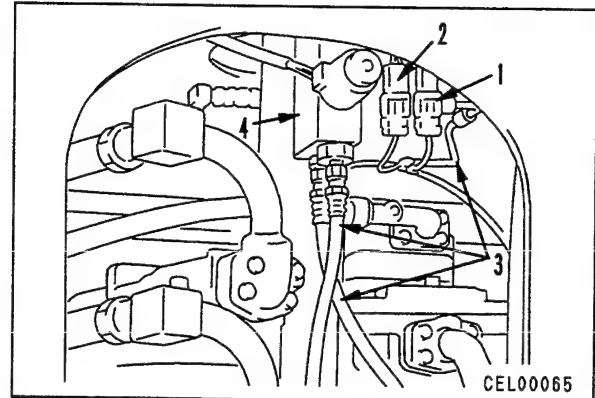
 **kgm** Solenoid valve mounting bolt
(M5 with hexagonal socket) :
4.90 – 6.86 Nm {0.5 – 0.7 kgm}

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

REMOVAL OF PTO CLUTCH, SUSPENSION LOCK PILOT SELECTOR VALVE ASSEMBLY

⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove hood assembly.
For details, see REMOVAL OF HOOD ASSEMBLY.
2. Remove transmission, steering (outrigger), and swing pump assembly top cover.
3. Disconnect wiring connectors (L28) (1) and (L27) (2).
4. Disconnect 3 hoses (3).
5. Remove 2 mounting bolts of PTO clutch and suspension lock pilot selector valve assembly from engine end.
6. Remove PTO clutch and suspension lock pilot selector valve assembly (4).



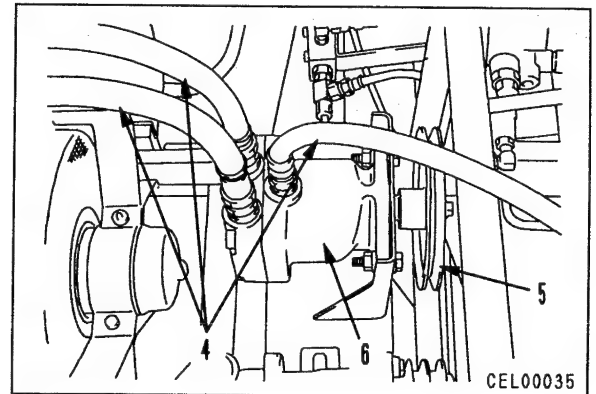
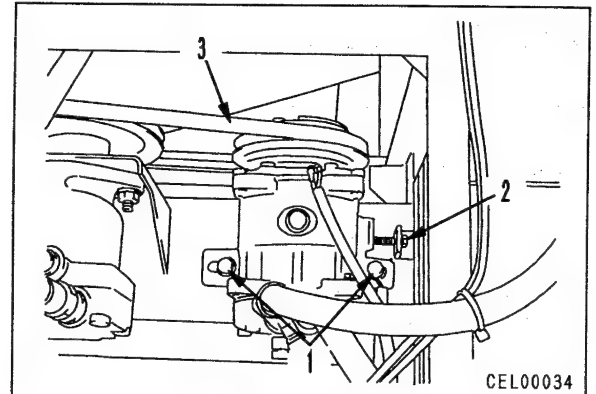
INSTALLATION OF PTO CLUTCH, SUSPENSION LOCK PILOT SELECTOR VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

REMOVAL OF AIR CONDITIONER COMPRESSOR MOTOR ASSEMBLY

⚠ Set the parking brake switch to PARKING.

1. Open air conditioner compressor top cover.
2. Loosen air conditioner compressor mounting bolts (1), then loosen adjustment bolt (2), and remove air conditioner compressor belt (3). ※ 1
3. Disconnect 3 hoses (4).
4. Remove pulley (5). ※ 2
5. Remove air conditioner compressor motor assembly (6).



INSTALLATION OF AIR CONDITIONER COMPRESSOR MOTOR ASSEMBLY


- Carry out installation in the reverse order to removal.

※ 1

- ★ Adjust the air conditioner compressor belt. For details, see TESTING AND ADJUSTING, Testing and adjusting of tension of air conditioner compressor belt.

※ 2

 Pulley bolt : **Thread tightener (LT-2)**

 Pulley bolt :
 $22.54 \pm 8.82 \text{ Nm}$ { $2.3 \pm 0.9 \text{ kgm}$ }

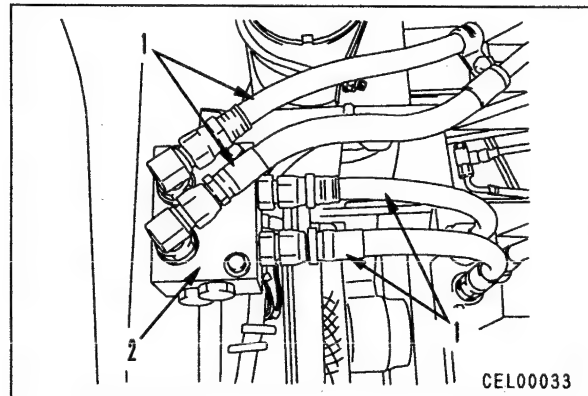
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

REMOVAL OF AIR CONDITIONER COMPRESSOR MOTOR CHECK VALVE ASSEMBLY

⚠ Set the parking brake switch to PARKING.

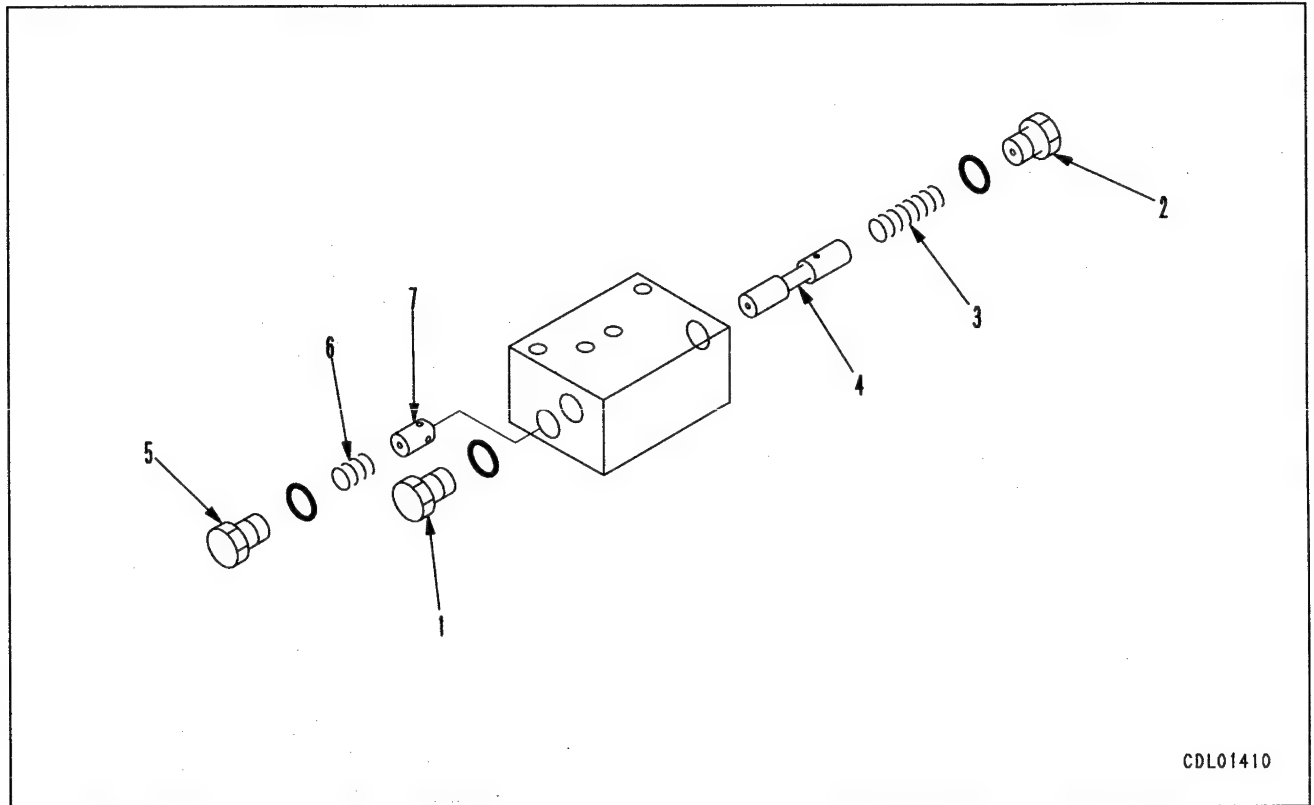
1. Open air conditioner compressor top cover.
2. Disconnect 4 hoses (1).
3. Remove air conditioner compressor motor check valve assembly (2).



INSTALLATION OF AIR CONDITIONER COMPRESSOR MOTOR CHECK VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02



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DISASSEMBLY OF AIR CONDITIONER MOTOR CHECK VALVE ASSEMBLY

1. Spool

- 1) Remove plugs (1) and (2).
- 2) Remove spring (3).
- 3) Remove spool (4).

2. Valve

- 1) Remove plug (5).
- 2) Remove spring (6).
- 3) Remove valve (7).

ASSEMBLY OF AIR CONDITIONER MOTOR CHECK VALVE ASSEMBLY

1. Valve

- 1) Assemble valve (7).
- 2) Assemble spring (6).
- 3) Fit O-ring and install plug (5).

2. Spool

- 1) Assemble spool (4).
- 2) Assemble spring (3).
- 3) Fit O-rings and install plugs (2) and (1).

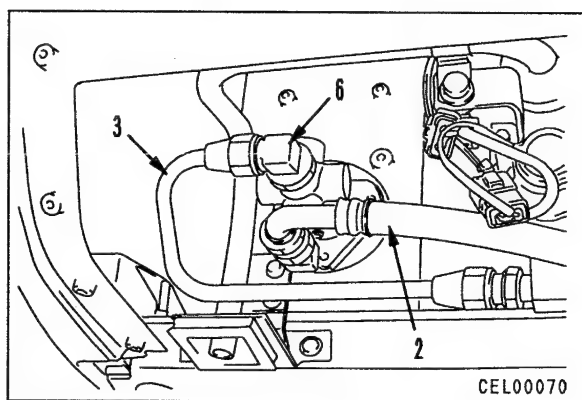
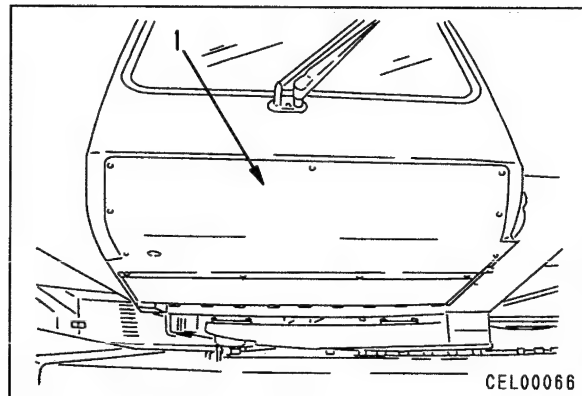
REMOVAL OF ACCELERATOR CONTROL VALVE ASSEMBLY

⚠ Extend the outriggers and set securely in contact with the ground, then swing the revolving frame 90°.

⚠ Open the drain valve of the air tank and drain the air.

1. Open cover (1) at front of operator's cab.
2. Disconnect hose (2).
3. Remove tube (3).
4. Remove 3 mounting bolts (5) of accelerator control valve from bracket of accelerator pedal (4).
★ When removing the mounting bolts, be careful not to drop accelerator control valve assembly (6).
5. Remove accelerator control valve assembly (6).

※ 1



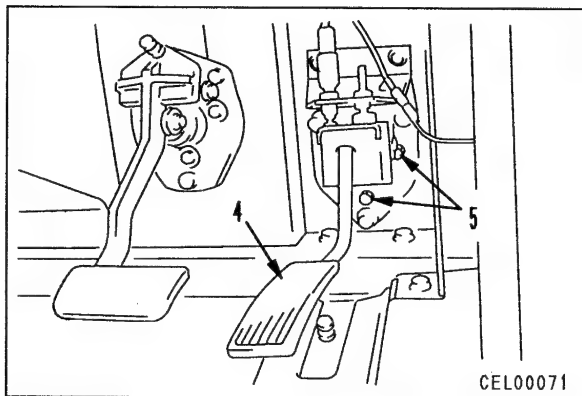
INSTALLATION OF ACCELERATOR CONTROL VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

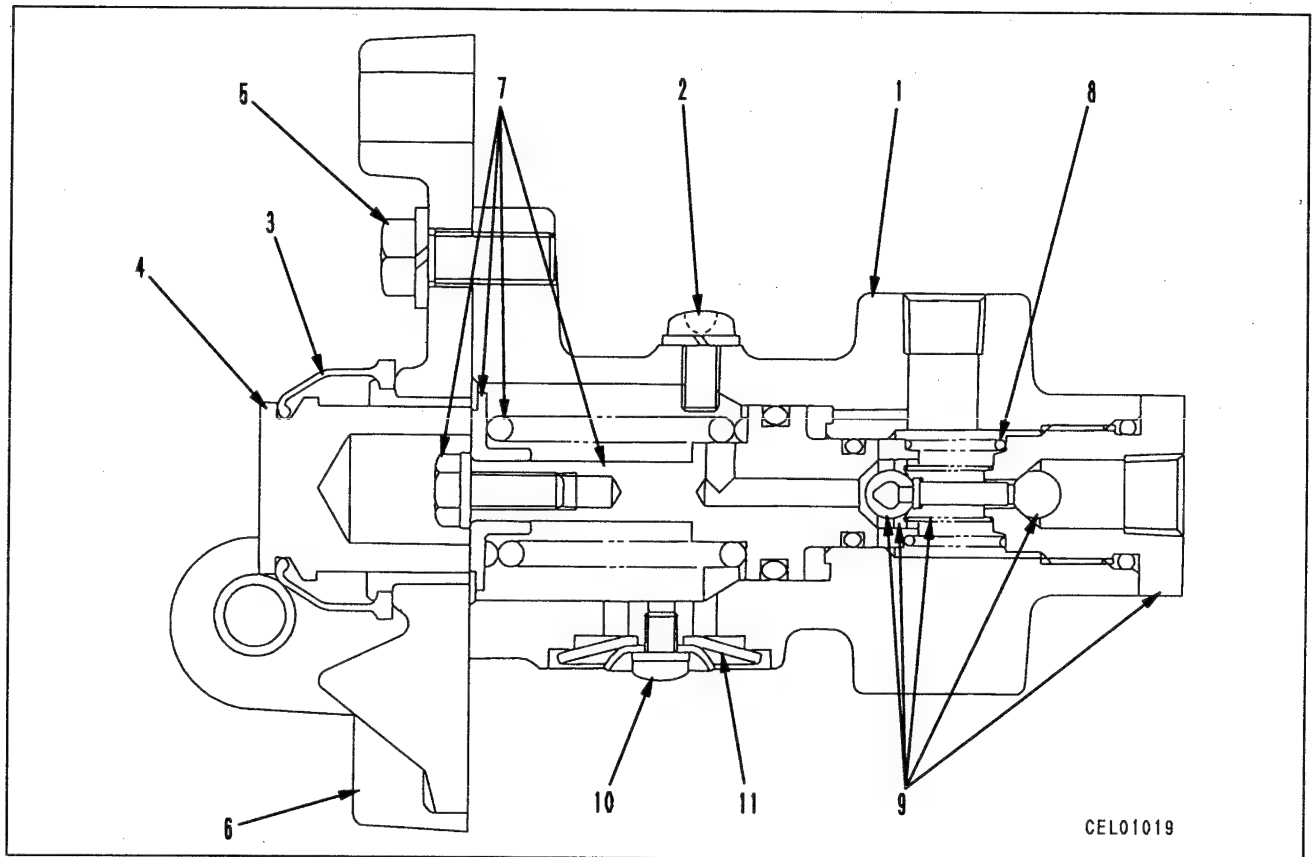


Accelerator control valve spline portion :
Grease (G2- LI)



023S02




023S02



DISASSEMBLY OF ACCELERATOR CONTROL VALVE ASSEMBLY

1. Remove screw (2) from body (1).
2. Remove plunger boot (3).
3. Remove plunger (4).
4. Remove bolt (5), then remove plate (6).
5. Remove piston assembly (7).
6. Remove spring (8).
7. Remove valve cap assembly (9).
8. Remove screw (10), then remove diaphragm (11).

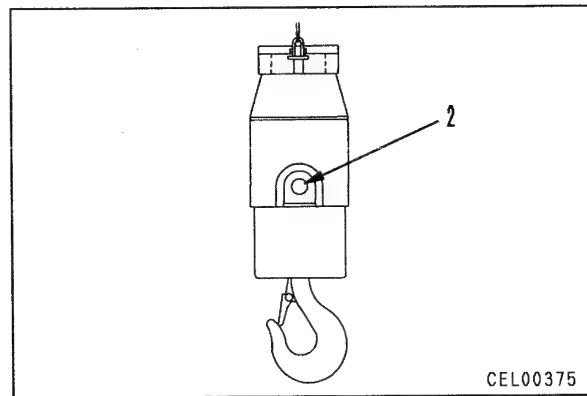
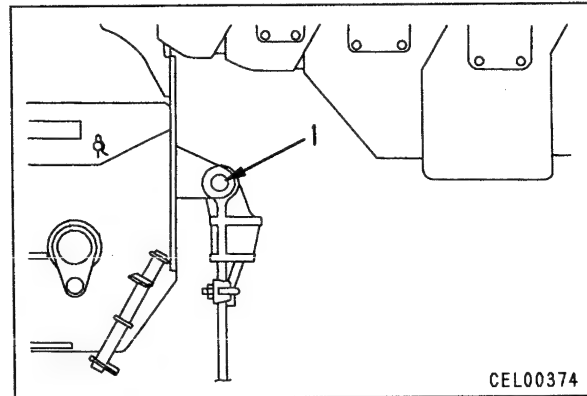
ASSEMBLY OF ACCELERATOR CONTROL VALVE ASSEMBLY

1. Fit diaphragm (11) to body (1), and install screw (10).
2. Install valve cap assembly (9).
 Valve cap assembly :
 $192.08 \pm 48.02 \text{ Nm}$ { $19.6 \pm 4.9 \text{ kgm}$ }
3. Install spring (8).
4. Install piston assembly (7).
 Piston sliding portion : **Grease (G2-LI)**
5. Fit plate (6) and install bolt (5).
6. Install plunger (4).
 Plunger sliding portion : **Grease (Molybdenum disulphide grease)**
7. Install plunger boot (3).
8. Install screw (2).

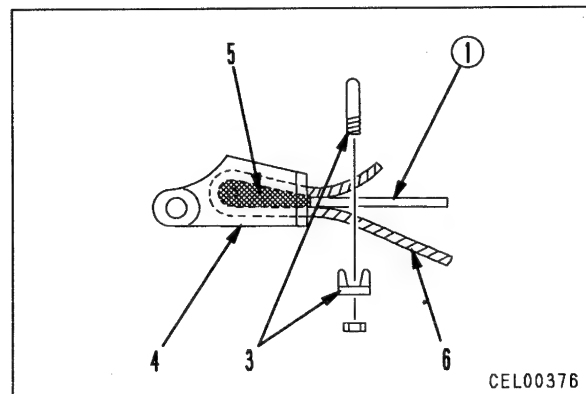
REMOVAL OF MAIN WINCH, AUXILIARY WINCH ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground, then retract the boom fully and lower the hook to the ground.
- ⚠ Always use thick leather gloves when carrying out the operation to remove the wire rope.

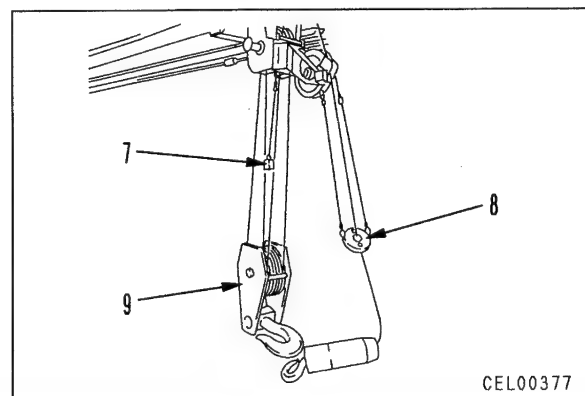
1. Remove main winch and auxiliary winch top covers.
2. Remove main winch wire socket mounting pin (1) and auxiliary winch wire socket mounting pin (2).



3. Remove wire clip (3), then use round bar ① to knock rope edge (5) out from wire socket (4).
4. Remove wire rope (6) from wire socket.



5. Remove main winch weight (7) and auxiliary winch weight (8) of overwind prevention device.
6. Remove wire rope from main winch hook (9).
7. Run engine, and wind in main winch slowly to wind wire rope on to drum.
 - ★ Repeat the same operation and wind in the auxiliary winch to wind the wire rope on to the drum.
 - ★ When winding the wire rope on to the winch drum, make sure that the wire rope is wound on neatly.
 - ★ After winding on the wire rope, tie it with wire to prevent it from becoming slack.



023S02

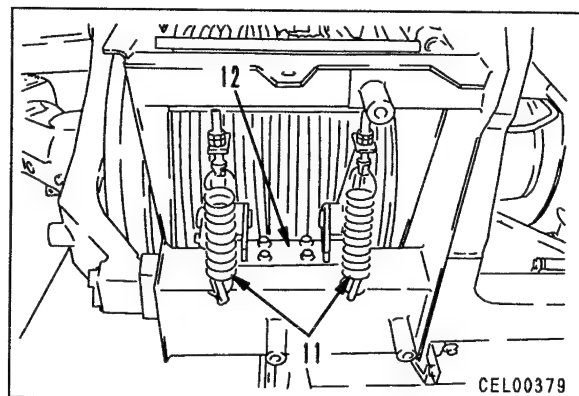
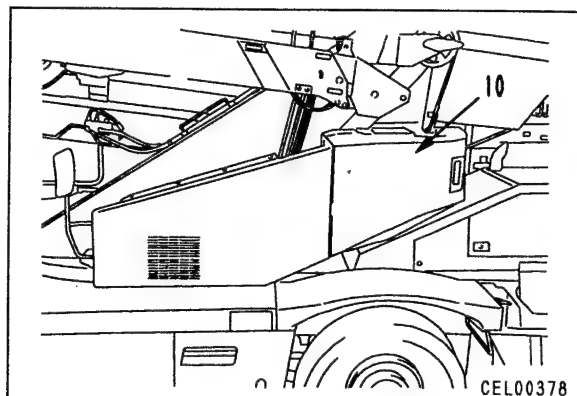
8. Remove cover (10) at rear left of revolving frame.
★ For the auxiliary winch motor, remove the cover at the rear right of the revolving frame.
9. Raise boom and tilt jib (main winch only).
10. Remove springs (11) and drum roller (12).
★ Before disconnecting, measure the installed dimension of the spring. ※ 1
11. Remove winch brake caliper assembly. For details, see REMOVAL OF WINCH BRAKE CALIPER ASSEMBLY.
12. Using tool X1, keep winch assembly (13) horizontal and remove from revolving frame. ※ 2



Main winch assembly : **600 kg**



Auxiliary winch assembly : **470 kg**



INSTALLATION OF MAIN WINCH, AUXILIARY WINCH ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1



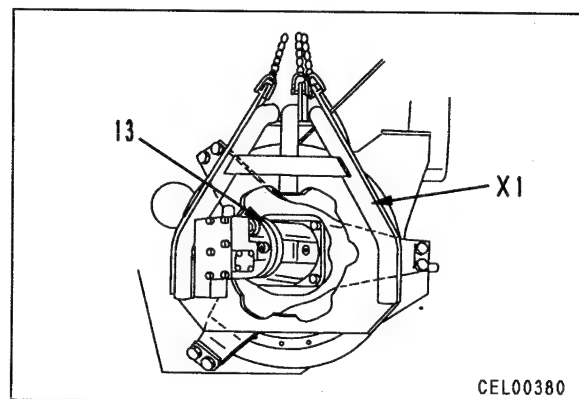
Spring mounting locknut :
 $110.25 \pm 12.25 \text{ Nm}$ { $11.25 \pm 1.25 \text{ kgm}$ }

※ 2



Winch assembly mounting bolt :
 $548.8 \pm 58.8 \text{ Nm}$ { $56 \pm 6 \text{ kgm}$ }

- Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- Bleeding air**
Bleed the air from the piping. For details, see TESTING AND ADJUSTING, Bleeding air.



DISASSEMBLY OF MAIN WINCH, AUXILIARY WINCH ASSEMBLY

1. Draining oil

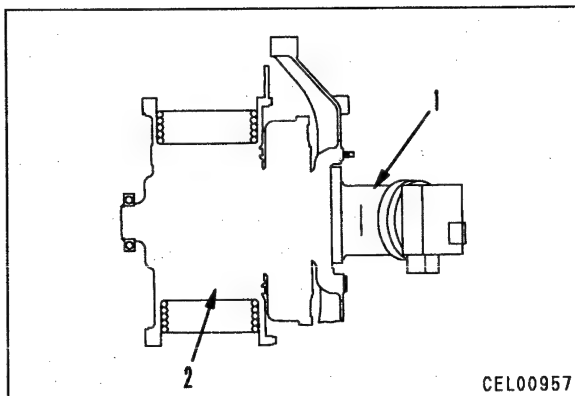
Remove drain plug (1) and drain oil from winch drum.



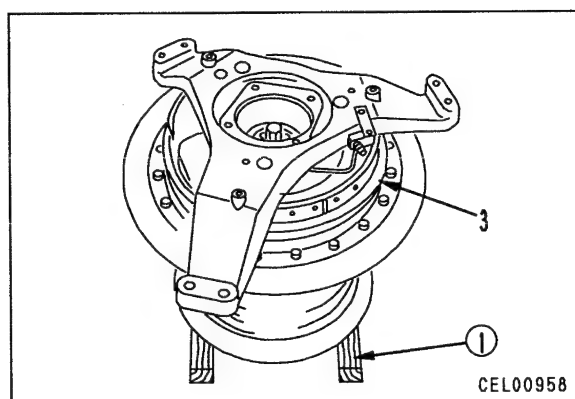
Winch drum : Approx. 7.1 ℓ

2. Winch motor assembly

Sling winch motor assembly (2), then remove 4 mounting bolts, and lift off.



3. Turn over winch assembly (3), and set on block ①.

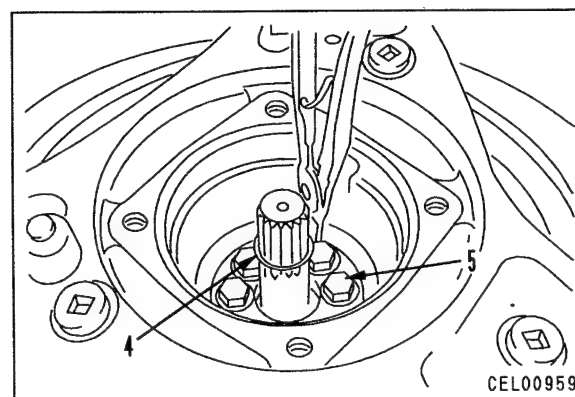


4. Snap ring

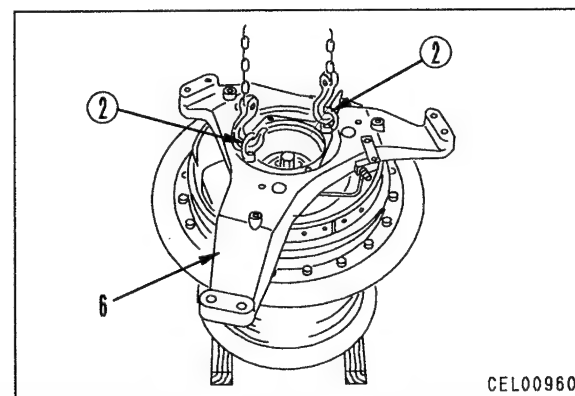
Remove snap ring (4).

5. Bracket, clutch assembly

1) Remove 8 mounting bolts (5).

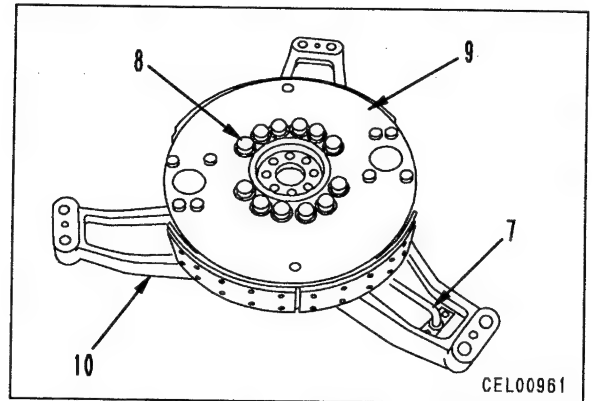


2) Using eyebolts ②, lift off bracket and clutch assembly (6).

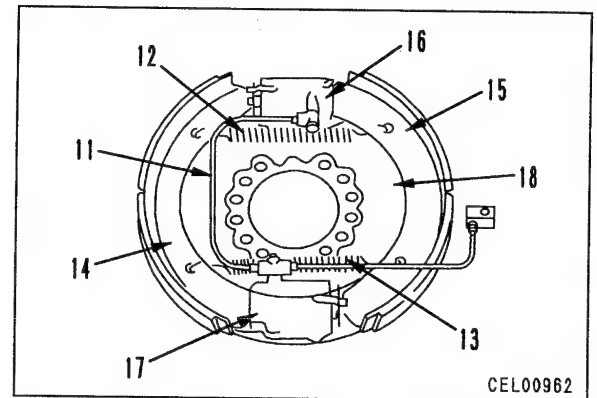


023S02

- 3) Disassembly of bracket, clutch assembly
 - i) Disconnect tube (7) at bracket end.
 - ii) Remove mounting bolts (8), then remove clutch assembly (9) from bracket (10).

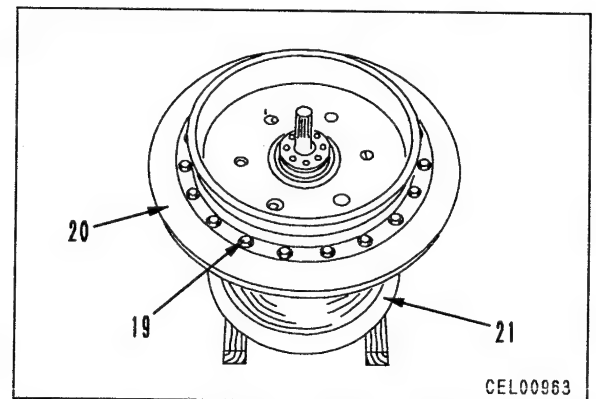


- iii) Disconnect tube (11).
- iv) Remove springs (12) and (13), then remove shoe assemblies (14) and (15).
- v) Remove mounting bolts, then remove cylinders (16) and (17) from plate (18).



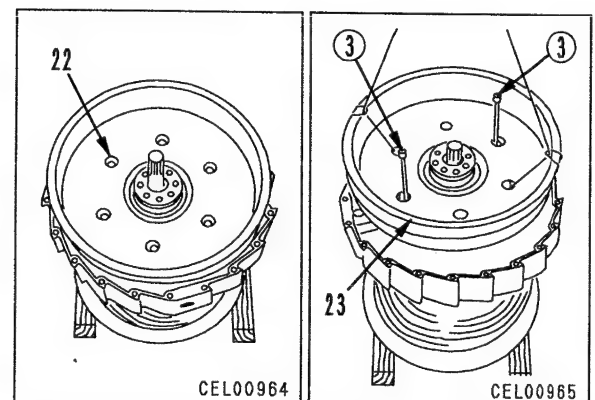
6. Winch brake disc

Remove mounting bolts (19), then remove winch brake disc (20) from drum (21).



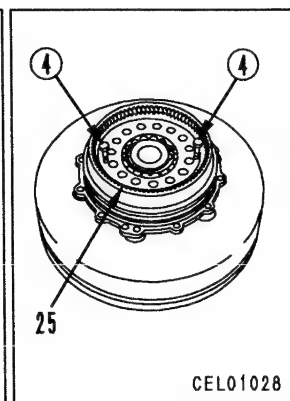
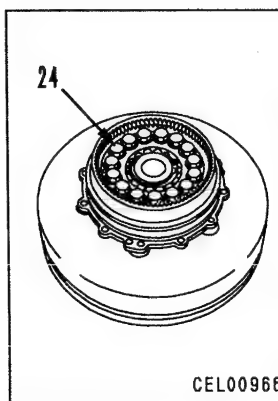
7. Clutch drum assembly

- 1) Remove 6 mounting bolts (22).
- 2) Using forcing screws (3), disconnect clutch drum assembly (23) from drum, then lift off.



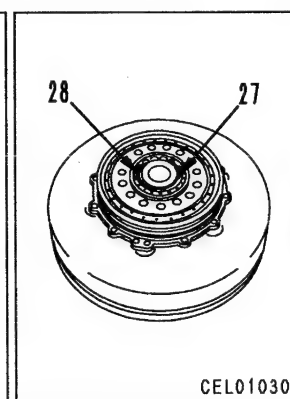
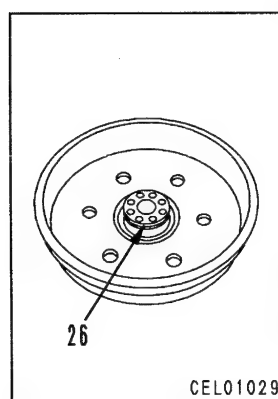
3) Disassembly of clutch drum assembly

- i) Remove mounting bolts (24), then using forcing screws ④, remove support gear (25).



- ii) Remove O-ring (26).

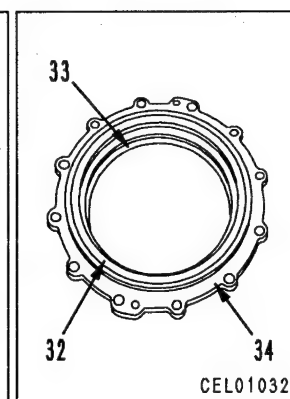
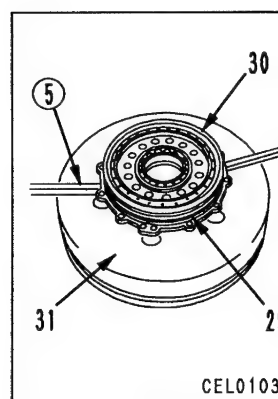
- iii) Remove snap ring (27), then pull out support shaft (28).



- iv) Remove O-ring (29).

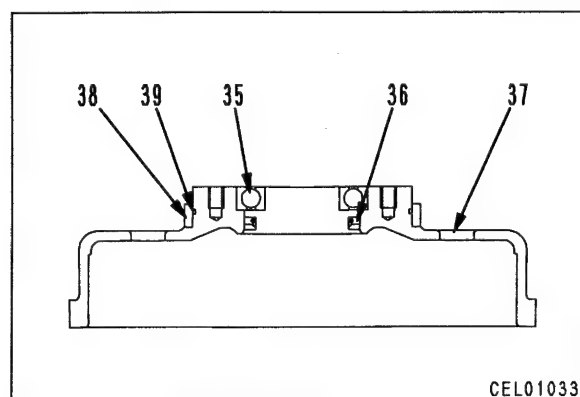
- v) Twist with bar ⑤, and remove retainer and bearing assembly (30) from clutch drum assembly (31).

- vi) Remove oil seal (32) and bearing (33) from retainer (34).



- vii) Remove bearing (35) and oil seal (36) from clutch drum (37).

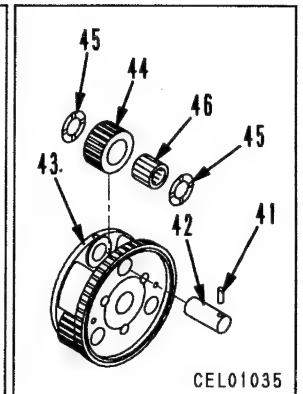
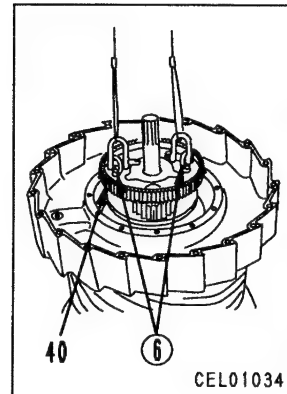
- viii) Remove seal seat (38), then remove O-ring (39).



023S02

8. No. 1 carrier assembly

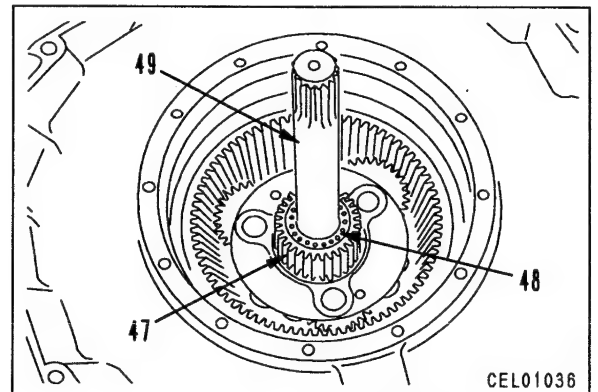
- 1) Using eyebolts ⑥, remove No. 1 carrier assembly (40).
- 2) Disassembly of No. 1 carrier assembly
 - i) Knock pin (41) inside shaft, then pull out shaft (42) from carrier (43).
 - ii) Remove planet gear (44) and thrust washer (45) from carrier (43).
 - iii) Remove needle bearing (46) from gear.

**9. No. 1 sun gear, spacer**

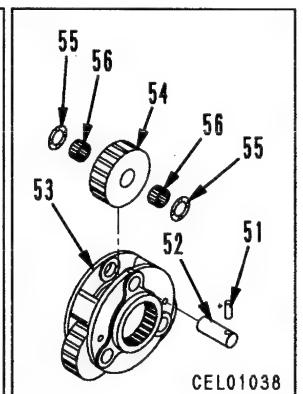
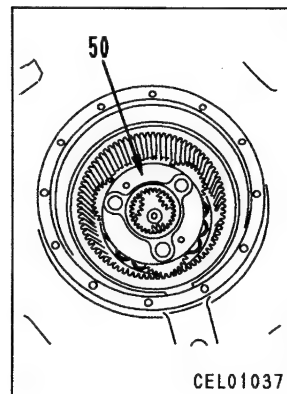
Remove No. 1 sun gear (47) and spacer (48).

10. No. 2 sun gear

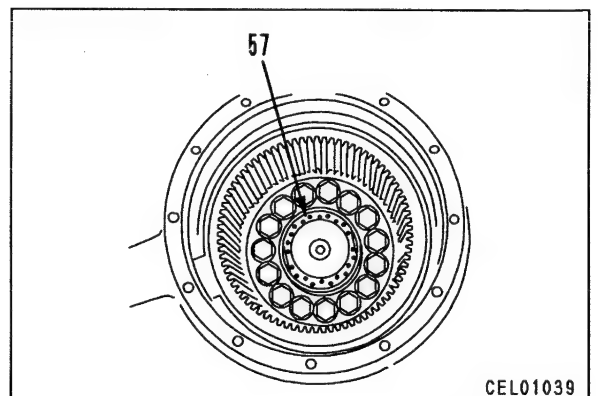
Remove No. 2 sun gear (49).

**11. No. 2 carrier assembly**

- 1) Remove No. 2 carrier assembly (50).
- 2) Disassembly of No. 2 carrier assembly
 - i) Knock pin (51) inside shaft, then pull out shaft (52) from carrier (53).
 - ii) Remove planet gear (54) and thrust washer (55) from carrier (53).
 - iii) Remove needle bearing (56) from gear.

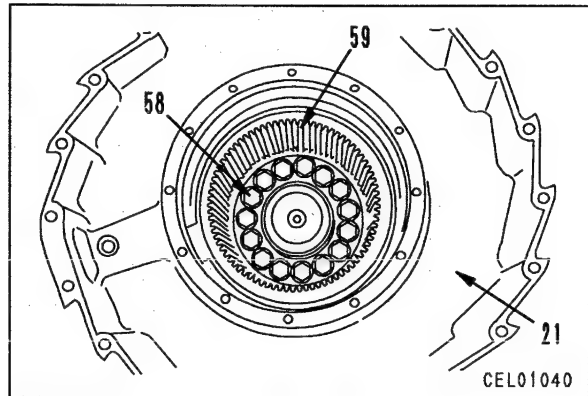
**12. Spacer**

Remove spacer (57).



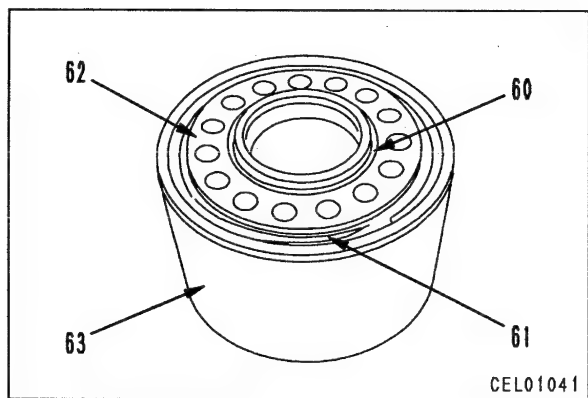
13. Ring gear assembly

- 1) Remove mounting bolts (58), then remove ring gear assembly (59) from drum (21).



- 2) Disassembly of ring gear assembly

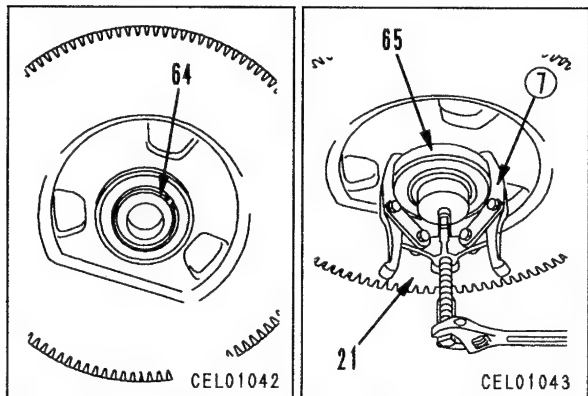
- i) Remove O-ring (60).
- ii) Remove snap ring (61), then remove drum gear (62) from ring gear (63).

**14. Snap ring**

Remove snap ring (64).

15. Bearing

Using puller ⑦, remove bearing (65) from drum (21).



023S02

ASSEMBLY OF MAIN WINCH, AUXILIARY WINCH ASSEMBLY

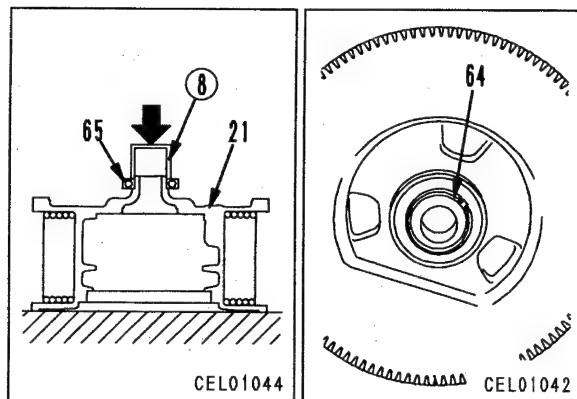
1. Bearing

Using push tool ⑧, press fit bearing (65) to drum (21).

2. Snap ring

Install snap ring (64).

- ★ Check that the snap ring is fitted securely in the groove.



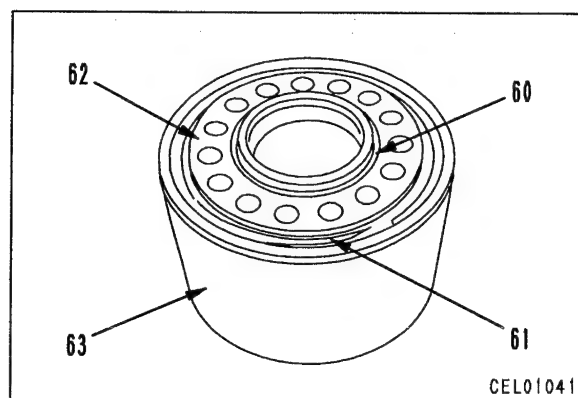
3. Ring gear assembly

1) Assembly of ring gear assembly

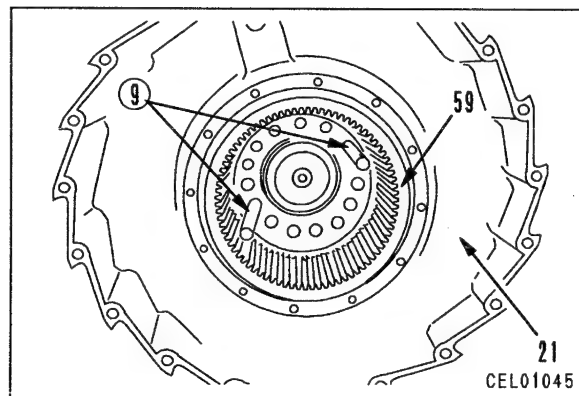
- i) Set drum gear (62) to ring gear (63), and install snap ring (61).

- ★ Check that the snap ring is fitted securely in the groove.

- ii) Install O-ring (60).



- 2) Fit guide bolts ⑨ to drum (21), then set ring gear assembly (59) to drum, and tighten mounting bolts temporarily.




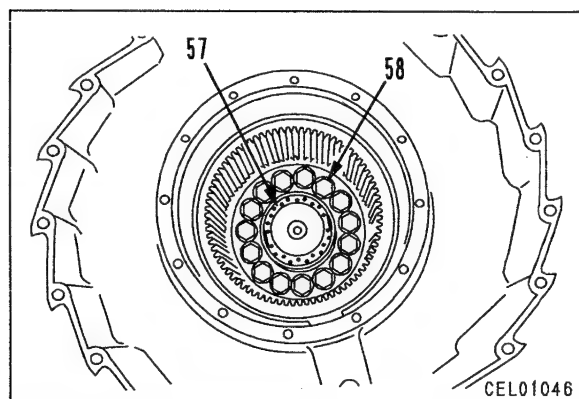
- 3) Turn over drum and set to block, then tighten mounting bolts (58).

 **kgm** Mounting bolt :
 $276.85 \pm 31.85 \text{ Nm} \{28.25 \pm 3.25 \text{ kgm}\}$

4. Spacer

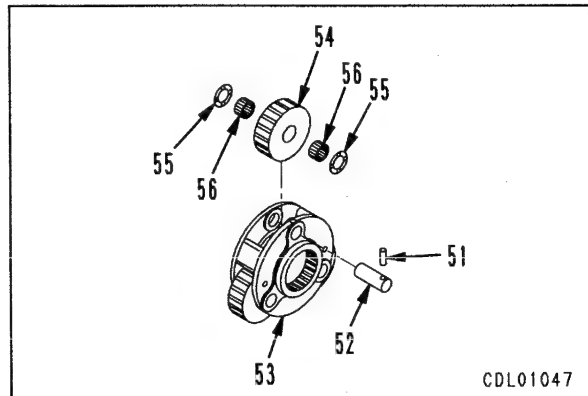
Install spacer (57).

 Contact surface of spacer : **Oil (AX075)**

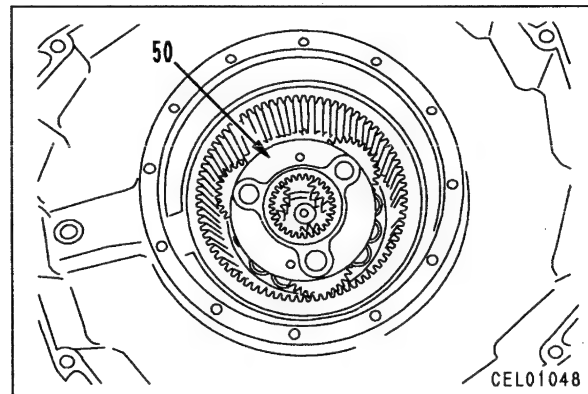


5. No. 2 carrier assembly

- 1) Assembly of No. 2 carrier assembly
 - i) Assemble needle bearing (56) to planet gear (54).
 - ii) Set planet gear (54) and thrust washers (55) as one unit to carrier (53).
 - iii) Align shaft (52) with pin hole of carrier, then knock in shaft with plastic hammer.
 - ★ When knocking in the shaft, be extremely careful not to damage the thrust washer and bearing.
 - iv) Knock in pin (51).




- 2) Install No. 2 carrier assembly (50) to ring gear.

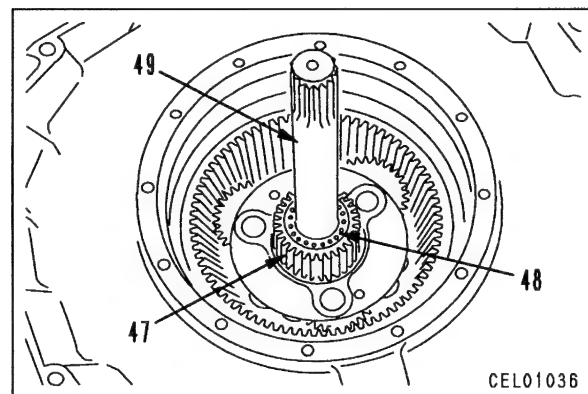
**6. No. 2 sun gear**

Install No. 2 sun gear (49).

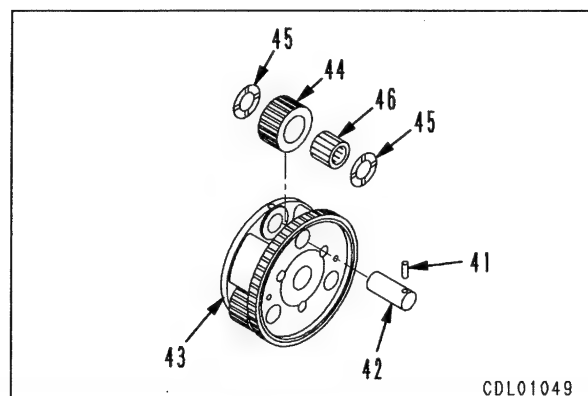
7. No. 1 sun gear, spacer

- 1) Install No. 1 sun gear (47).
- 2) Install spacer (48) to No. 1 sun gear.

 Contact surface of spacer : Oil (AX075)

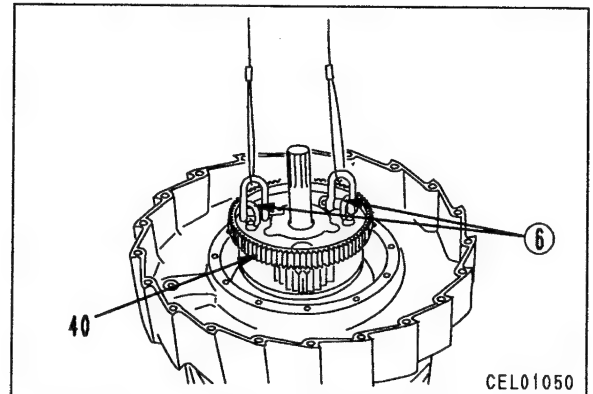
**8. No. 1 carrier assembly**

- 1) Assembly of No. 1 carrier assembly
 - i) Assemble needle bearing (46) to planet gear (44).
 - ii) Set planet gear (44) and thrust washers (45) as one unit to carrier (43).
 - iii) Align shaft (42) with pin hole of carrier, then knock in shaft with plastic hammer.
 - ★ When knocking in the shaft, be extremely careful not to damage the thrust washer and bearing.
 - iv) Knock in pin (41).





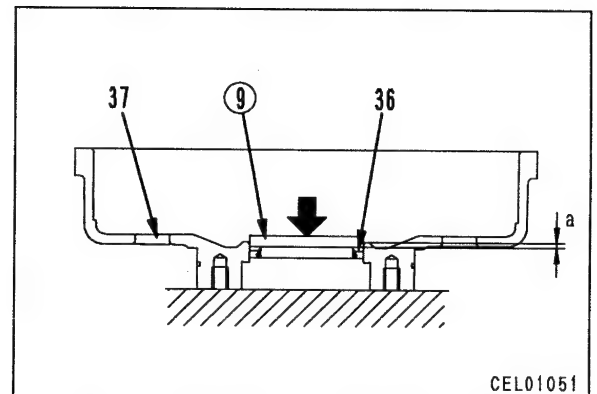
023S02

- 2) Using eyebolts ⑥, install No. 1 carrier assembly (40) to ring gear.

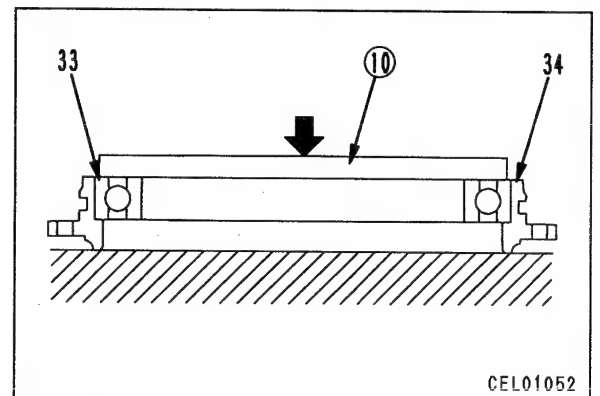


9. Clutch drum assembly



- 1) Assembly of clutch drum assembly
- i) Using push tool ⑨, press fit oil seal (36) to clutch drum (37) so that dimension **a** is correct.
- ★ Dimension **a** : 45 mm
-  Oil seal press-fitting portion :
Liquid adhesive (Seal end 242)
-  Lip of oil seal : **Grease (G2-LI)**

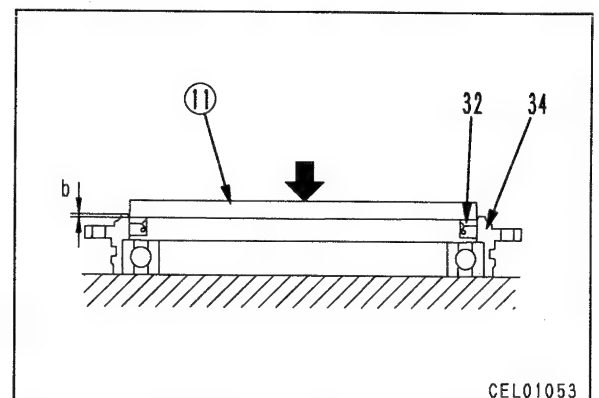


- ii) Using push tool ⑩, press fit bearing (33) to retainer (34).

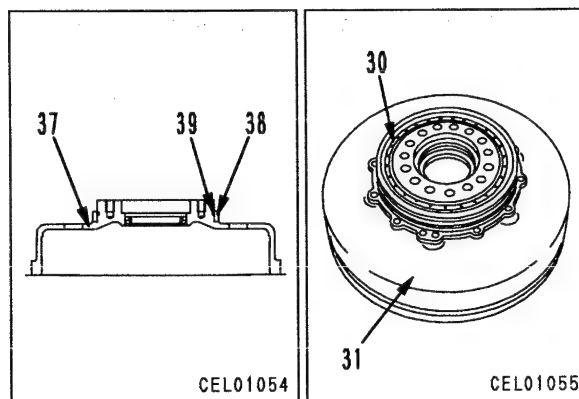


- iii) Using push tool ⑪, press fit oil seal (32) to retainer (34) so that dimension **b** is correct.
- ★ Dimension **b** : 3.0 mm

-  Oil seal press fitting portion :
Liquid adhesive (Seal end 242)
-  Lip of oil seal : **Grease (G2-LI)**

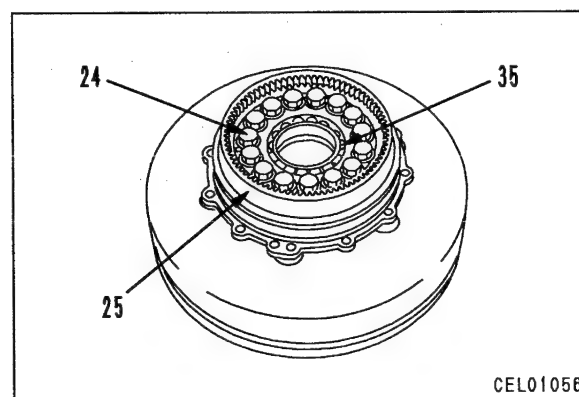


- iv) Fit O-ring (39) to clutch drum (37) and install seal seat (38).
- v) Install retainer bearing assembly (30) to clutch drum assembly (31).



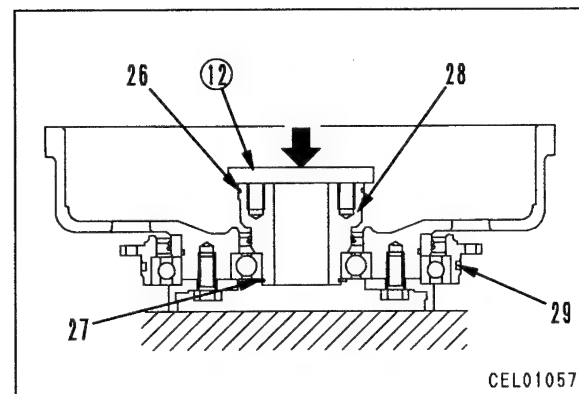
- vi) Press fit bearing (35) to clutch drum.
- vii) Fit support gear (25) and tighten mounting bolts (24).

 Mounting bolt :
 $276.8 \pm 31.85 \text{ Nm}$ { $28.25 \pm 3.25 \text{ kgm}$ }

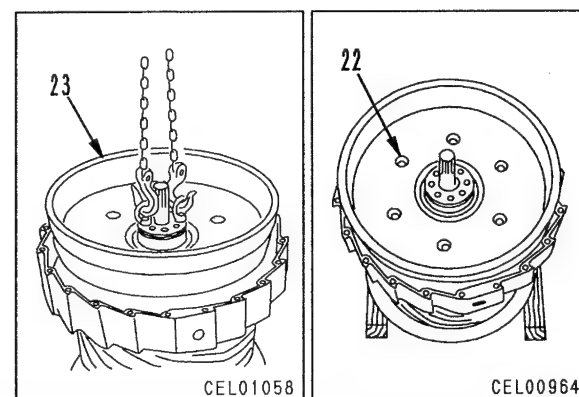


- viii) Turn over clutch drum assembly, then using push tool ⑫, press fit support shaft (28) and install snap ring (27).
 ★ Check that the snap ring is fitted securely in the groove.

- ix) Install O-ring (26) to support shaft and install O-ring (29) to retainer.



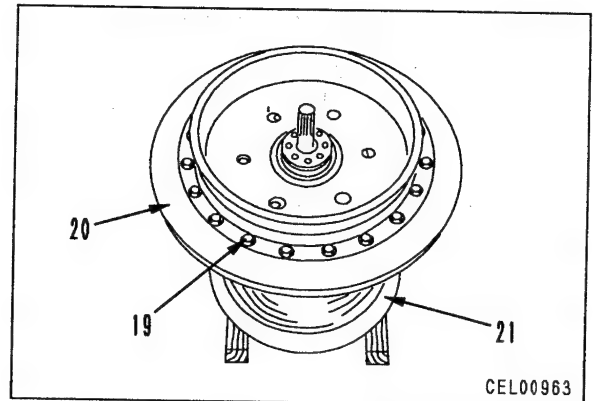
- 2) Raise clutch drum assembly (23) and set to drum, then tighten 6 mounting bolts (22).



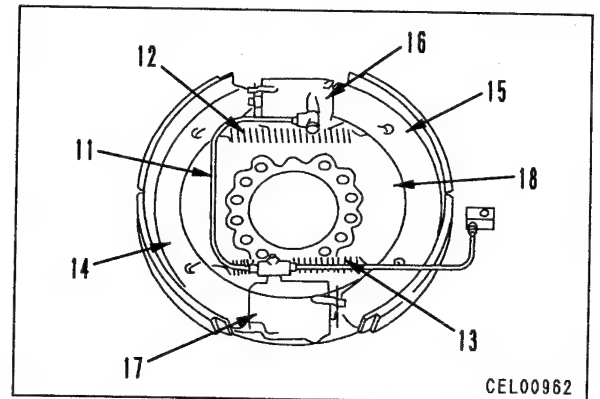
023S02

10. Winch brake disc


Set winch brake disc (20) to drum (21) and tighten mounting bolts (19).

**11. Bracket, clutch assembly**

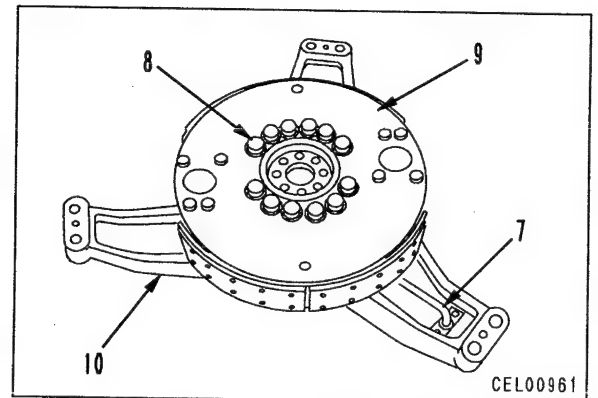
- 1) Assembly of bracket, clutch assembly
 - i) Fit cylinders (16) and (17) to plate (18), and tighten mounting bolts.
 - ii) Set shoe assemblies (14) and (15) to cylinder and install springs (12) and (13).
 - iii) Fit gasket and install tube (11) to cylinder.



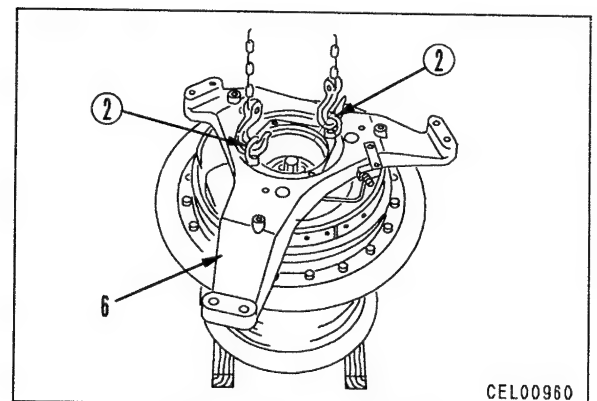
- iv) Set clutch assembly (9) to bracket (10) and tighten mounting bolts (8).

 **kgm** Mounting bolt :
 $276.85 \pm 31.85 \text{ Nm}$ { $28.25 \pm 3.25 \text{ kgm}$ }

- v) Connect tube (7).




- 2) Using eyebolts ②, raise bracket and clutch assembly (6), and set to clutch drum.



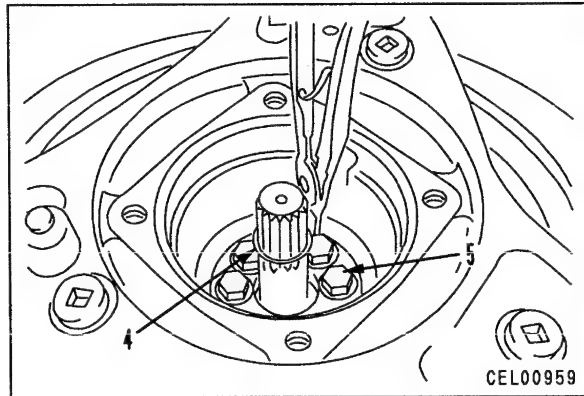
023S02

- 3) Tighten 8 mounting bolts (5).

 **kgm** Mounting bolt :
 $276.85 \pm 31.85 \text{ Nm}$ $\{28.25 \pm 3.25 \text{ kgm}\}$


12. Snap ring

Install snap ring (4).



13. Winch motor assembly

Fit O-ring, then raise winch motor assembly (2) and install to winch assembly.

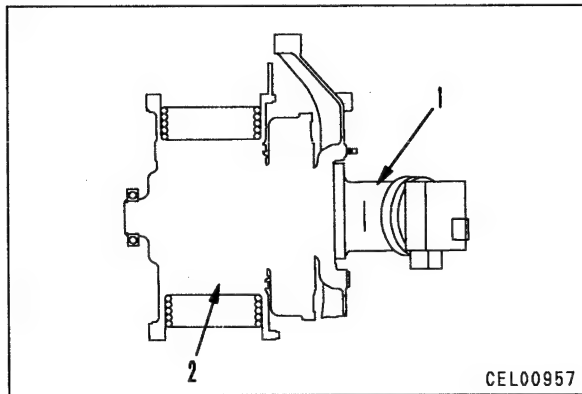
 **kgm** Mounting bolt :
 $276.85 \pm 31.85 \text{ Nm}$ $\{28.25 \pm 3.25 \text{ kgm}\}$

- **Refilling with oil (winch case)**

Tighten drain plug (1), then add approx. 7.1 L of oil (AX075) through oil filler.

- **Adjusting clearance of clutch shoe**

After installing the winch assembly to the body, adjust the clearance of the clutch shoe. For details, see TESTING AND ADJUSTING, Adjusting winch clutch.

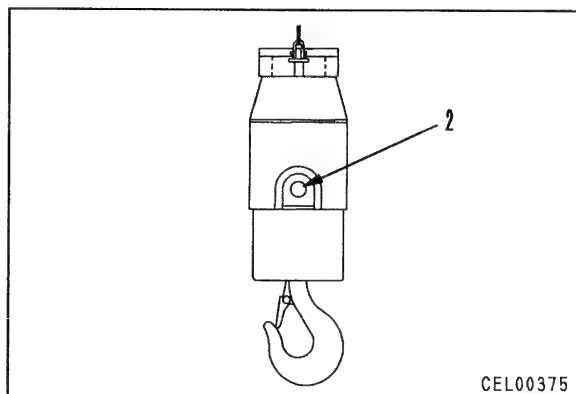
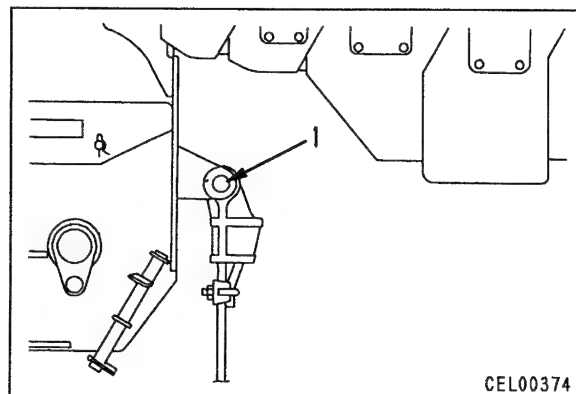


023S02

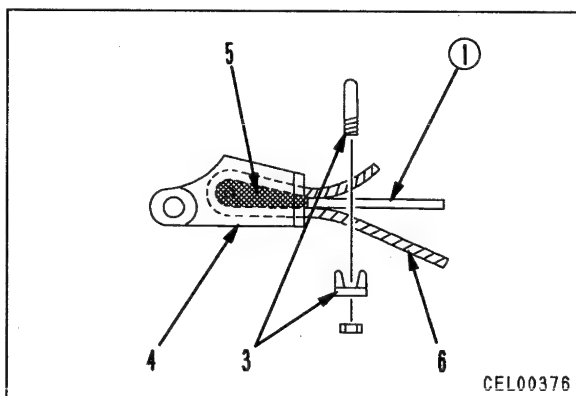
REMOVAL OF BOOM ASSEMBLY

- ⚠️ Extend the outriggers and set securely in contact with the ground, then retract the boom fully and lower the hook to the ground.
- ⚠️ Always use thick leather gloves when carrying out the operation to remove the wire rope.
- ⚠️ After lowering the boom on to a stand, operate the boom 2 or 3 times lightly to the LOWER position to release the remaining pressure inside the circuit.
- ⚠️ The operation requires working at high places, so be extremely careful during the operation.
- ⚠️ Disconnect the cable from the negative (-) terminal of the battery.

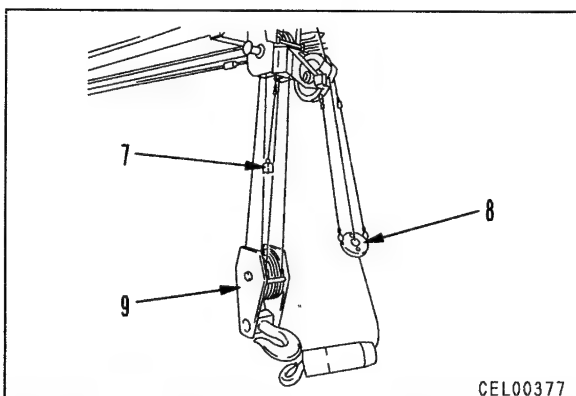
1. Remove main winch and auxiliary winch top covers.
2. Remove main winch wire socket mounting pin (1) and auxiliary winch wire socket mounting pin (2).



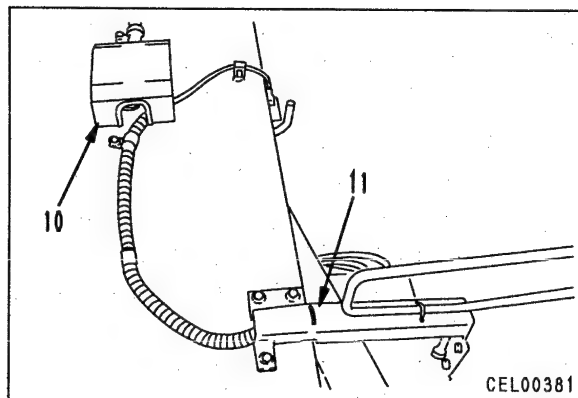
3. Remove wire clip (3), then use round bar ① to knock rope edge (5) out from wire socket (4).
4. Remove wire rope (6) from wire socket.



5. Remove main winch weight (7) and auxiliary winch weight (8) of overwind prevention device.
6. Remove wire rope from main winch hook (9).
7. Run engine, wind in main winch slowly to wind wire rope on to drum.
 - ★ Repeat the same operation and wind in the auxiliary winch to wind the wire rope on to the drum.
 - ★ When winding the wire rope on to the winch drum, make sure that the wire rope is wound on neatly.
 - ★ After winding on the wire rope, tie it with wire to prevent it from becoming slack.

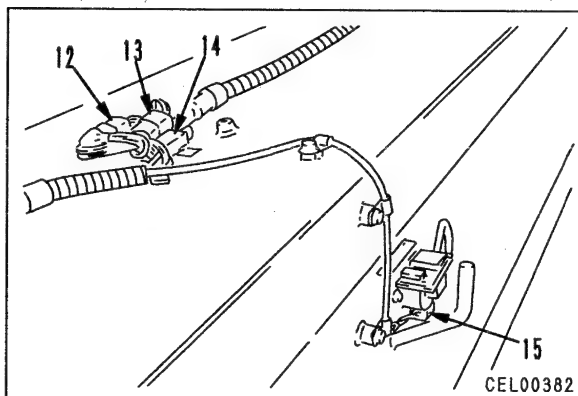


8. Remove cover (10) and wire bracket (11).



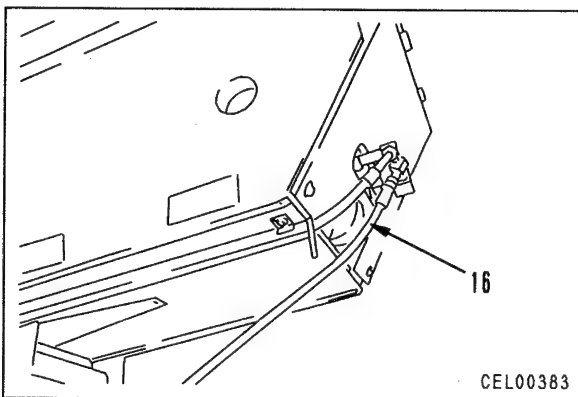
9. Disconnect wiring connectors (BR2) (12), (BR3) (13), (BR1) (14), and (R65) (15).

★ Disconnect the clamps (5 places) from the wiring harnesses.

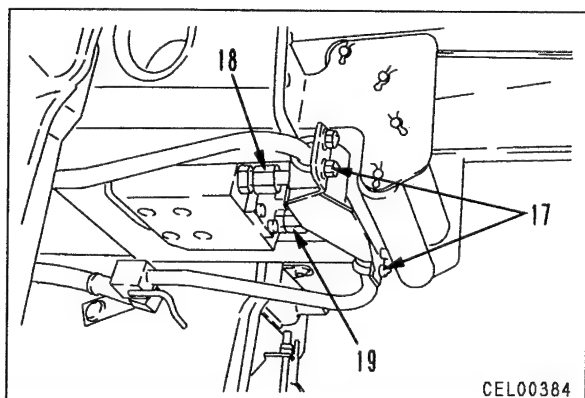


10. Disconnect hose (16).

★ Tie the hose at the chassis end with rope.



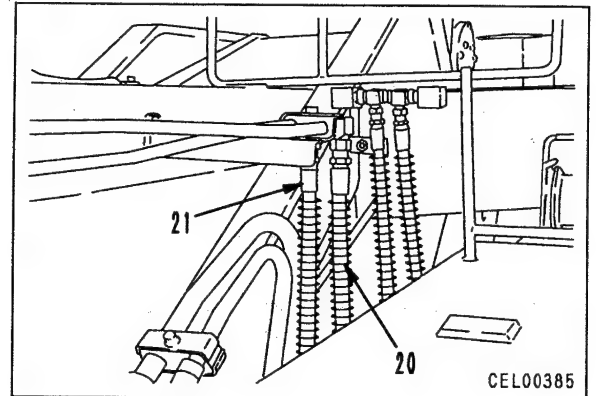
11. Remove U-clamps (17), and disconnect tubes (18) and (19).



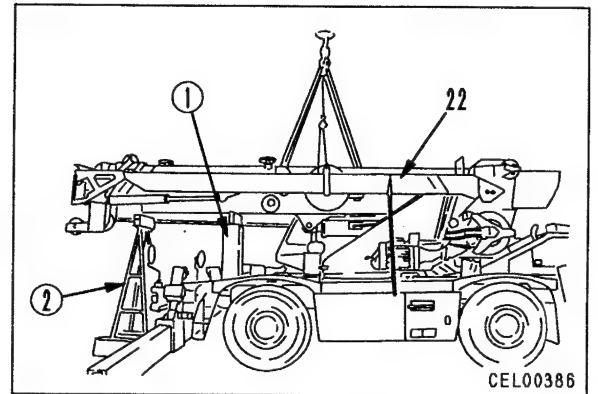
023S02

12. Disconnect hoses (20) and (21).

★ Before removing the hoses, fit tags to prevent mistakes in the position of installation.

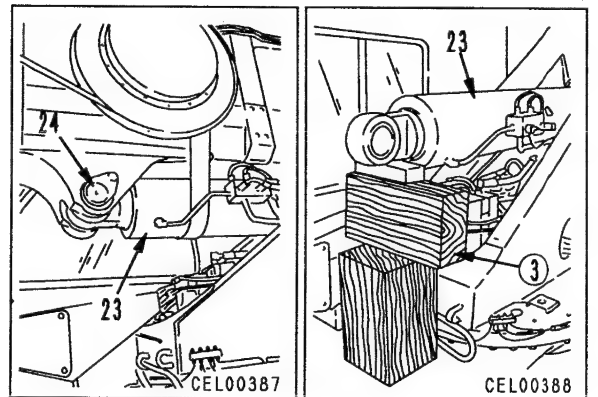


13. Sling boom assembly (22), and support boom assembly with block ① and stand ②.



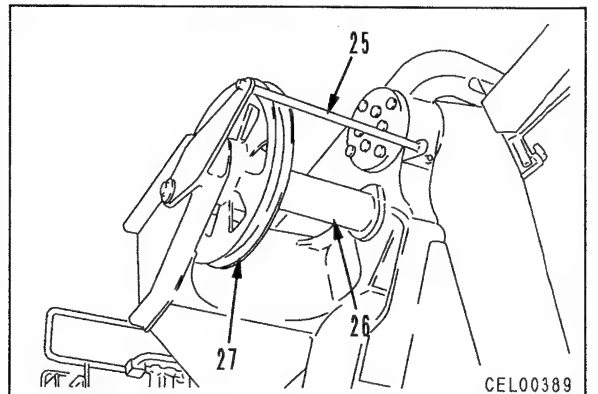
14. Sling boom hoist cylinder (23), remove head pin (24), then lower boom hoist cylinder on block ③.

※ 1



15. Remove guide (25), pin (26), and sheave (27) from one side of revolving frame.

※ 2



16. Remove cover (28).

17. Remove holder (29) and shim (30) from opposite side from which sheave was removed. ※ 3

- ★ Check the number and thickness of the shims, and keep in a safe place.

18. Using tool V, pull out boom mounting pin (31). ※ 4

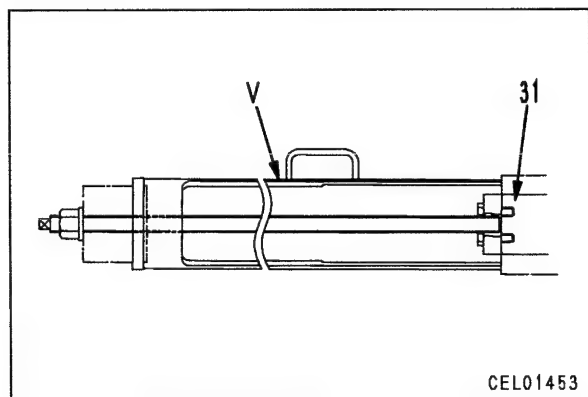
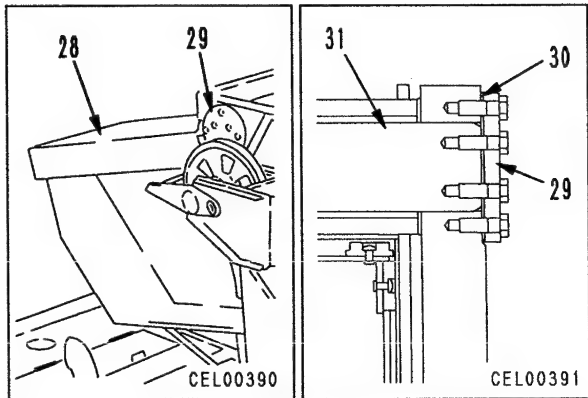
- ★ When the tip of the pin comes completely out from the boom, do not pull the pin out any further.

19. Lift off boom assembly.

- ★ Be careful not to damage the wiring or piping when removing.



Boom assembly : 6,050 kg



INSTALLATION OF BOOM ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1 ※ 2 ※ 4



Pin portion : **Molybdenum disulphide lubricant (LM-G)**

※ 3

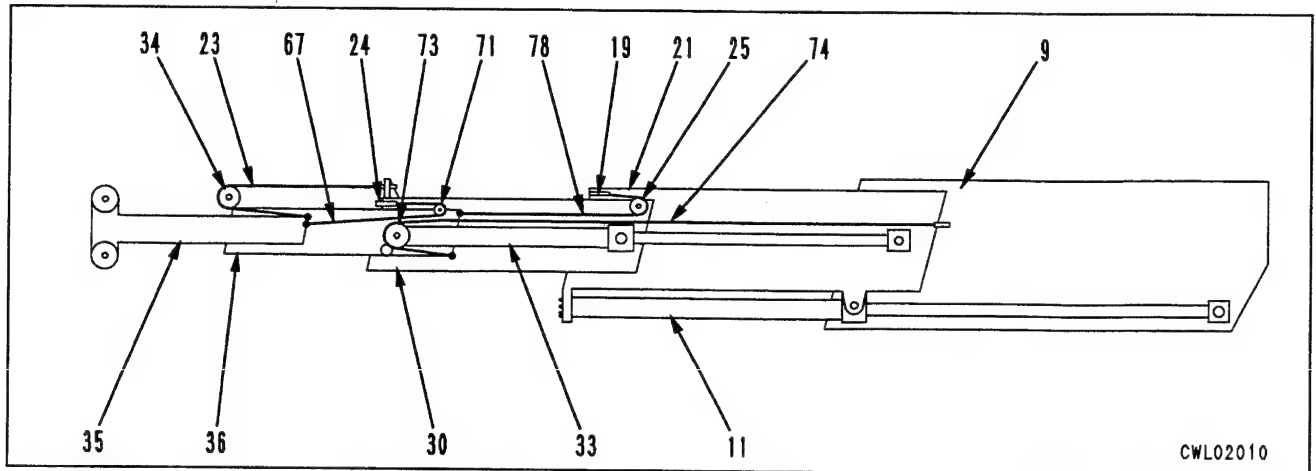


Holder mounting bolt :

276.85 ± 31.85 Nm (28.25 ± 3.25 kgm)

- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.
- **Bleeding air**
Bleed the air from the piping. For details, see TESTING AND ADJUSTING, Bleeding air from winch motor.

DISASSEMBLY OF BOOM ASSEMBLY

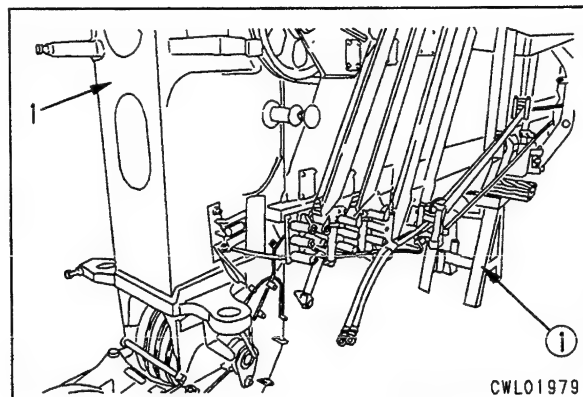


- Top boom (35)
- 4th boom (36)
- 3rd boom (30)
- 2nd boom (21)
- Base boom (9)
- No. 2 telescope cylinder (33)
- No. 1 telescope cylinder (11)
- Top boom extension rope (23)
- Top boom retraction rope (67)
- 4th boom retraction rope (78)
- 4th boom extension rope (74)
- 4th boom front sheave (34)
- 4th boom rear sheave (71)
- No. 2 telescope cylinder bottom sheave (73)
- 3rd boom rear sheave (25)
- Top boom retraction rope (24)
- 4th boom retraction rope (19)

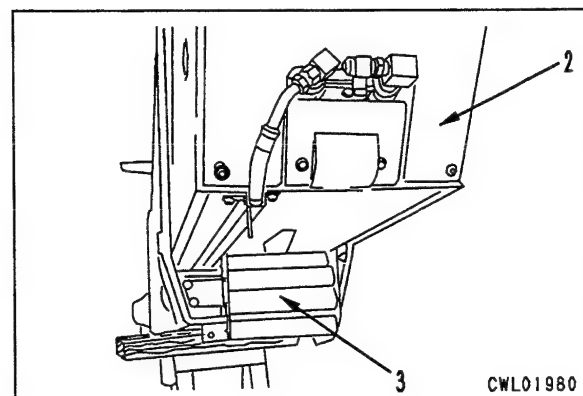
023S02

1. Boom assembly

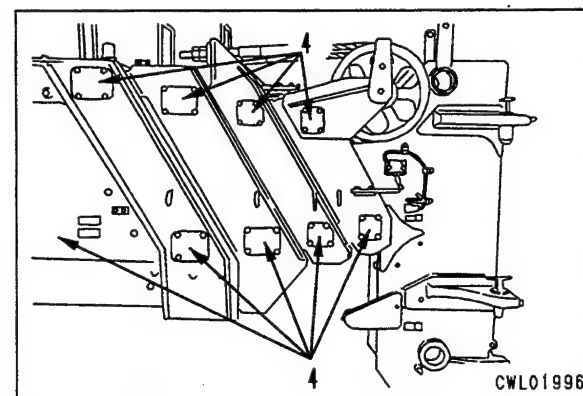
Set boom assembly (1) on stand ① to make it stable.

**2. Cover**

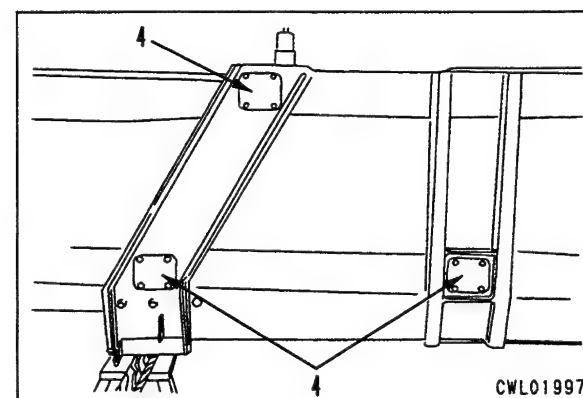
Remove cover (2) from rear cover assembly.

**3. Roller assembly**

Remove roller assembly (3).

**4. Front left and right pads**

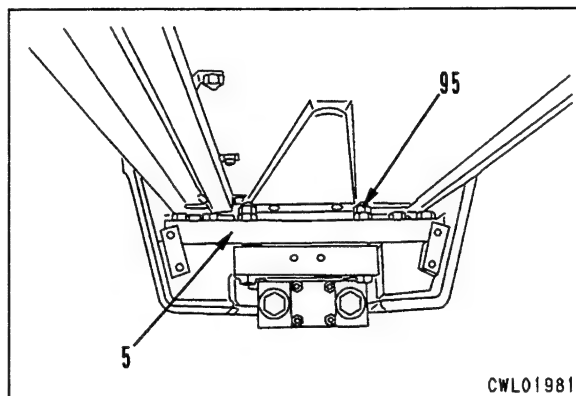
Remove 18 left and right pads (4) from front of boom assembly.



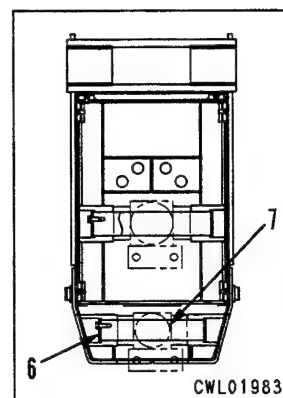
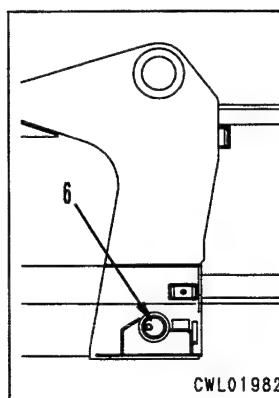
023S02

5. 2nd boom assembly

- 1) Remove No. 1 telescope cylinder head end mounting bolts (95) from rear of boom, then remove bracket (5).

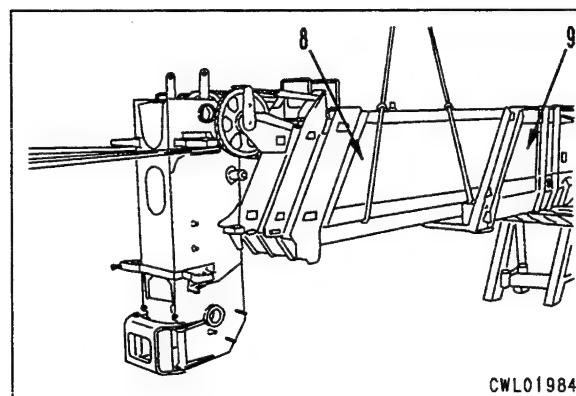


- 2) Remove lock plate (6) of No. 1 telescope cylinder head pin, then remove pin (7).

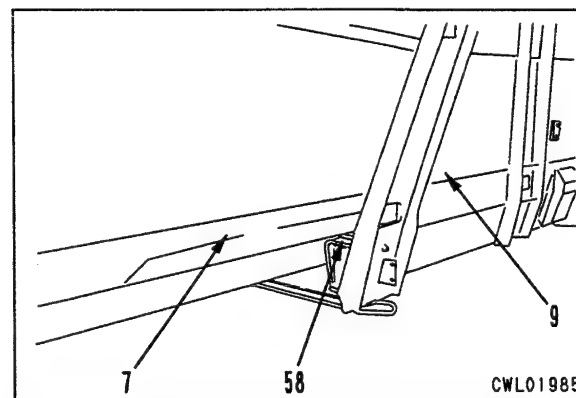


- 3) Sling with a nylon lifting tool, then pull out top boom portion of 2nd boom assembly (8) a little at a time with a forklift truck.

⚠ Fix in position so that base boom (9) does not fall off the stand.

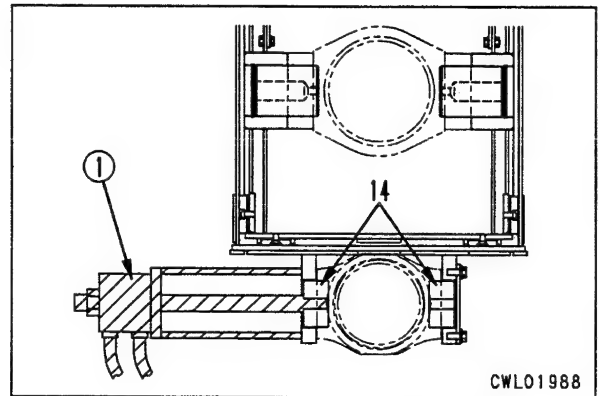
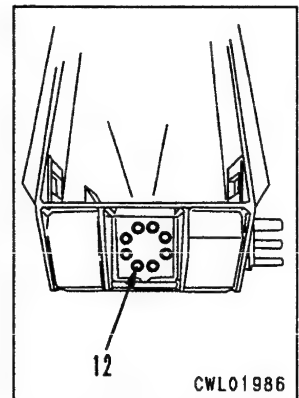
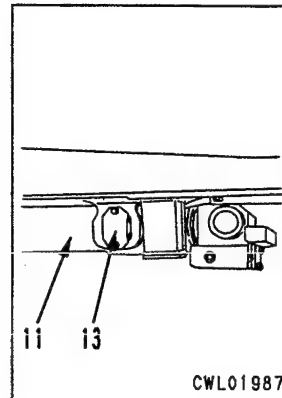


- 4) Before removing 2nd boom completely, remove bottom pad and bracket assembly (58) from front of base boom (9).
- 5) Remove 2nd boom assembly (7) from base boom (9) and set on stand.

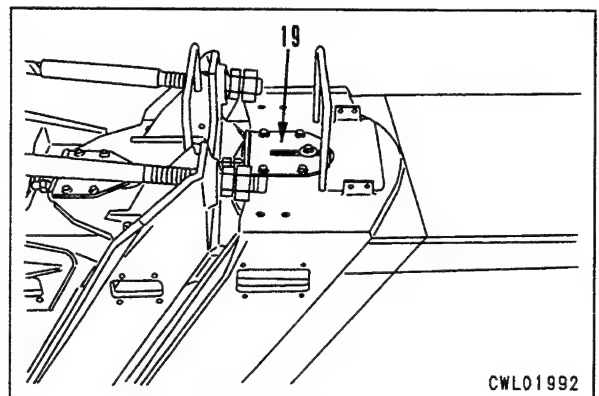


6. No. 1 telescope cylinder assembly

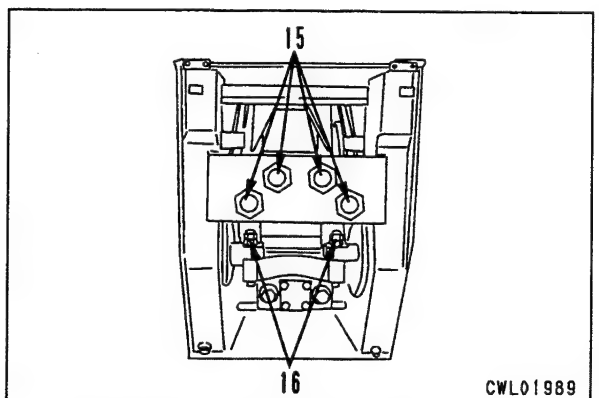
- 1) Sling No. 1 telescope cylinder (11) at 2 places (front and rear).
- 2) Remove mounting bolts (12) of cylinder bottom.
- 3) Remove 2 covers (13), then using tool ①, remove 2 pins (14).
- 4) Remove No. 1 telescope cylinder assembly (11) from 2nd boom assembly.

**7. 3rd boom assembly**

- 1) Remove 4th boom retraction sheave (19).

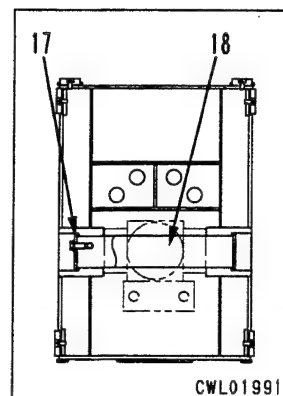
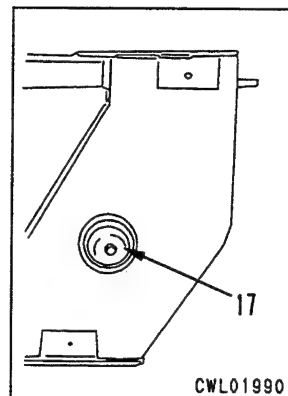


- 2) Remove 4th boom extension rope mounting nuts (15) (4 places).
★ Before disconnecting the rope, check the mounting dimensions of the nuts.
- 3) Remove mounting bolts and nuts (16) at No. 2 telescope cylinder head end.



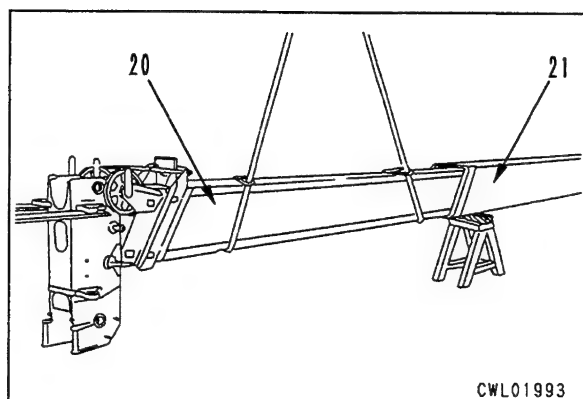
023S02

- 4) Remove pin lock plate (17).
- 5) Remove No. 2 telescope cylinder head pin (18).

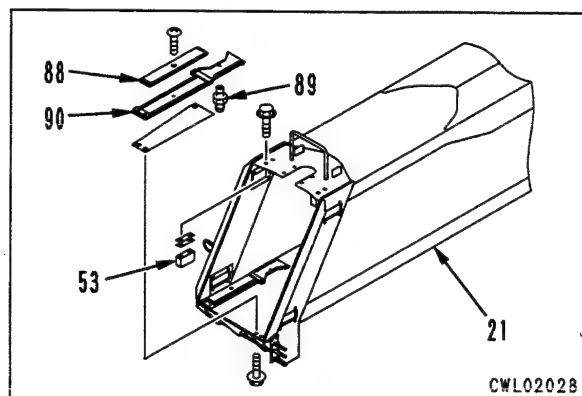


- 6) Sling with nylon lifting tool, then pull out top boom portion of 3rd boom assembly (20) a little at a time with a forklift truck.

⚠ Fix in position so that 2nd boom (21) does not fall off the stand.

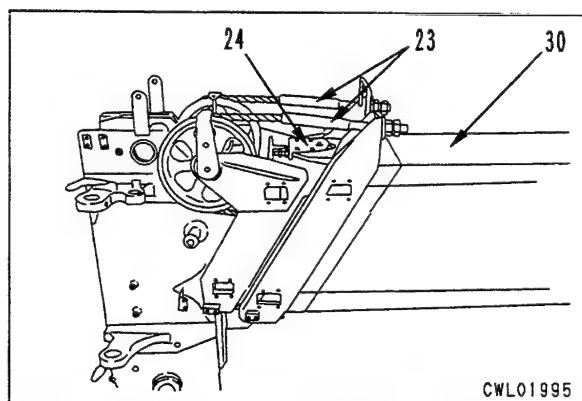


- 7) Before removing 3rd boom completely, remove 2 top pads (53) from front of 2nd boom (21) and 2 grease nipples (89), 2 retainers (90), and 2 bottom pads (88) from bottom.
- 8) Remove 3rd boom assembly (20) from 2nd boom (21), and set on stand.

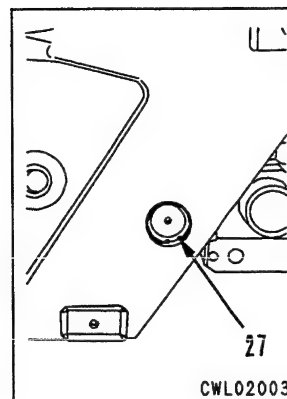
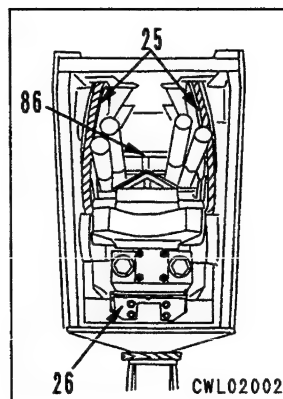


8. 4th boom assembly

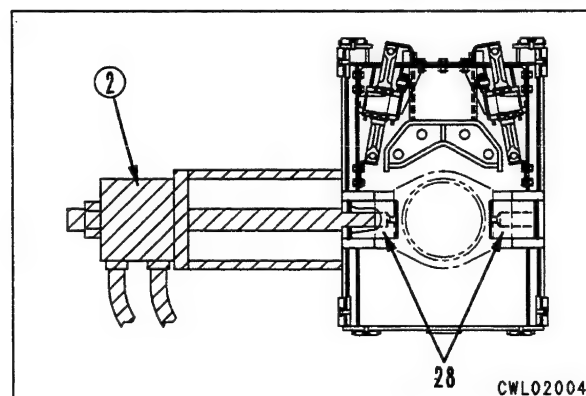
- 1) Disconnect top boom extension rope (23) from 3rd boom (30).
 - ★ Before disconnecting, check the mounting dimension of the nut.
- 2) Remove top boom retraction sheave (24).



- 3) Remove rear sheave (25) of 3rd boom.
- 4) Remove No. 2 telescope cylinder bracket (26).
- 5) Remove bracket (86).
- 6) Using snap ring pliers, remove snap ring (27).

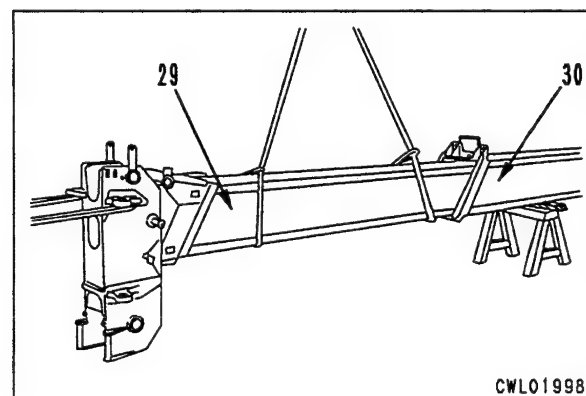


- 7) Using tool ②, remove No. 2 telescope cylinder bottom pin (28).



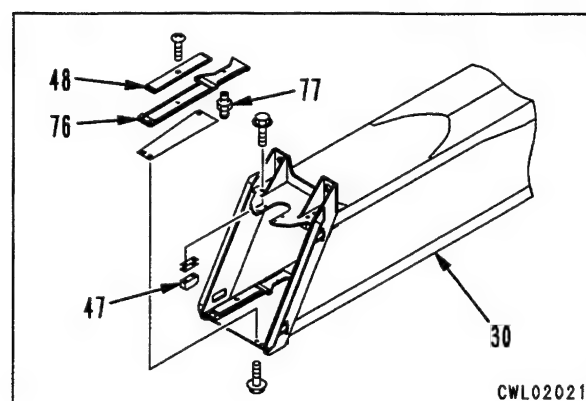
- 8) Sling with nylon lifting tool, then pull out top boom portion of 4th boom assembly (29) a little at a time with a forklift truck.

⚠ Fix in position so that 3rd boom (30) does not fall off the stand.



- 9) Before removing 4th boom completely, remove 2 top pads (47) from front of 3rd boom (30) and 2 grease nipples (77), 2 retainers (76), and 2 bottom pads (48) from bottom.

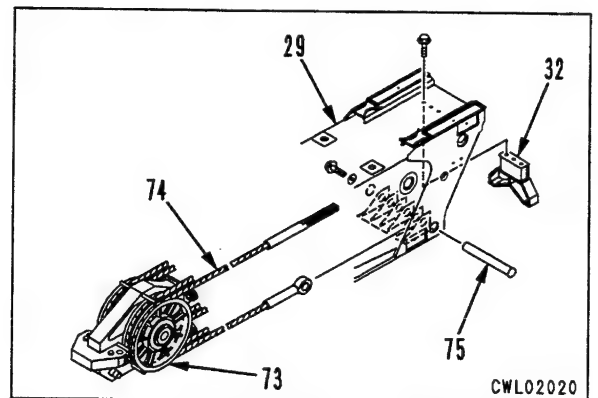
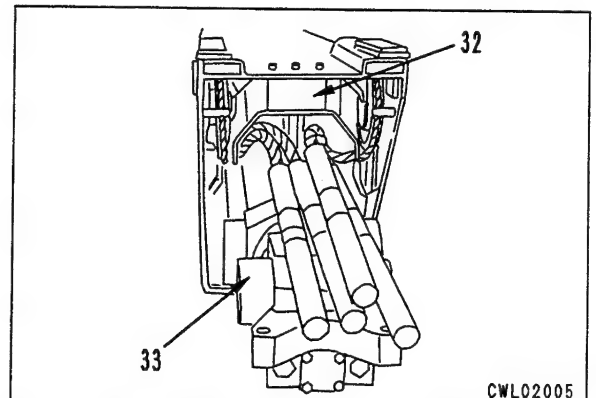
- 10) Remove 4th boom assembly (29) from 3rd boom (30), and set on stand.



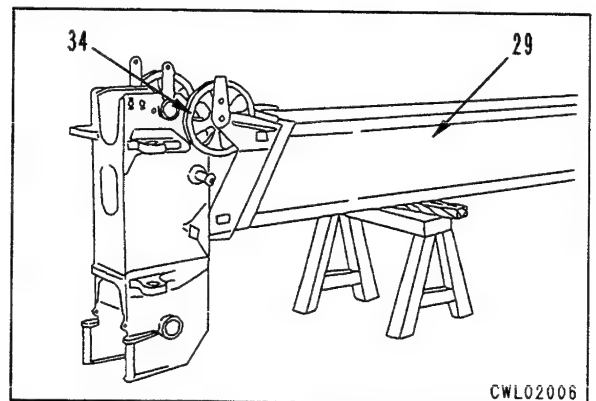
023S02

9. No. 2 telescope cylinder assembly

- 1) Remove bracket (32).
- 2) Remove pin (75), and disconnect 4th boom extension rope (74) from rear end of 4th boom assembly (29).
- 3) Lift off No. 2 telescope cylinder assembly (33).

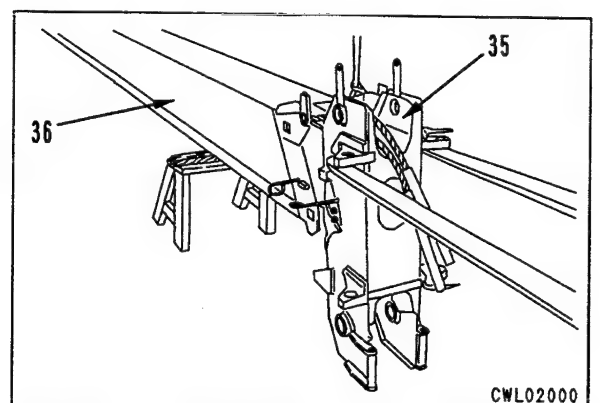
**10. Top boom**

- 1) Remove front sheave (34) from 4th boom (29).

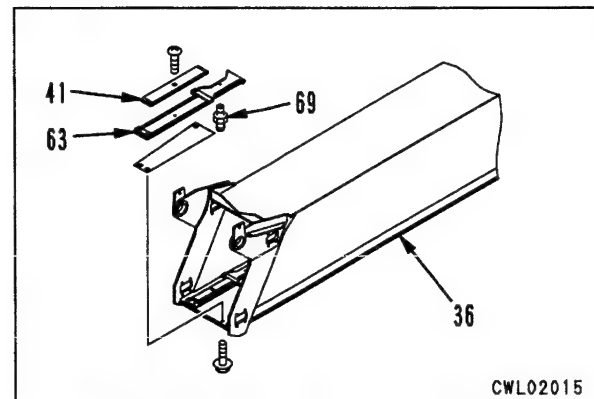


- 2) Sling with nylon lifting tool, then pull out tip of top boom (35) a little at a time with a fork-lift truck.

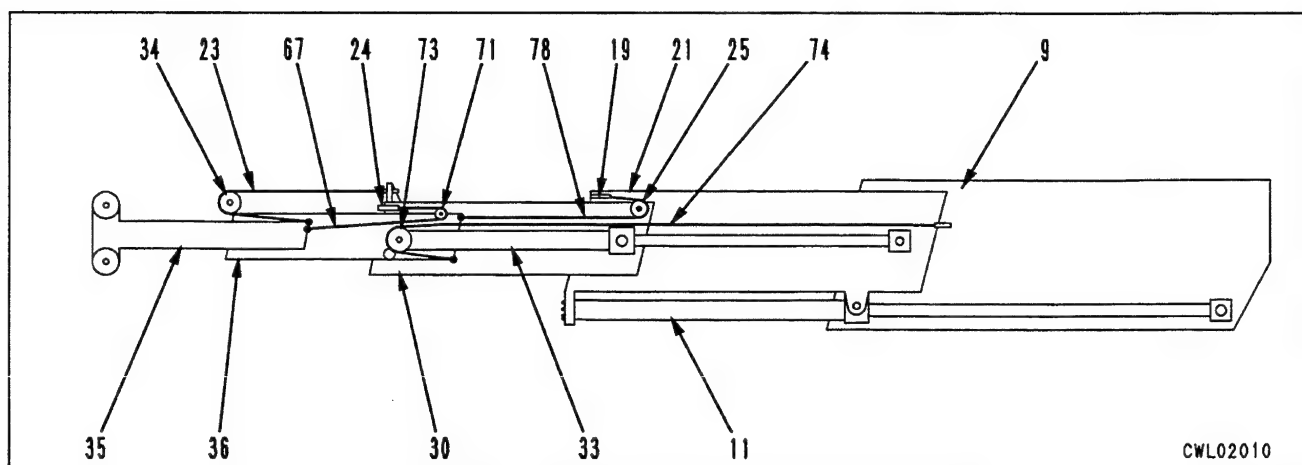
! Fix in position so that 4th boom (36) does not fall off the stand.



- 3) Before removing top boom completely, remove 2 grease nipples (69), 2 retainers (63), and 2 pads (41) from front bottom of 4th boom (36).
- 4) Remove top boom assembly (35) from 4th boom (36), and set on stand.

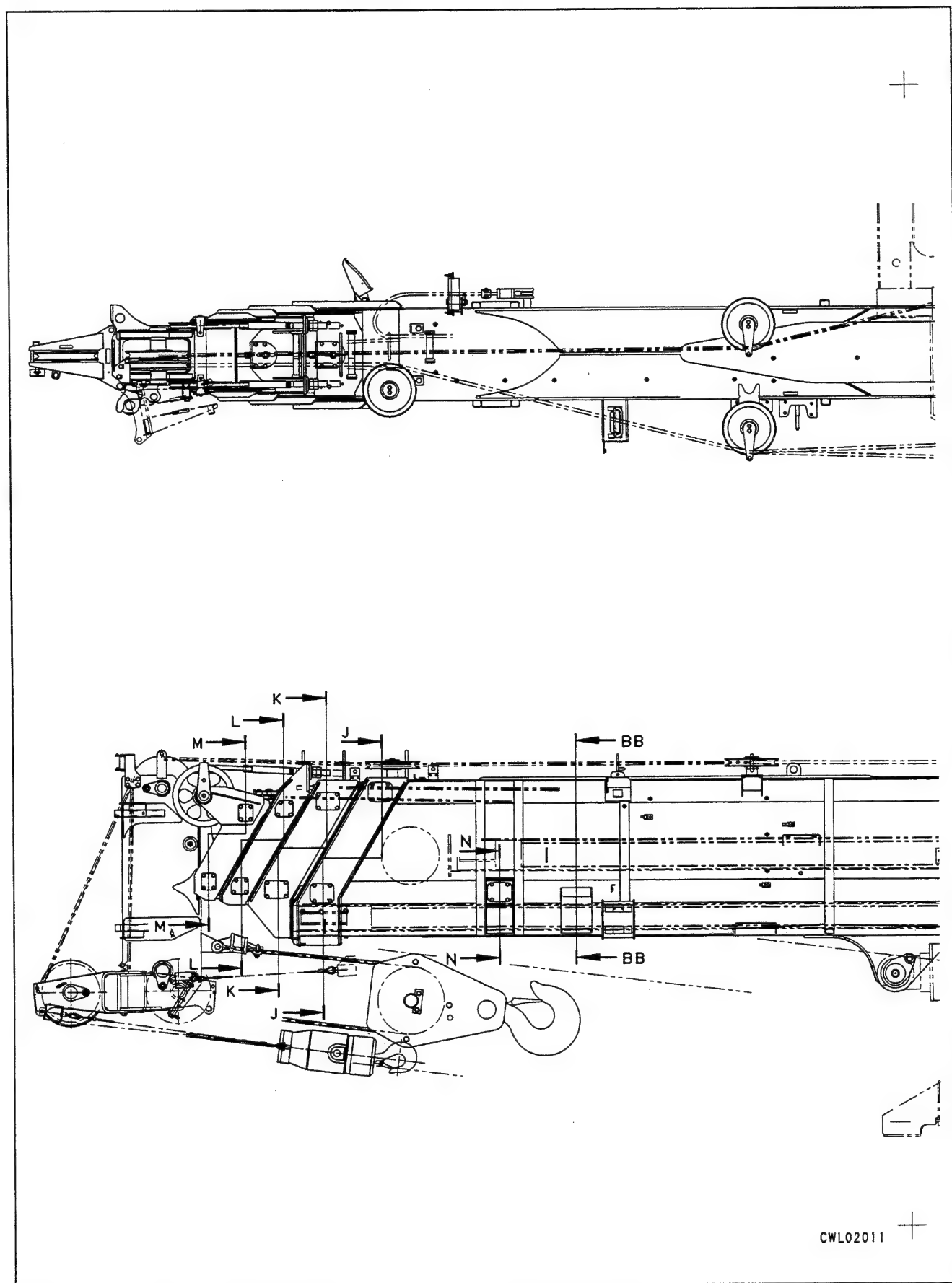


ASSEMBLY OF BOOM ASSEMBLY



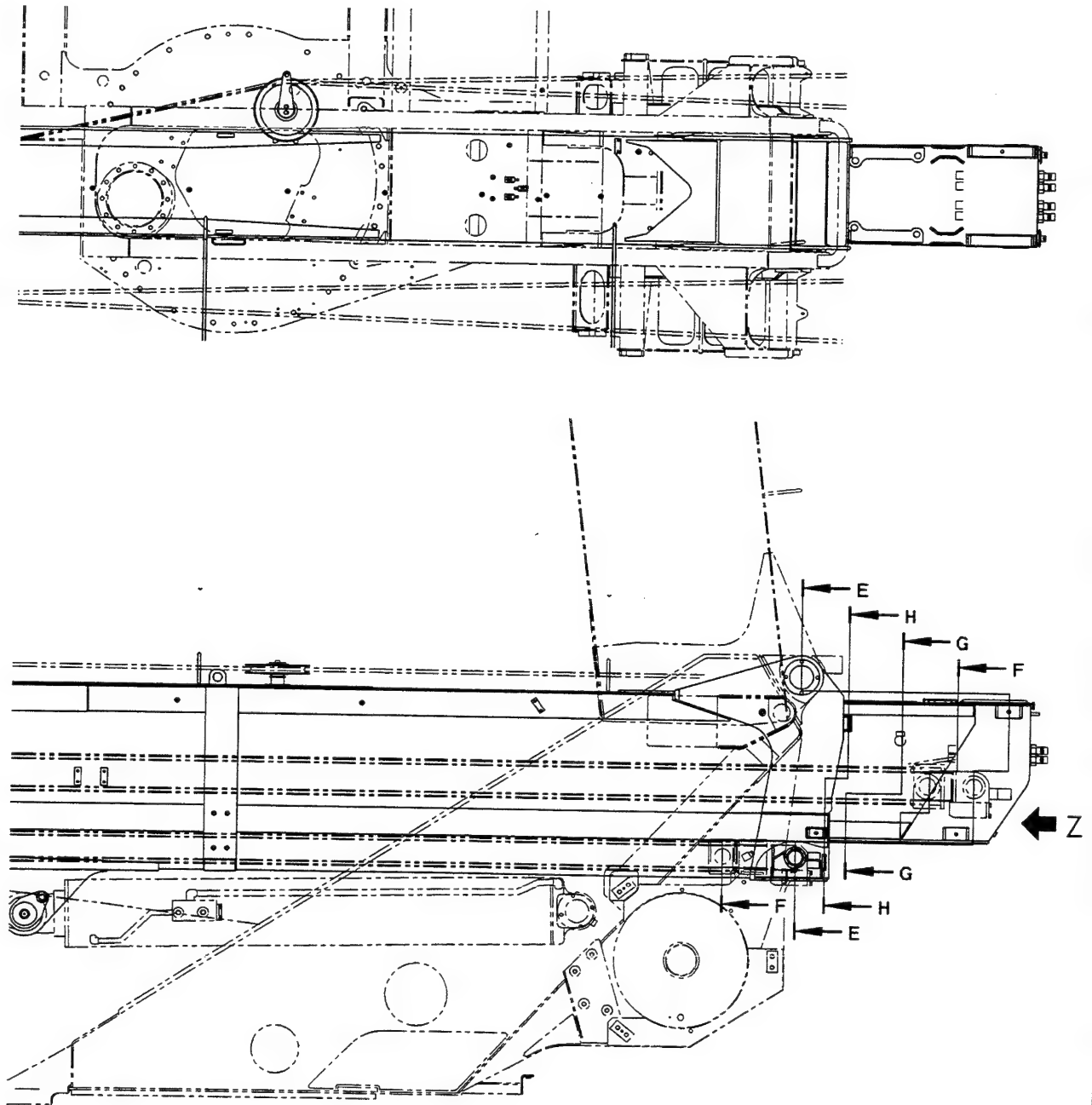
- Top boom (35)
- 4th boom (36)
- 3rd boom (30)
- 2nd boom (21)
- Base boom (9)
- No. 2 telescope cylinder (33)
- No. 1 telescope cylinder (11)
- Top boom extension rope (23)
- Top boom retraction rope (67)
- 4th boom retraction rope (78)
- 4th boom extension rope (74)
- 4th boom front sheave (34)
- 4th boom rear sheave (71)
- No. 2 telescope cylinder bottom sheave (73)
- 3rd boom rear sheave (25)
- Top boom retraction rope (24)
- 4th boom retraction rope (19)

023S02

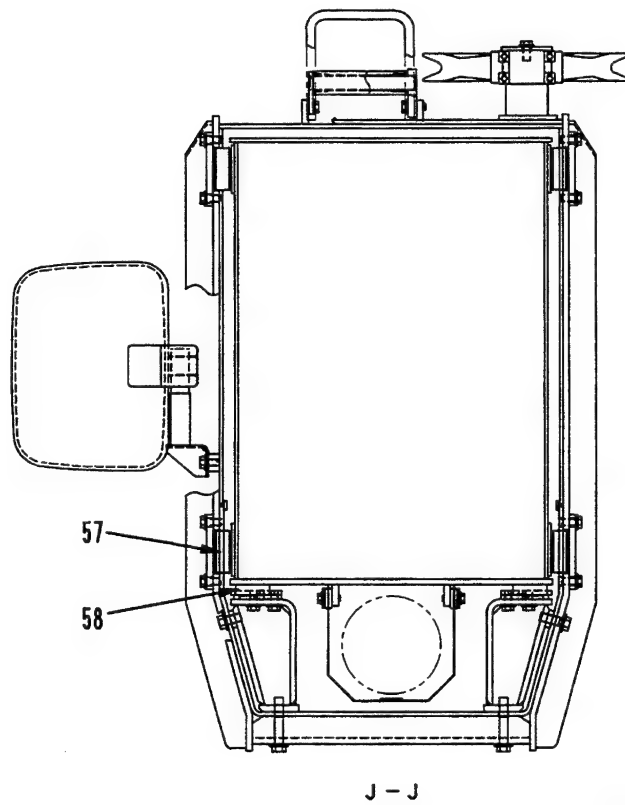
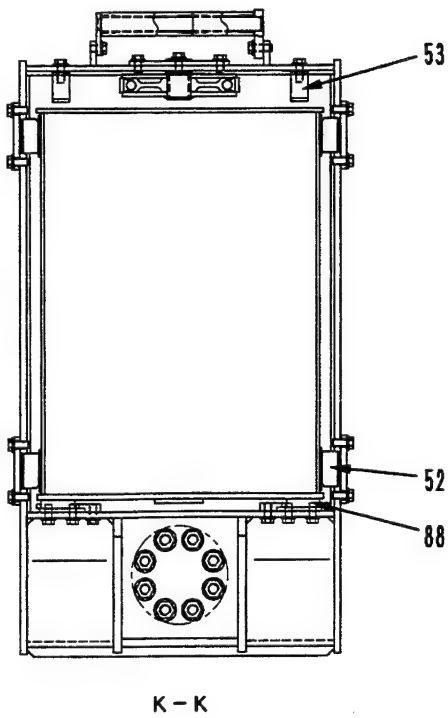
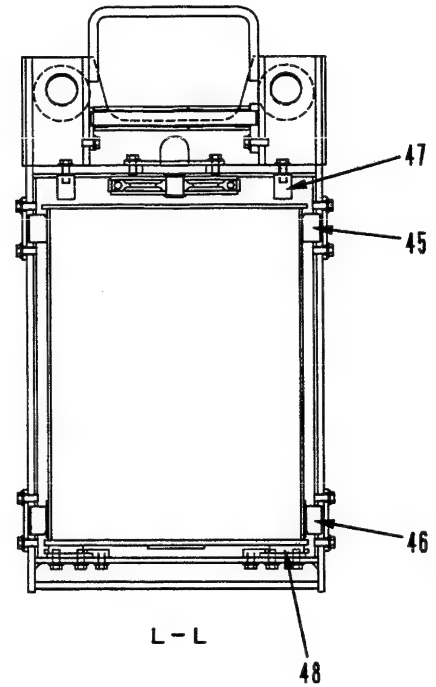
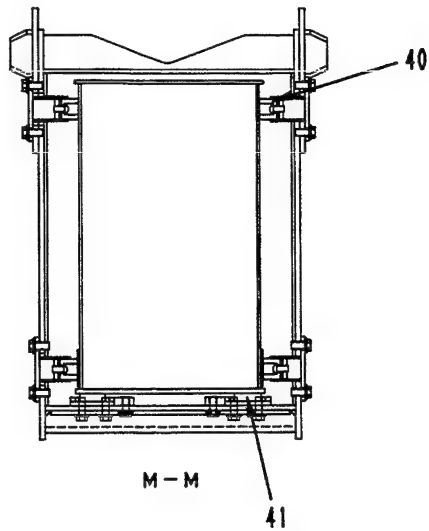


023S02

023S02

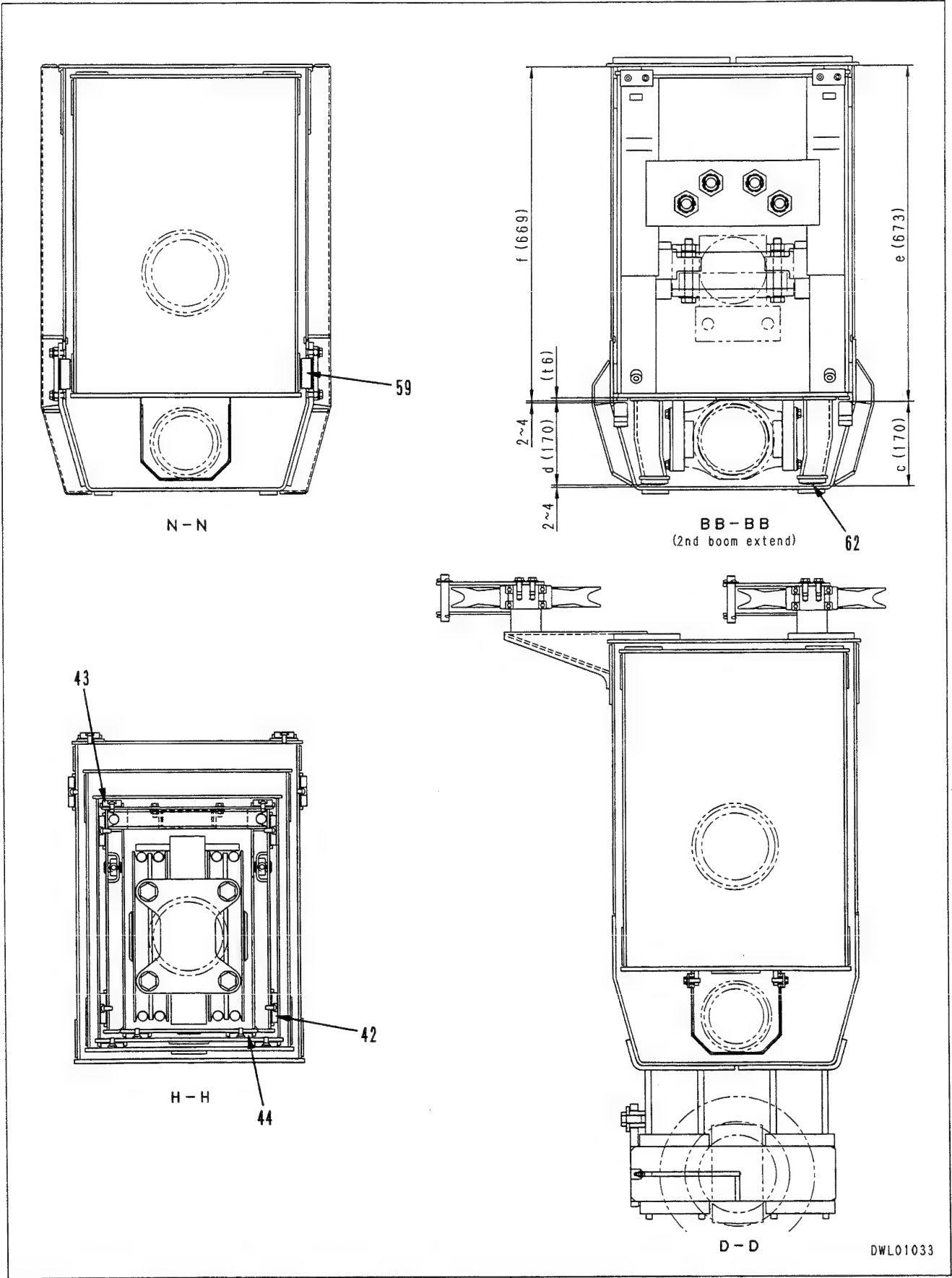


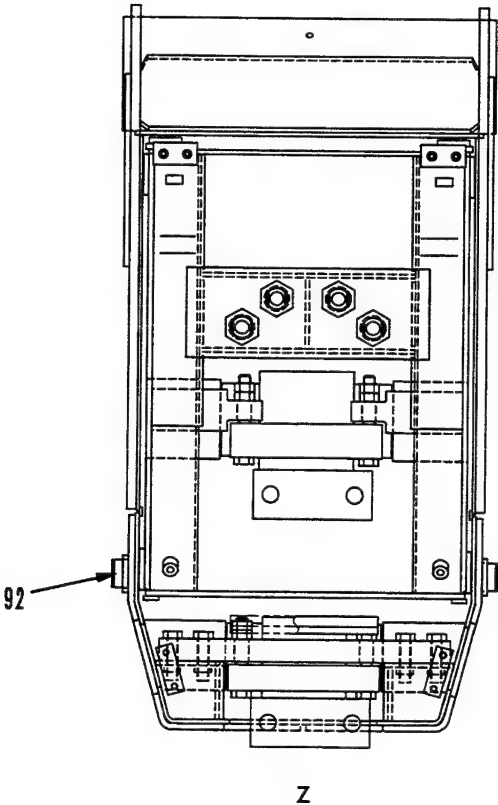
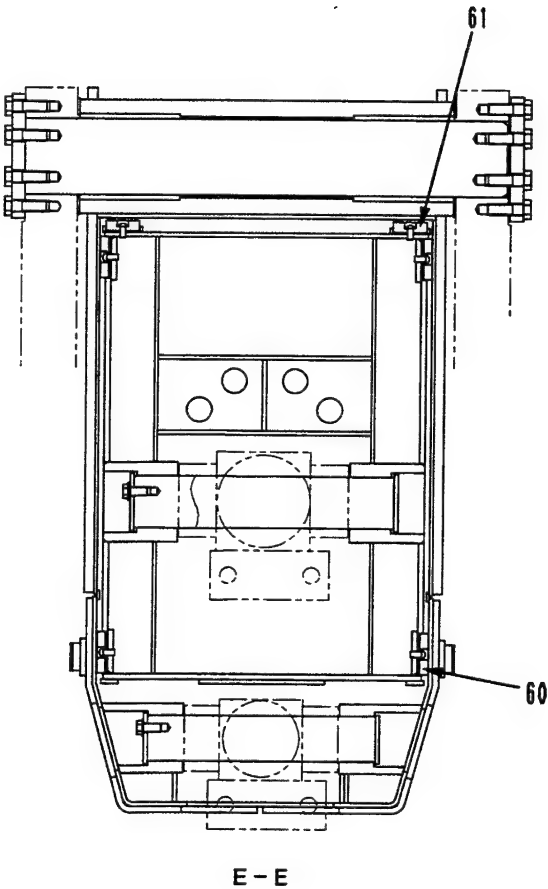
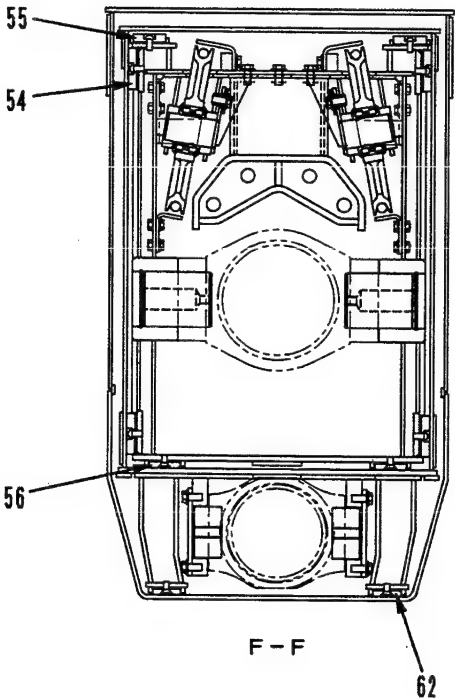
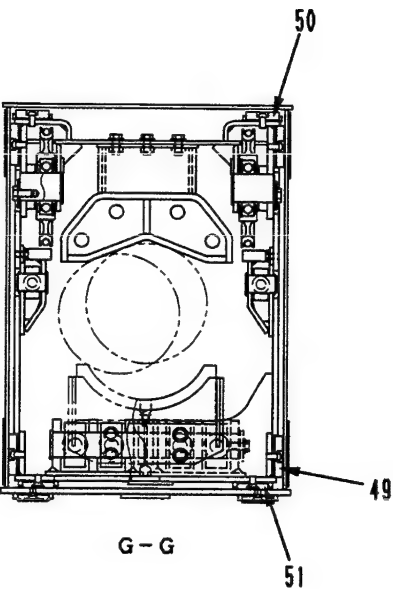
CWL02012



CWL02013

023S02





023S02

CWL02032

1. Select shim for each boom (top boom, 4th boom, 3rd boom, 2nd boom) as follows.

1) Selection of shim for side face sliding pad

- i) Imagine condition when inner boom is inserted in outer boom, and set top or bottom pad at right side of inner boom (38) in contact with side face of outer boom (39).

- ii) In above condition, compare clearance at top and bottom on left side and select shim from side where clearance is small.

★ For example, if clearance ① is smaller than clearance ②, and clearance ① = 2.9 mm :

The clearance to be divided on the left and right is $S = 2.9/2 = 1.45$ mm

Insert one shim each at both clearances ① and ④ so that the standard value for the clearance is 0.3 – 0.5 mm, and make the clearance 0.45 mm.

- iii) Next, select shim for clearance which was wider (②, ③) in Step i).

Imagine that the inner boom is set at the center of the movement to the left and right inside outer boom (39) (in the example in Step ii), clearance S at ① and ④ = 1.45), and select the shim thickness for the remaining two places.

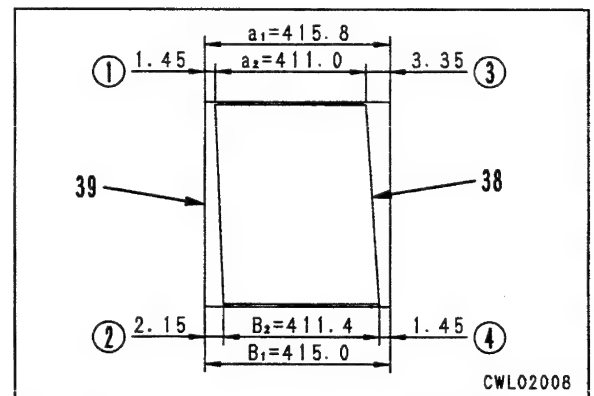
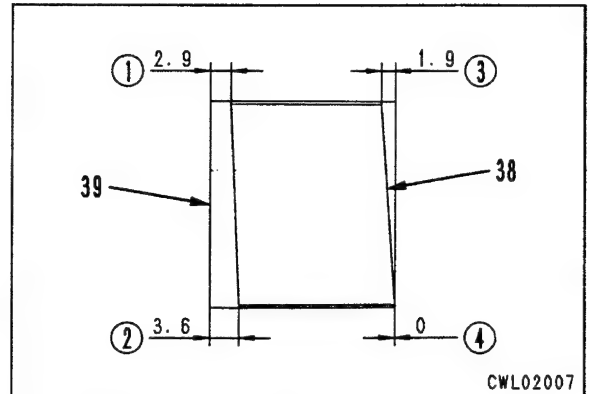
★ For example : If $a_1 = 415.8$, $a_2 = 411.0$, $b_1 = 415.0$, and $b_2 = 411.4$:

$$\begin{aligned} \textcircled{2} &= b_1 - b_2 - \textcircled{4} \\ &= 415.0 - 411.4 - 1.45 = 2.15 \end{aligned}$$

$$\begin{aligned} \textcircled{3} &= a_1 - a_2 - \textcircled{1} \\ &= 415.8 - 411.0 - 1.45 = 3.35 \end{aligned}$$

Therefore, if a shim of 1.8 mm is inserted at ②, the clearance will become 0.35 mm, and, if a shim of 3 mm is inserted at ⑤, the clearance will become 0.35 mm.

⚠ To ensure the hold tolerance of the sliding pad, do not insert shims of more than 3.5 mm.



2) Selection of shim for top sliding pad

Select the shim for the top sliding pad so that the difference in the clearance of the side face sliding pad is within 0.5 mm.


- 3) Standard shim thickness of sliding pads
 - (1) Between top boom and 4th boom (front of boom)
 - Standard shim thickness of left and right pads (40) : 3.3 mm (3 types: $t=0.3$, $t=0.5$, $t=1.0$)
 - Standard shim thickness of bottom pad (41) : 0 mm ($t=1.0$)
 - (2) Between top boom and 4th boom (rear of boom)
 - Standard shim thickness of left and right pads (42) : 1.5 mm (2 types : $t=0.3$, $t=1.0$)
 - Standard shim thickness of top pad (43) : 2 mm ($t=1.0$)
 - ★ Adjust shims so that the clearance is 2 – 4.
 - Standard shim thickness of bottom pad (44) : 2 mm ($t=1.0$)
 - (3) Between 4th boom and 3rd boom (front of boom)
 - Standard shim thickness of left and right pads (45) (top) : 4 mm (3 types : $t=0.3$, $t=0.5$, $t=1.0$)
 - Standard shim thickness of left and right pads (46) (bottom) : 3.8 mm (3 types : $t=0.3$, $t=0.5$, $t=1.0$)
 - Standard shim thickness of top pad (47) : 0 mm ($t=1.0$)
 - Standard shim thickness of bottom pad (48) : 0 mm ($t=0.5$)
 - (4) Between 4th boom and 3rd boom (rear of boom)
 - Standard shim thickness of left and right pads (49) : 3.5 mm (2 types : $t=0.3$, $t=1.0$)
 - Standard shim thickness of top pad (50) : 2 mm ($t=1.0$)
 - ★ Adjust shims so that the clearance is 2 – 4.
 - Standard shim thickness of bottom pad (51) : 2 mm ($t=1.0$)
 - (5) Between 3rd boom and 2nd boom (front of boom)
 - Standard shim thickness of left and right pads (52) : 4.3 mm (3 types : $t=0.3$, $t=0.5$, $t=1.0$)
 - Standard shim thickness of top and bottom pads (53), (88) : 0 mm ($t=1.0$)
 - (6) Between 3rd boom and 2nd boom (rear of boom)
 - Standard shim thickness of left and right pads (54) : 3.5 mm (2 types : $t=0.3$, $t=1.0$)
 - Standard shim thickness of top pad (55) : 2 mm ($t=1.0$)
 - ★ Adjust shims so that the clearance is 2 – 4.
- (7) Between 2nd boom and base boom (front of boom)
 - Standard shim thickness of left and right pads (57) : 4.5 mm (3 types : $t=0.3$, $t=0.5$, $t=1.0$)
 - Standard shim thickness of bottom pad (58) : 0 mm ($t=0.5$)
- (8) Between 2nd boom and boom boom (front center of boom)
 - Standard shim thickness of left and right pads (59) : 4.5 mm (2 types : $t=0.5$, $t=1.0$)
- (9) Between 2nd boom and base boom (rear center of boom)
 - Adjust shims (2 types : $t=0.3$, $t=1.0$) so that shim height of left and right pads (91) is 1 – 1.5 mm lower than height of boom rear left and right pads (including shims).
 - Adjust shims ($t=1.0$) so that shim height of top pad (90) is 1 – 1.5 mm lower than height of boom top rear pad (61) (including shims).
 - Standard thickness of bottom pad (52) : 2 mm ($t=1.0$)
 - ★ Adjust shims so that $a - b = 0 - 1$ mm at cross section E – E and F – F.
(Align mounting height of No. 1 cylinder with bottom end of base boom.)
Adjust shims so that there is a clearance of 2 – 4 mm between pad (62) and the base boom at cross section BB – BB (with 2nd boom extended), and that $c - d = -1 - +1$ mm.
- (10) Between 2nd boom and base boom (rear of boom)
 - Standard shim thickness of left and right pads (60) : 3.5 mm (2 types : $t=0.3$, $t=1.0$)
 - Standard shim thickness of top pad (61) : 2 mm ($t=1.0$)
 - ★ Adjust shims so that $E - F = 2 - 4$ mm at cross section BB – BB (2nd boom extended).
- (11) Between base boom and revolving frame (rear of boom)
 - Standard shim thickness of top pad (92) : 2 mm ($t=1.0$)

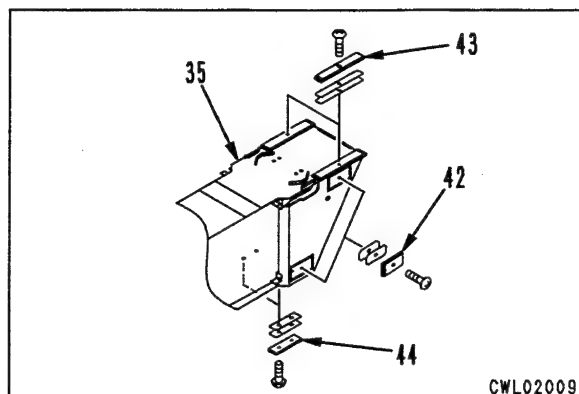
2. Top boom

- 1) Install 4 left and right pads (42), 2 top pads (43), and 2 bottom pads (44) at rear of top boom (35).

★ For details of the shim adjustment, see Item 1 above.

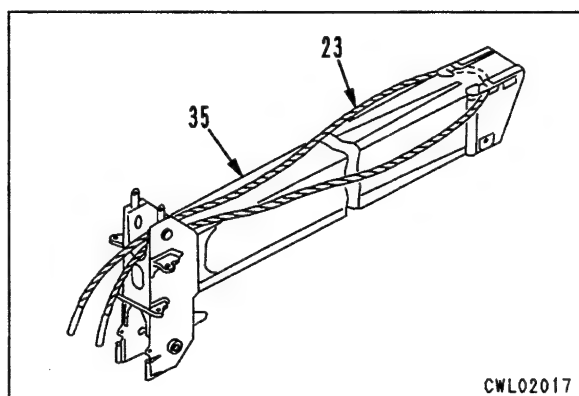
 Mounting bolt : **Thread tightener (LT-2)**

 Mounting bolt : **7.85 – 9.81 Nm {0.8 – 1.0 kgm}**



- 2) Pass top boom extension rope (23) through rear of top boom (35), and place at front of top boom.


 Coat the whole length of the rope with red oil.

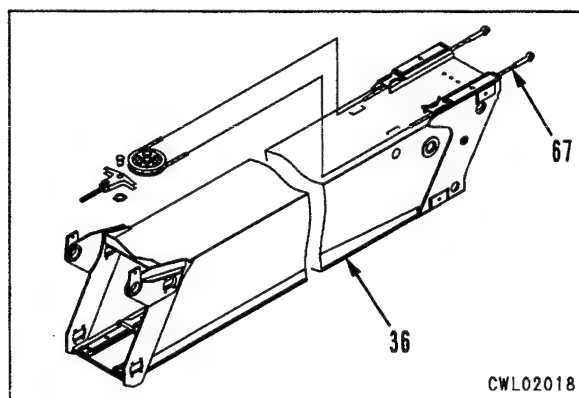


- 3) Pass top boom retraction rope (67) through rear of 4th boom (36).


 Coat the whole length of the rope with red oil.

- 4) After passing top boom retraction rope (67) through rear of 4th boom, install 4th boom rear sheave (71) to 4th boom with pin (80) and bolt (72).

 Sheave pin portion: **Molybdenum disulphide lubricant (LM-G)**



- 5) Pass tip of top boom retraction rope (67) through center of 4th boom (36), and place at front of 4th boom.

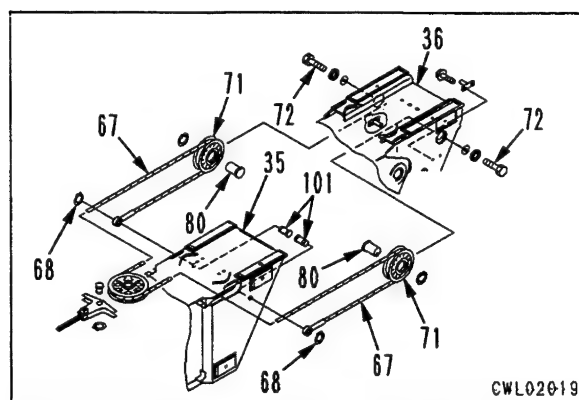
 Coat the whole length of the rope with red oil.

- 6) Raise top boom (35) and place at front of 4th boom (36).


- 7) Secure top boom retraction rope (67) to rear of top boom with snap ring (68).


★ Insert pin (101) from inside of top boom.

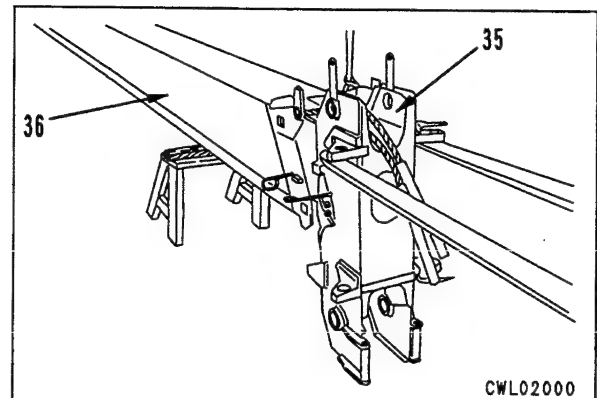
 Pin portion : **Molybdenum disulphide lubricant (LM-P)**



- 8) Insert 4th boom (36) in rear end of top boom (35), then push in tip of top boom a little at a time with a forklift truck.

 Before installing, remove all rust, spatter, and scale along the whole pad contact surface length, coat with molybdenum disulphide lubricant (LMW-G), or fill grease groove with LMW-G.

 Fix in position so that 4th boom (36) does not fall off the stand.





- 9) Before inserting top boom completely, install 2 grease nipples (69), 2 retainers (63), and 2 bottom pads (41) to front of 4th boom (36).


★ When installing the pads, raise the top boom and install.

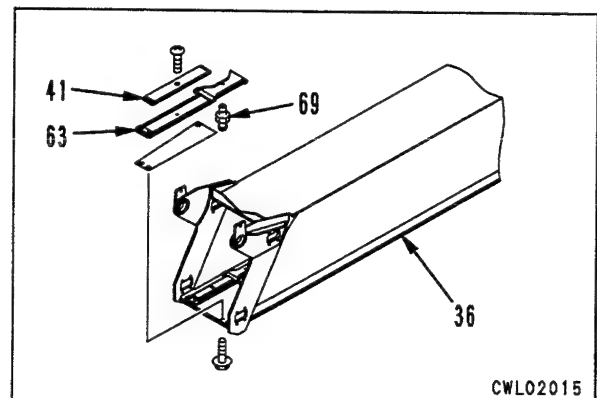
★ For details of the shim adjustment, see Item 1 above.

 Mounting bolt of pad (41) :
Thread tightener (LT-2)

 **kgm** Mounting bolt of pad (41) :
7.85 – 9.81 Nm {0.8 – 1.0 kgm}

 Retainer : **Molybdenum disulphide lubricant (LMW-G)**

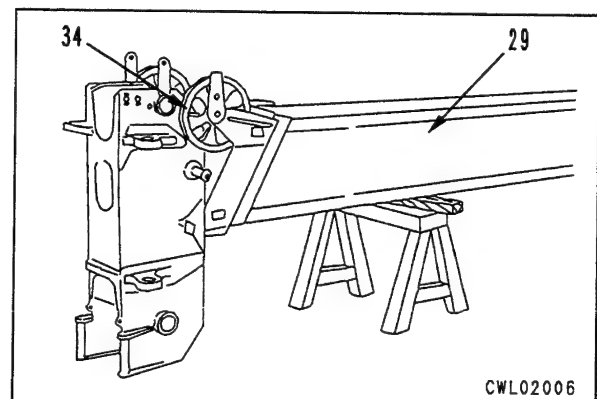
 **kgm** Mounting bolt of retainer (63) :
59 – 74 Nm {6.0 – 7.5 kgm}



- 10) Install front sheave (34) to 4th boom (29).

 Sheave pin portion : **Molybdenum disulphide lubricant (LM-G)**

 And bearing portion : **Grease (G2-LI)**





3. 4th boom

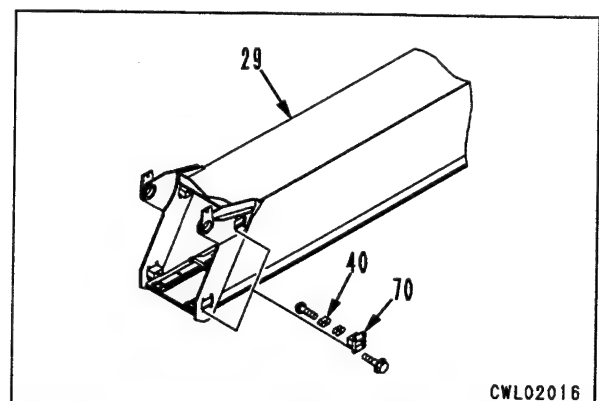
- 1) Install 2 left and right pads (40) and 2 retainers (70) to front of 4th boom assembly (29).

★ For details of the shim adjustment, see Item 1 above.

 Mounting bolt of pad (40) :
Thread tightener (LT-2)

 **kgm** Mounting bolt of pad (40) :
7.85 – 9.81 Nm {0.8 – 1.0 kgm}


 **kgm** Mounting bolt of retainer (70) :
59 – 74 Nm {6.0 – 7.5 kgm}

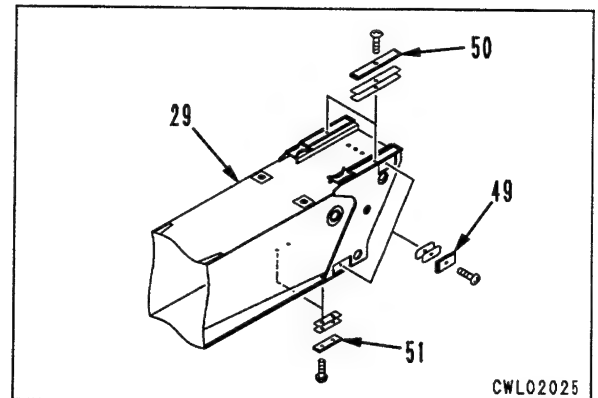


- 2) Install 4 left and right pads (49), 2 top pads (50), and 2 bottom pads (51).

★ For details of the shim adjustment, see Item 1 above.

 Mounting bolt of pad :
Thread tightener (LT-2)

 Mounting bolt of pad :
7.85 – 9.81 Nm {0.8 – 1.0 kgm}




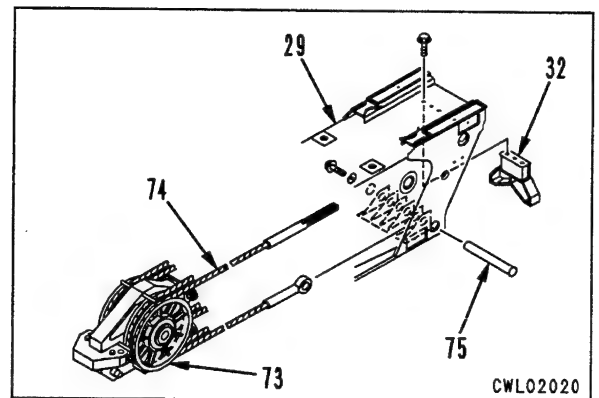
- 3) Set 4th boom extension ropes (74) (x4) to No. 2 telescope cylinder bottom sheave (73).

 Coat the whole length of the rope with red oil.

- 4) Install 4th boom extension ropes (x4) to rear of 4th boom assembly (29).

 Pin (75) : **Molybdenum disulphide lubricant (LM-P)**

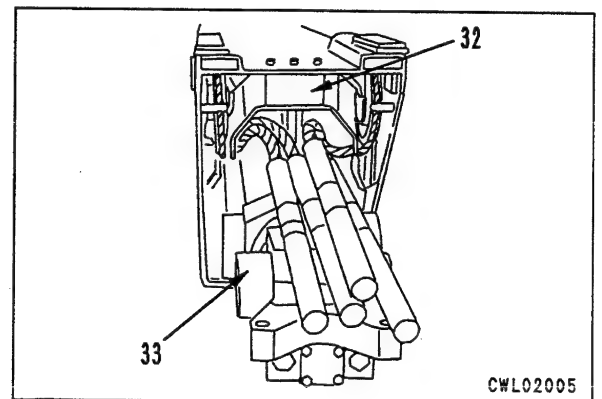
 Pin mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}




- 5) Raise No. 2 telescope cylinder assembly (33) and insert in 4th boom.


- 6) Pass 4th boom extension ropes (x4) through bracket (32).

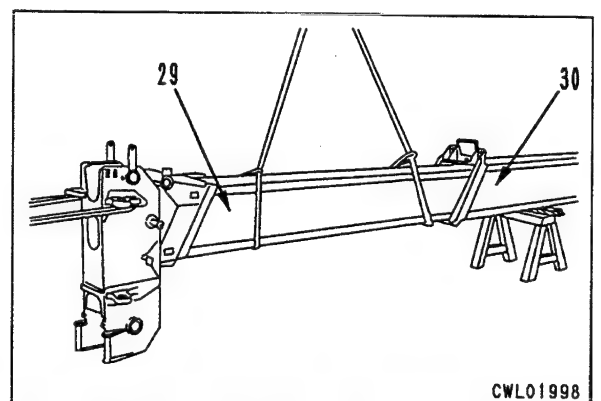
 Mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}



- 7) Insert rear end of 4th boom (29) in 3rd boom (30), then push in tip of 4th boom assembly a little at a time with a forklift truck.





 Fix in position so that 3rd boom (30) does not fall off the stand.

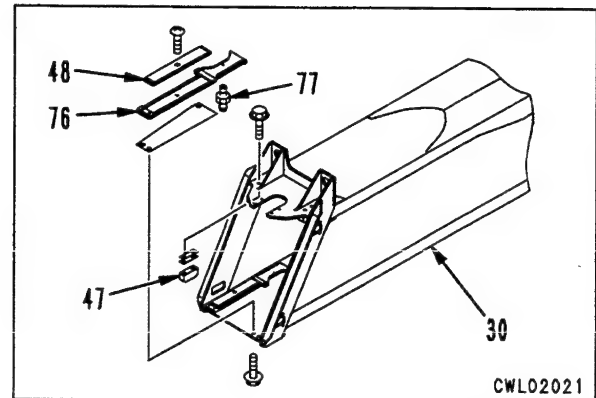
 Before installing, remove all rust, spatter, and scale along the whole pad contact surface length, coat with molybdenum disulphide lubricant (LMW-G), or fill grease groove with LMW-G.



- 8) Before inserting 4th boom completely, install 2 grease nipples (77), 2 retainers (71), 2 bottom pads (48), and 2 top pads (47) to front of 3rd boom (30).

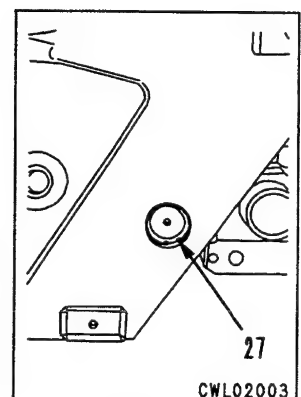
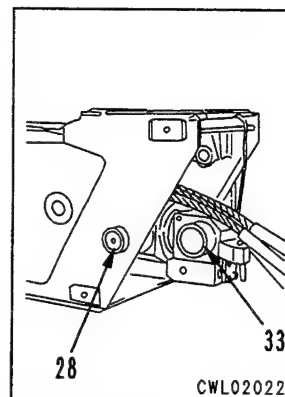
- ★ When installing the bottom pads, raise the 4th boom and install.
- ★ For details of the shim adjustment, see Item 1 above.

-  Mounting bolt of pad (48) :
Thread tightener (LT-2)
-  **kgm** Mounting bolt of pad (48) :
7.85 – 9.81 Nm {0.8 – 1.0 kgm}
-  Retainer (76): **Molybdenum disulphide lubricant (LMW-G)**
-  **kgm** Mounting bolt of retainer (76) :
59 – 74 Nm {6.0 – 7.5 kgm}




- 9) Raise No. 2 telescope cylinder assembly (33) and install left and right cylinder bottom pins (28).


- 10) Using snap ring pliers, install snap ring (27).

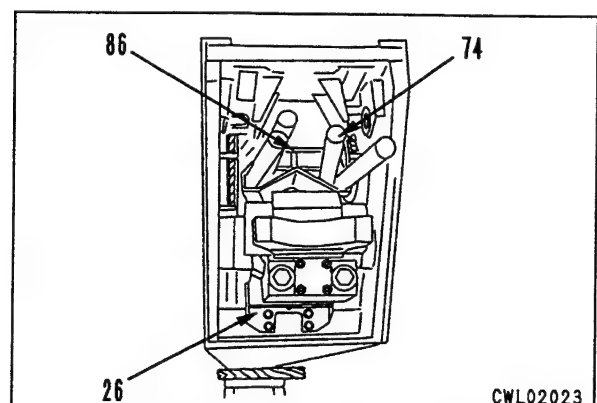


- 11) Install No. 2 telescope cylinder bracket (26).

-  Mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}


- 12) Pass 4th boom extension ropes (74) (x4) through bracket (86).

-  Mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}




- 13) Secure 4th boom retraction ropes (78) to rear of 4th boom (36).

* Insert pin (81) from inside of top boom.

 Coat the whole length of the rope with red oil.

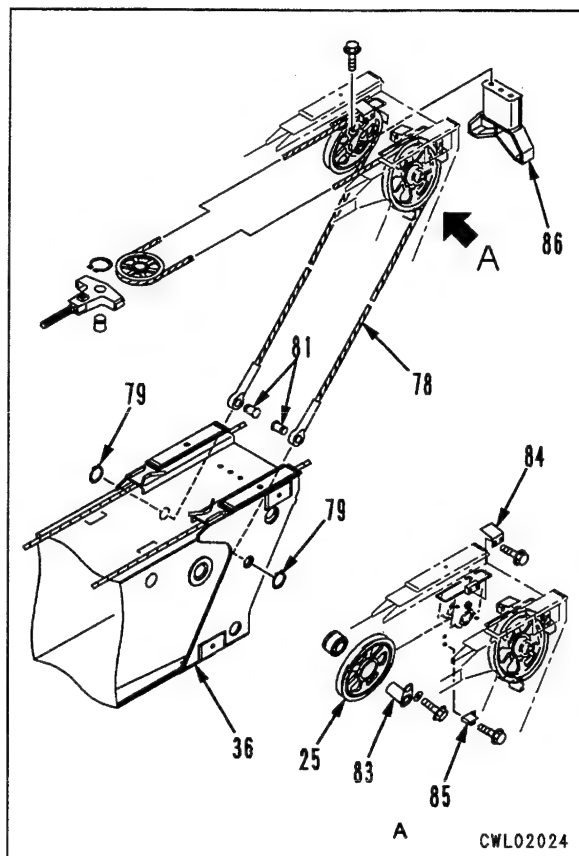
 Pin portion : **Molybdenum disulphide lubricant (LM-P)**

- 14) After passing 4th boom retraction ropes (78) through rear sheave (25) of 3rd boom, install rear sheave.


 Sheave pin (83) : **Molybdenum disulphide lubricant (LM-G)**

- 15) Install sheave brackets (84) and (85).

 Mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}




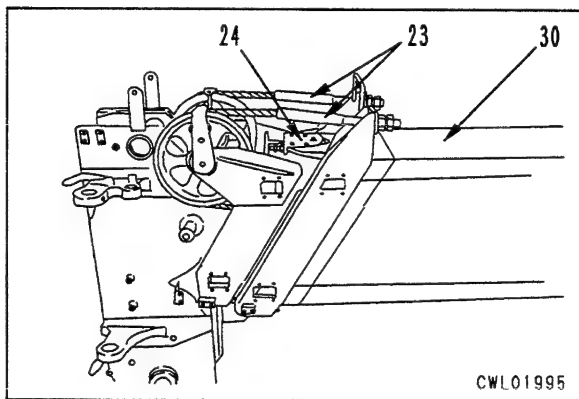
- 16) Install top boom retraction sheave (24).

 Sheave pin portion : **Molybdenum disulphide lubricant (LM-G)**

- 17) Secure top boom extension ropes (23) to 3rd boom.

★ When installing, set the nut to the mounting dimensions measured when disconnecting.


 Spherical portion at tip of rope: **Molybdenum disulphide lubricant (LM-G)**

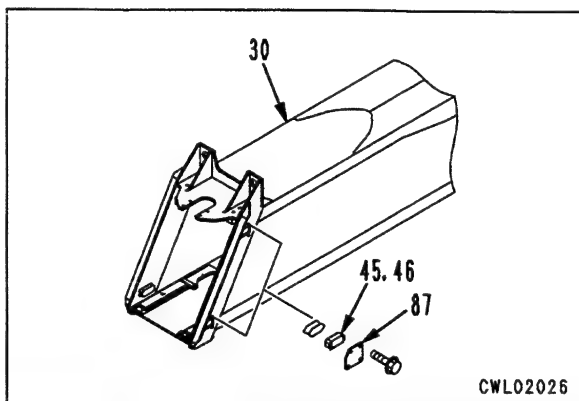


4. 3rd boom

- 1) Install left and right pads (45) and (46) (2 each) and 4 plates (87) to front of 3rd boom assembly (20).



★ For details of the shim adjustment, see Item 1 above.

 Mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}





- 2) Install 4 left and right pads (54), 2 top pads (55), and 2 bottom pads (56) to rear of 3rd boom (20).

★ For details of the shim adjustment, see Item 1 above.

 Mounting bolt :
Thread tightener (LT-2)
 Mounting bolt :
7.85 – 9.81 Nm {0.8 – 1.0 kgm}

- 3) Insert rear end of 3rd boom assembly (20) in 2nd boom (21), then push in tip of 3rd boom assembly a little at a time with a forklift truck.





 Before installing, remove all rust, spatter, and scale along the whole pad contact surface length, coat with molybdenum disulphide lubricant (LMW-G), or fill grease groove with LMW-G.

 Fix in position so that 2nd boom (21) does not fall off the stand.

- 4) Before inserting 3rd boom completely, install 2 grease nipples (89), 2 retainers (90), 2 bottom pads (88), and 2 top pads (53) to front of 2nd boom.

★ When installing the bottom pads, raise the 3rd boom and install.


★ For details of the shim adjustment, see Item 1 above.

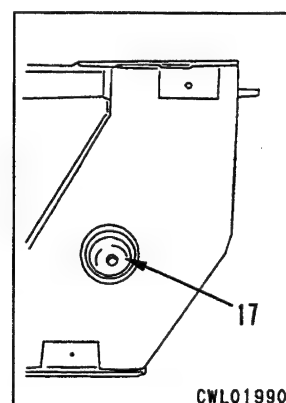
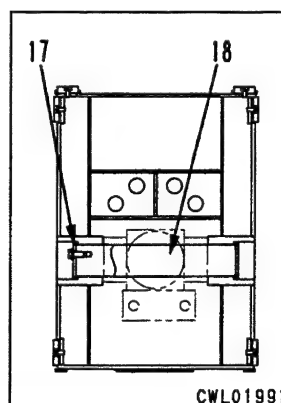
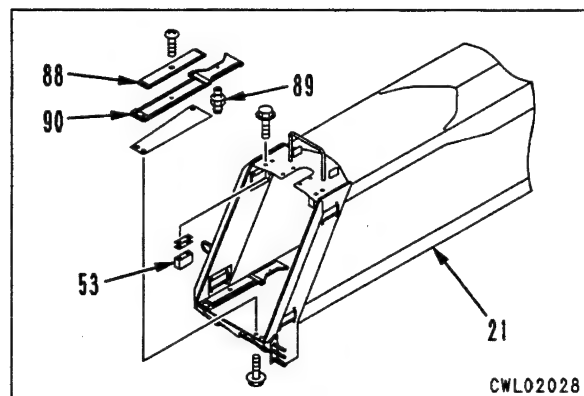
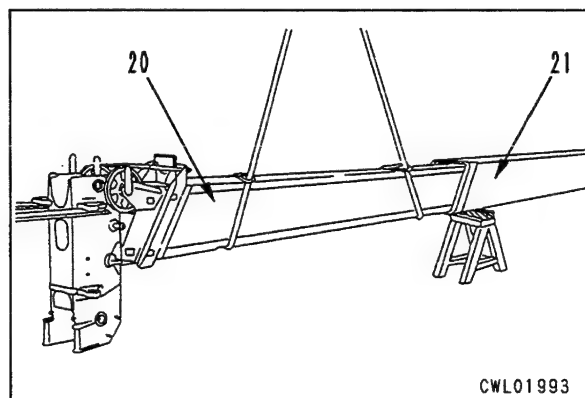
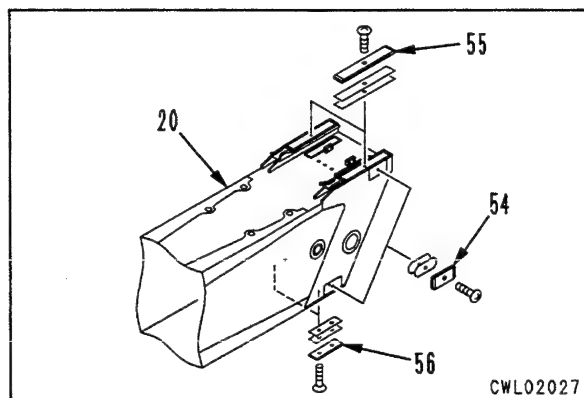
 Mounting bolt of bottom pad (88):
Thread tightener (LT-2)
 Mounting bolt of bottom pad (88):
7.85 – 9.81 Nm {0.8 – 1.0 kgm}
 Retainer (90) : **Molybdenum disulphide lubricant (LMW-G)**
 Mounting bolt of retainer (90):
59 – 74 Nm {6.0 – 7.5 kgm}

- 5) Install head pin (18) of No. 2 telescope cylinder.

 Pin portion : **Molybdenum disulphide lubricant (LMW-G)**

- 6) Install cover (17).

 Mounting bolt :
98 – 123 Nm {10 – 12.5 kgm}



- 7) Install head mounting bolts (16) of No. 2 telescope cylinder.

★ Tighten the mounting bolts by hand to a point where the bolts contact, then tighten the locknut.

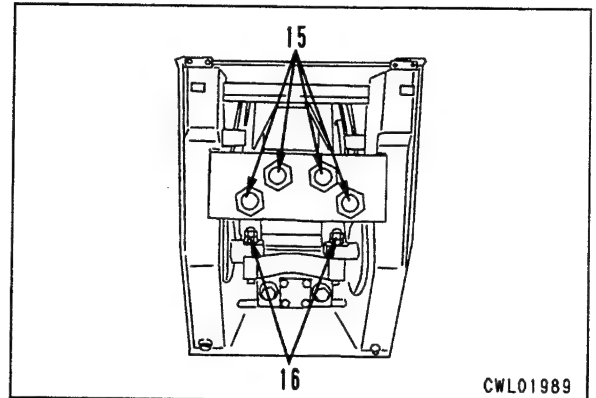


Mounting bolt :

Thread tightener (LT-2)

- 8) Install 4th boom extension rope mounting nuts (15) at 4 places.

★ When installing, set the nuts to the mounting dimensions measured when disconnecting.



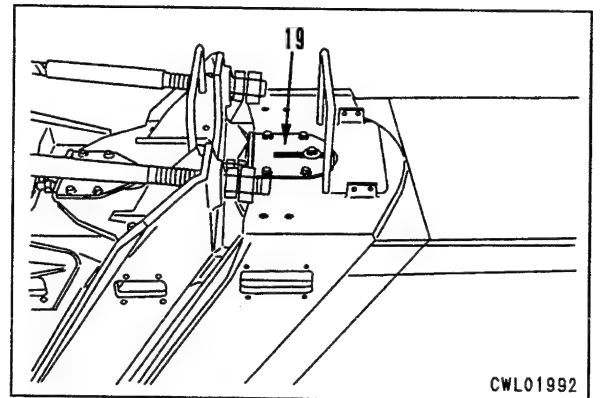
- 9) Install 4th boom retraction sheave (19).



Sheave pin portion: **Molybdenum**

disulphide

lubricant (LM-G)



5. 2nd boom

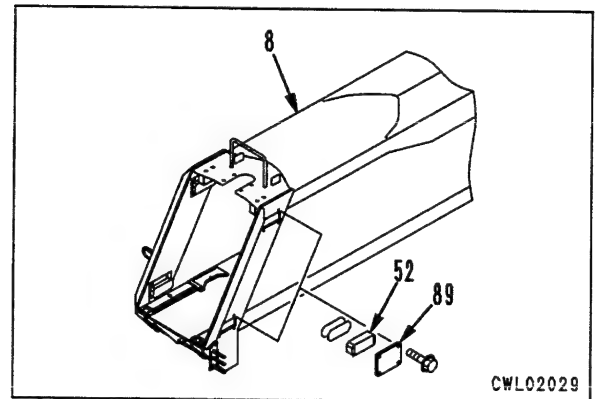
- 1) Install 4 left and right pads (52) and 4 plates (89) to front of 2nd boom assembly (8).

★ For details of the shim adjustment, see Item 1 above.



Mounting bolt :

59 – 74 Nm {6.0 – 7.5 kgm}



- 2) Install 4 left and right pallets (60) and 2 top pads (61) to rear of 2nd boom assembly (8), and 2 left and right pads (91), 2 top pads (90), and 2 bottom pads (62) to rear center.

★ For details of the shim adjustment, see Item 1 above.



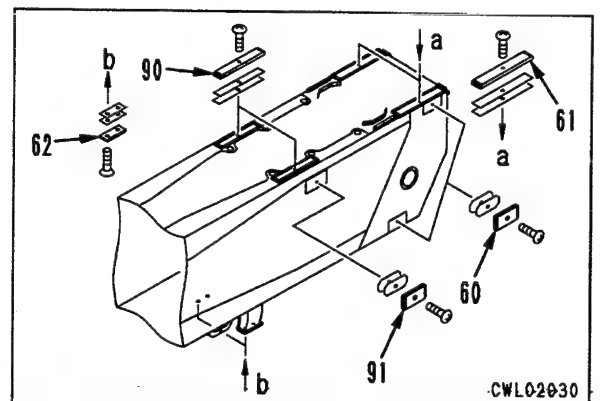
Mounting bolt :

Thread tightener (LT-2)



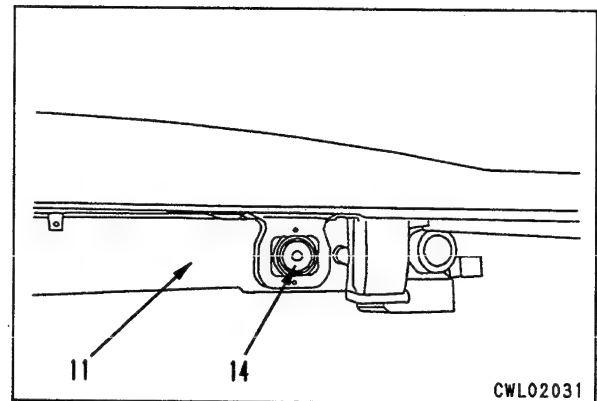
Mounting bolt :

7.85 – 9.81 Nm {0.8 – 1.0 kgm}




- 3) Raise No. 1 telescope cylinder assembly (11), set to 2nd boom assembly, then install cylinder bottom pin (14).

 Pin portion : **Molybdenum disulphide lubricant (LM-P)**

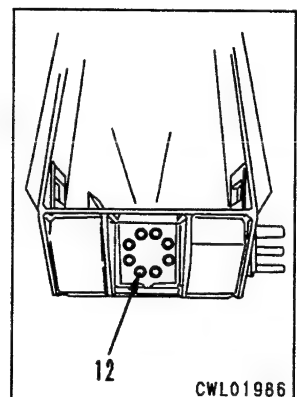
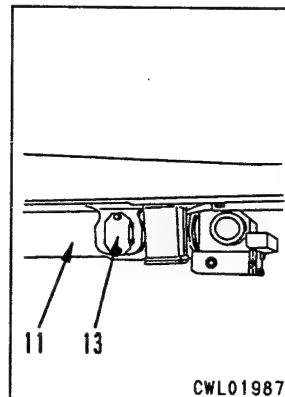


- 4) Install 2 covers (13).


 Mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}


- 5) Install mounting bolts (12) at cylinder bottom.

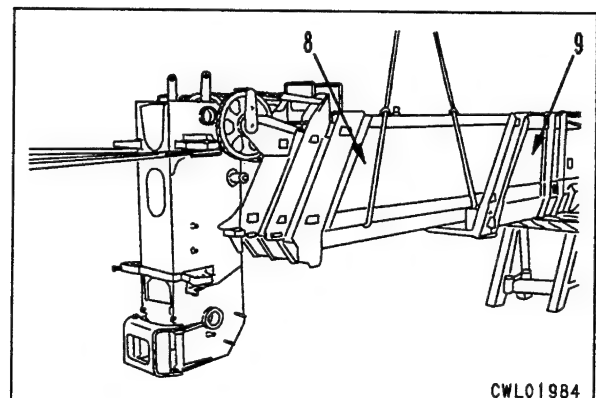
 Mounting bolt :
245 – 309 Nm {25 – 31.5 kgm}



- 6) Insert rear end of 2nd boom (8) in base boom (9), then push in tip of 2nd boom assembly a little at a time with a forklift truck.

 Before installing, remove all rust, spatter, and scale along the whole pad contact surface length, coat with molybdenum disulphide lubricant (LMW-G), or fill grease groove with LMW-G.

 Fix in position so that base boom (9) does not fall off the stand.

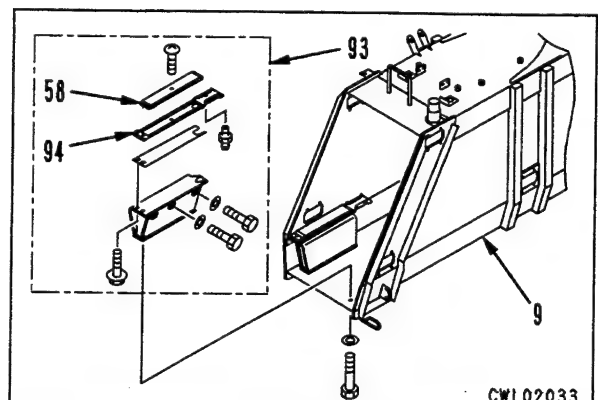






- 7) Before inserting 2nd boom completely, install 2 bottom pad and bracket assemblies (93) to front of base boom (9).

★ When installing the assemblies, raise the 2nd boom and install.

★ For details of the shim adjustment, see Item 1 above.

 Mounting bolt of bottom pad (58):
Thread tightener (LT-2)




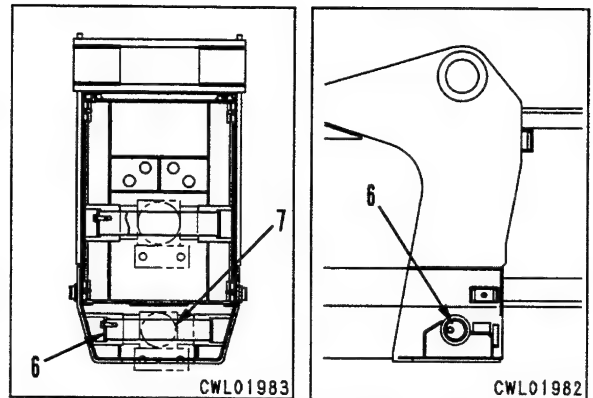
-  **kgm** Mounting bolt of bottom pad (58):
7.85 – 9.81 Nm {0.8 – 1.0 kgm}
-  Retainer (94) : **Molybdenum disulphide lubricant (LMW-G)**
-  **kgm** Mounting bolt of retainer (94) :
59 – 74 Nm {6.0 – 7.5 kgm}
-  **kgm** Mounting bolt of bottom pad and bracket assembly (93) :
98 – 123 Nm {10 – 12.5 kgm}

- 8) Install head pin (7) of No. 1 telescope cylinder.

 Pin portion : **Molybdenum disulphide lubricant (LM-P)**

- 9) Install pin lock plate (6).

 **kgm** Pin lock plate mounting bolt :
98 – 123 Nm {10 – 12.5 kgm}



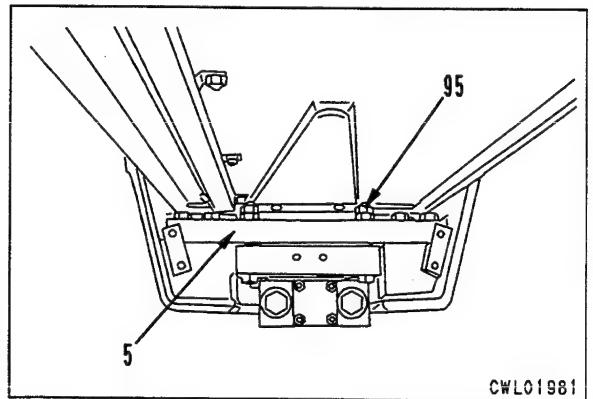
- 10) Install bracket (5) to No. 1 telescope cylinder head.

 **kgm** Bracket mounting bolt :
245 – 309 Nm {25 – 31.5 kgm}

- 11) Install No. 1 telescope cylinder mounting bolts and nuts (95)

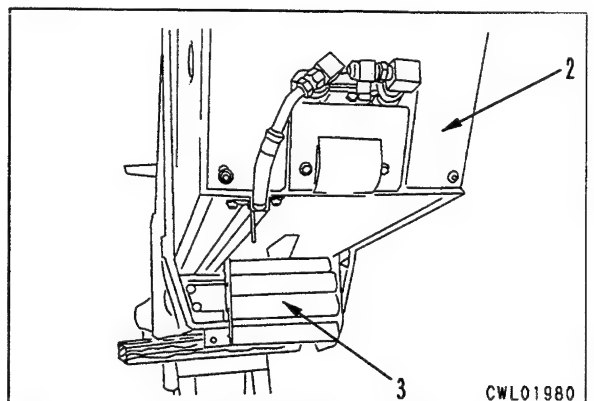
★ Tighten the nuts by hand to a point where the bolts contact, then tighten the locknut.

 **kgm** Mounting bolt :
Thread tightener (LT-2)




6. Base boom

- 1) Install roller assembly (3).
- 2) Install cover (2).




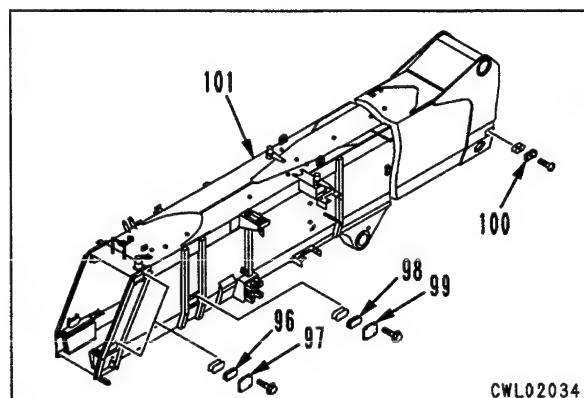
- 3) Install 4 left and right pads (96), 4 plates (97), 2 left and right pads (98), and 2 plates (99) to front of base boom assembly (101).

 Mounting bolt :
59 – 74 Nm {6.0 – 7.5 kgm}

- 4) Install 2 left and right pads (100) to rear of base boom.

 Mounting bolt :
Thread tightener (LT-2)

 Mounting bolt :
7.85 – 9.81 Nm {0.8 – 1.0 kgm}



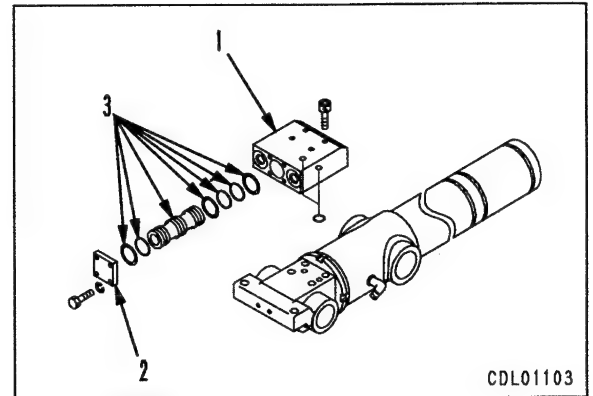
7. After installing boom assembly to machine, adjust top boom retraction rope, 4th boom retraction rope, top boom extension rope, and 4th boom extension rope.

For details, see TESTING AND ADJUSTING, Adjusting telescope wire rope.

DISASSEMBLY OF BOOM TELESCOPE CYLINDER ASSEMBLY

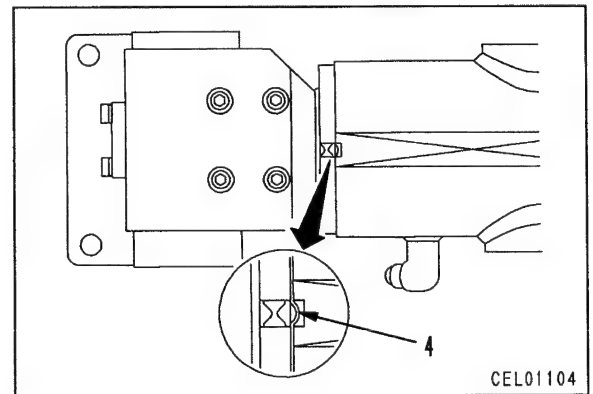
1. Counterbalance valve assembly

- 1) Remove valve body (1).
- 2) Remove plate (2) and valve assembly (3).

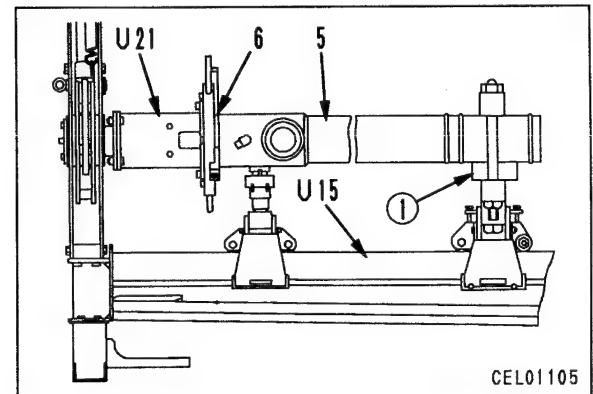


2. Piston rod assembly

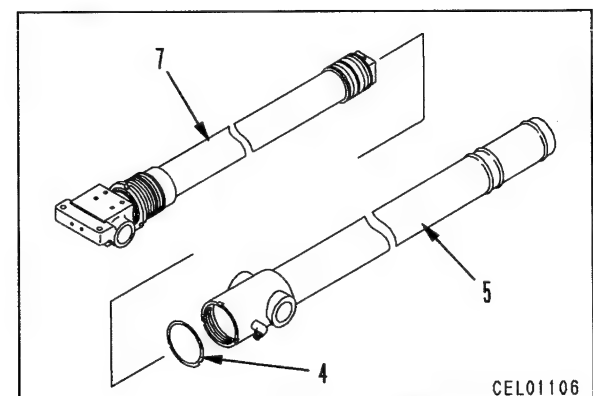
- 1) Raise lock washer (4) and make it flat.



- 2) Put cylinder assembly (5) on block ① and set to tool U15.
- 3) Using U21, loosen cylinder head assembly (6).



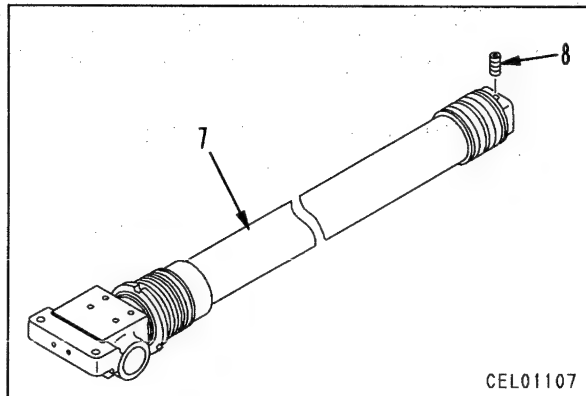
- 4) Remove piston rod assembly (7) and lock washer (4).
 - ★ Put an oil pan under the cylinder to catch the oil.



023S02

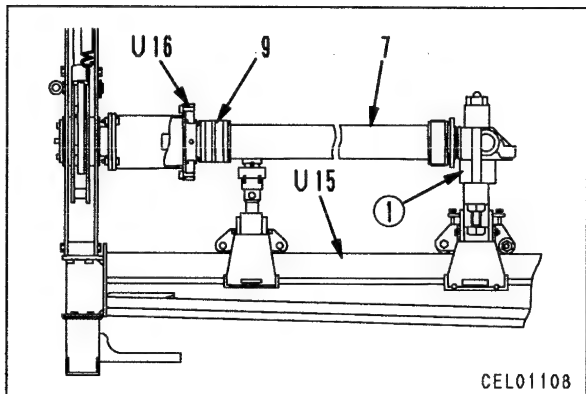
3. Piston assembly

- 1) Remove set screw (8).
 - ★ Grind off the caulking of the set screw with a hand drill.

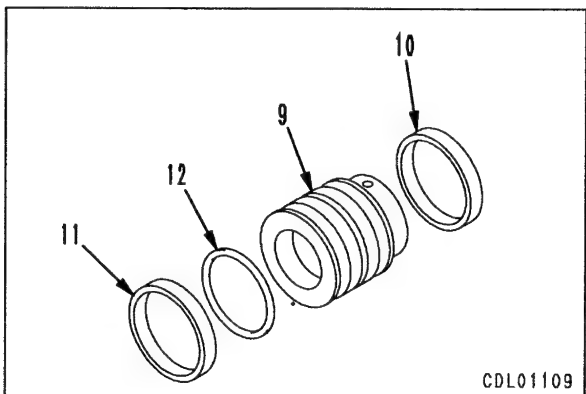


- 2) Put piston rod assembly (7) on block ① and set to tool **U15**.

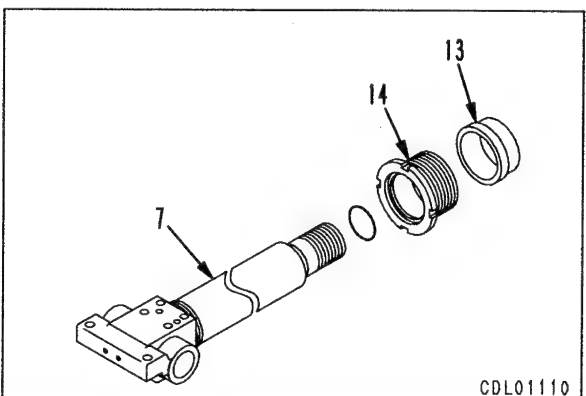
- 3) Using tool **U16**, remove piston assembly (9).



- 4) Disassemble piston assembly (9) as follows:
 - i) Remove wear rings (10) and (11).
 - ii) Remove piston ring (12).
 - ★ Put a screwdriver in contact with the piston ring, hit with a hammer to cut the ring, then remove the ring.

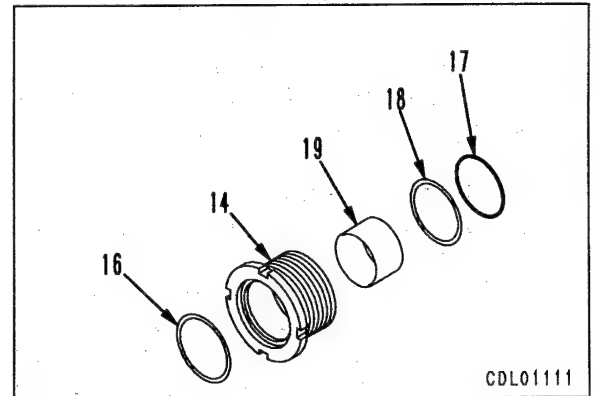
**4. Cylinder head assembly**

- 1) Remove spacer (13) and cylinder head assembly (14) from piston rod (7).



023S02

- 2) Disassemble cylinder head assembly (14).
- i) Remove dust seal (16).
 - ii) Remove packing (17) and back-up ring (18).
 - iii) Remove bushing (19).



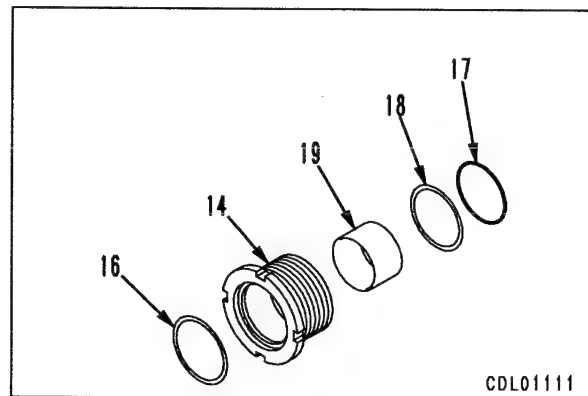
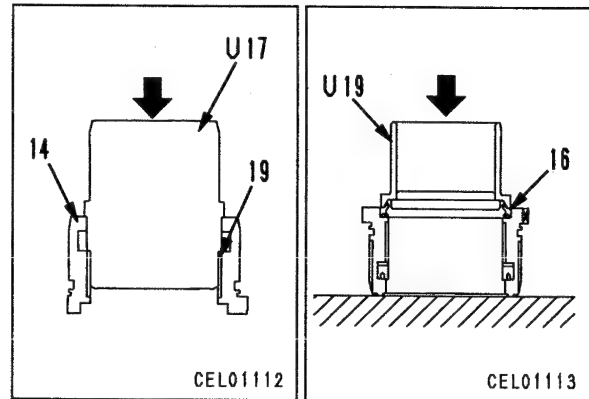
023S02

ASSEMBLY OF BOOM TELESCOPE CYLINDER ASSEMBLY

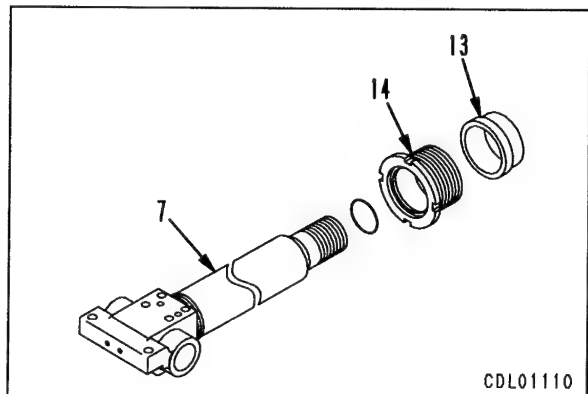
- ★ Coat the sliding surfaces of all parts with engine oil before installing. Be careful not to damage the packings, dust seals, and O-rings when installing.

1. Cylinder head assembly

- 1) Assemble cylinder head assembly (14) as follows.
 - i) Using tool **U17**, press fit bushing (19).
 - ★ After press fitting, check that there is no stepped portion on the bushing.
 - ii) Install packing (17) and back-up ring (18).
 - iii) Using tool **U19**, press fit dust seal (16).

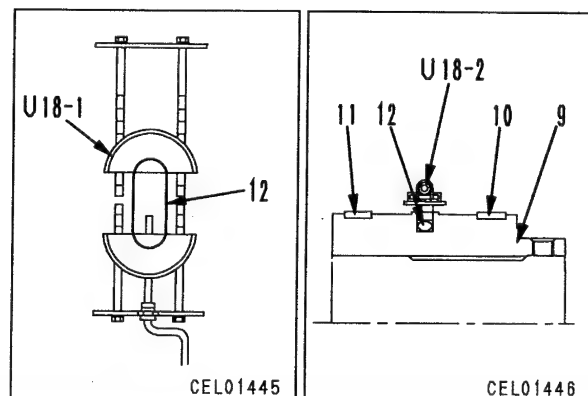


- iv) Install cylinder head assembly (14) and spacer (13) to piston rod (7).



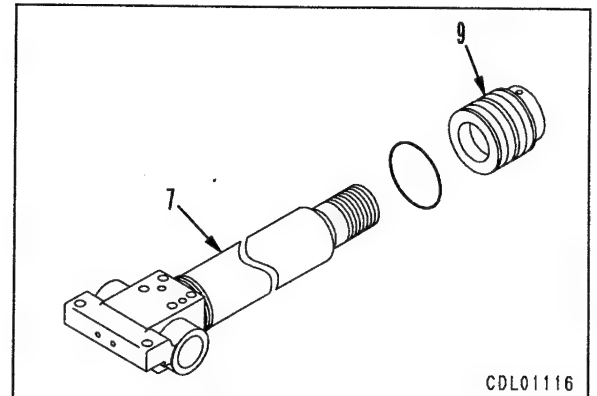
2. Piston assembly

- 1) Using tool **U18-1**, expand piston ring (12).
 - ★ Set the piston ring on the tool and turn the handle 8 – 10 times to expand the ring.
- 2) Remove piston ring (12) from tool, and install to piston (9).
- 3) Using tool **U18-2**, compress piston ring (12).
- 4) Install wear rings (11) and (10) to piston.



023S02

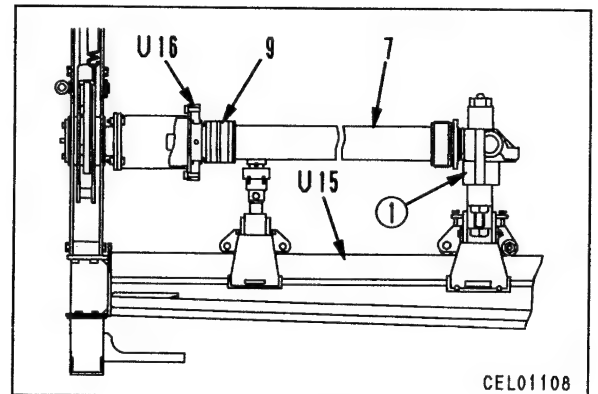
- 5) Fit O-ring and install piston assembly (9) to piston rod (7).




- 6) Put piston rod assembly (7) on block ① and set to tool U15.
- 7) Using tool U16, tighten cylinder piston assembly (9).

 Piston assembly :

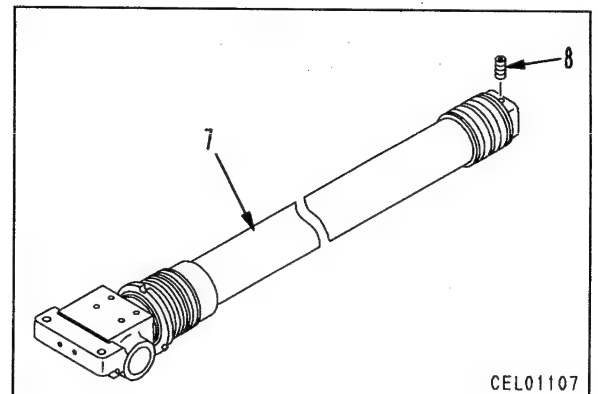
No.1 Cylinder : $1,960 \pm 245$ Nm { 200 ± 25 kgm}
No.2 Cylinder : $3,920 \pm 196$ Nm { 400 ± 20 kgm}



- 8) Install set screw (8).

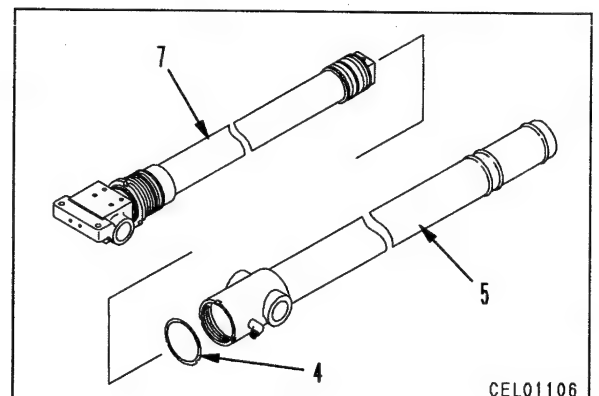
 Set screw : **56.84 Nm {5.8 kgm}**

★ After tightening, use a punch to caulk at 2 places on the outside circumference of the set screw.



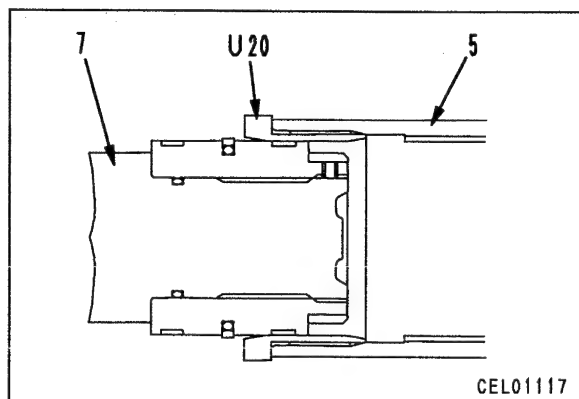
3. Piston rod assembly

- 1) Assemble lock washer (4) and piston rod assembly (7) to cylinder (5).




- 2) Using tool **U20**, assemble piston rod assembly (7) to cylinder (5).

★ Push in the piston rod fully.



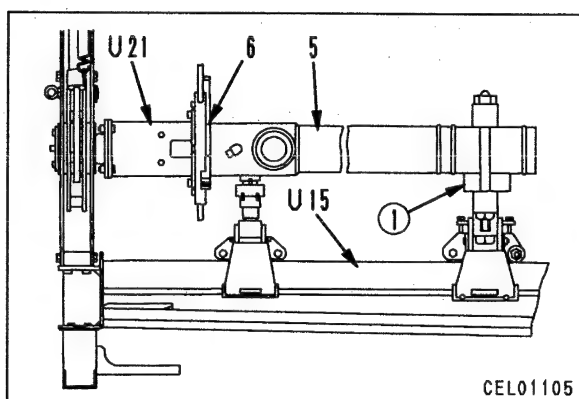
- 3) Put cylinder assembly (5) on block (1) and set to tool **U15**.

- 4) Using tool **U21**, tighten cylinder head assembly (6).

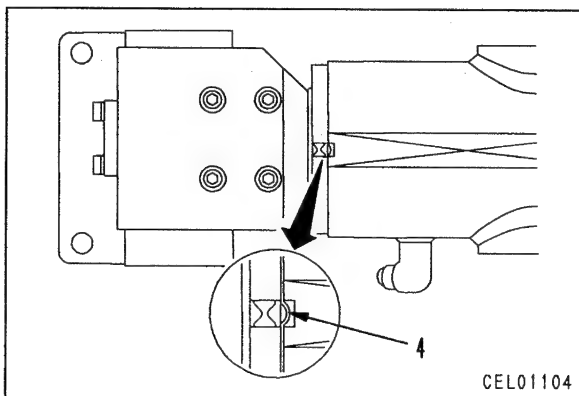
 Cylinder head assembly :

No.1 Cylinder : $1,636 \pm 372.4 \text{ Nm}$ $\{167 \pm 3\text{kgm}\}$

No.2 Cylinder : $2,458 \pm 539 \text{ Nm}$ $\{260 \pm 55 \text{kgm}\}$




- ★ After tightening, bend lock washers (4) at 2 places (at the cylinder head and cylinder bottom).




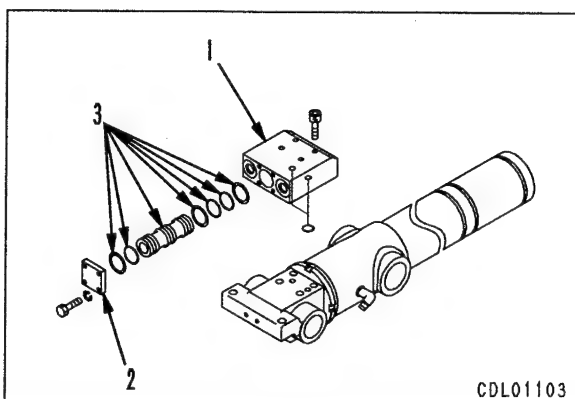
4. Counterbalance valve assembly

- 1) Install valve assembly (3) and plate (2).

 Mounting bolt : **31.36 Nm $\{3.2 \text{kgm}\}$**

- 2) Install valve body (1).

 Mounting bolt : **56.84 Nm $\{5.8 \text{kgm}\}$**

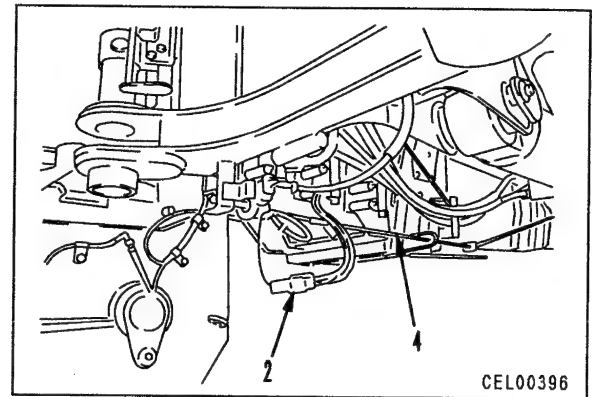
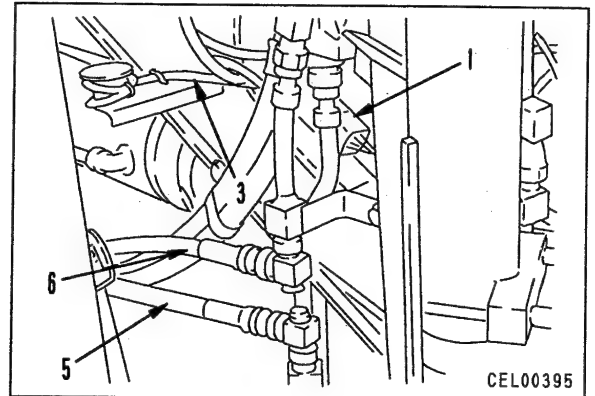


023S02

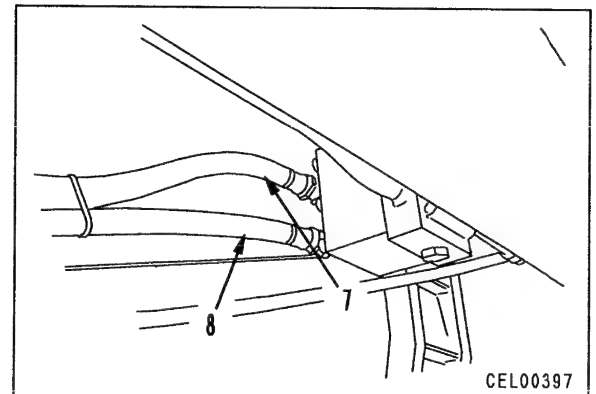
REMOVAL OF JIB ASSEMBLY

- ⚠ Extend the outriggers and set securely in contact with the ground.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

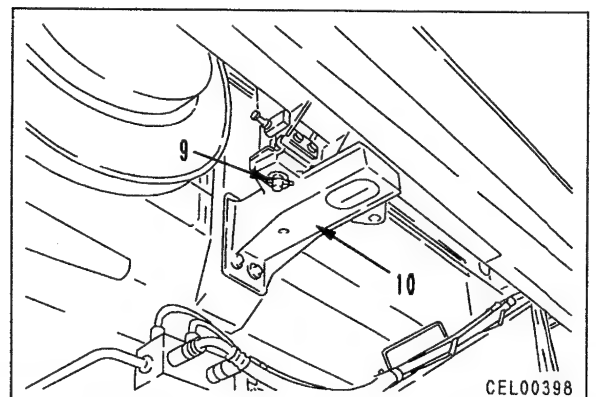
1. Disconnect wiring connectors (BJ1) (1) and (BJ2) (2).
2. Remove output cables (3) and (4) from hook and secure to boom.
3. Disconnect hoses (5) and (6).



4. Disconnect hoses (7) and (8).
- ⚠ After disconnecting the hoses, install plugs at the jib power tilt cylinder end and prevent the cylinder from moving down.



5. Pull out jib stow pin (9), then remove rear jib mount (10).



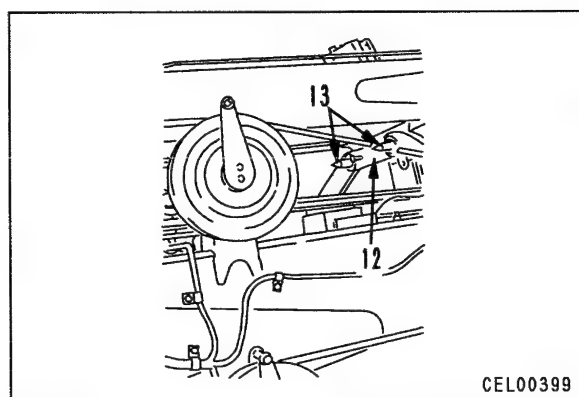
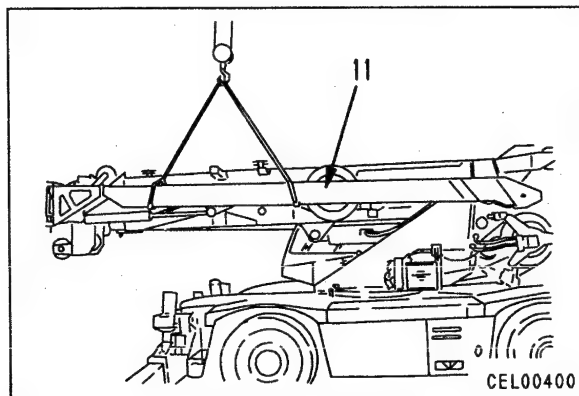
023S02

6. Lift off jib assembly (11).

- ★ Move the jib assembly to the front, and lift up when pin (13) comes out from front jib mount (12).



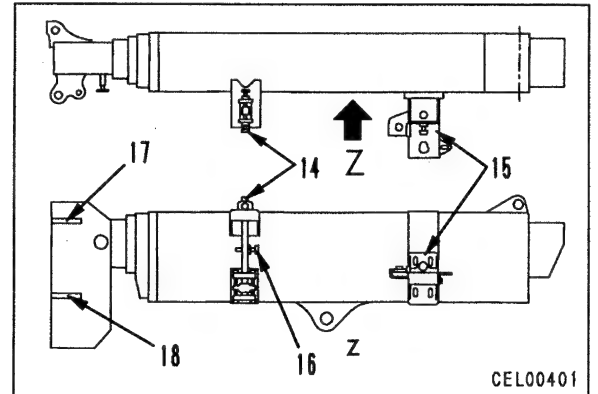
Jib assembly : 800 kg



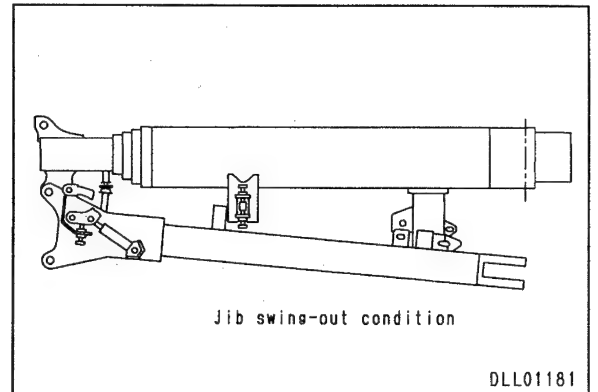
023S02

INSTALLATION OF JIB ASSEMBLY

- Before installing jib assembly to jib mounts (14) and (15), pay attention to the following.
 - Check that jib power tilt cylinder is fully extended.
 - Check that left and right jib lock cylinders are fully retracted.
 - Check that jib rotation cylinder is fully retracted.
 - Check that boom is fully retracted and boom angle is at 0°.
 - Remove proximity switch of mount (14) and left jib block cylinder from plate.
 - Loosen bolt (16) for adjusting fore-and-aft position of mount (14).



- Raise jib assembly and set in mounting position.
- Fit mount (15) temporarily.
 - ★ Align the mounting bolts of mount (15) with the center of the oblong hole, then install temporarily.
- Install wiring and piping in opposite order from removal.



- After installing, swing out jib assembly and carry out following checks and adjustments.

- Check that it enters top booms (17) and (18) smoothly.

- ★ If it does not enter smoothly, sling the jib assembly and adjust with bolt (19) for adjusting the vertical position of mount (14).
- ★ Be careful not to tighten the bolts too far.

 Vertical adjustment bolt :
 $156.8 \pm 19.6 \text{ Nm } \{16 \pm 2 \text{ kgm}\}$

- Check that top boom holes (17) and (18) are aligned with jib bracket holes.


- ★ If they are not aligned in the left and right direction, adjust with bolt (20) for adjusting left and right position of mount (14).

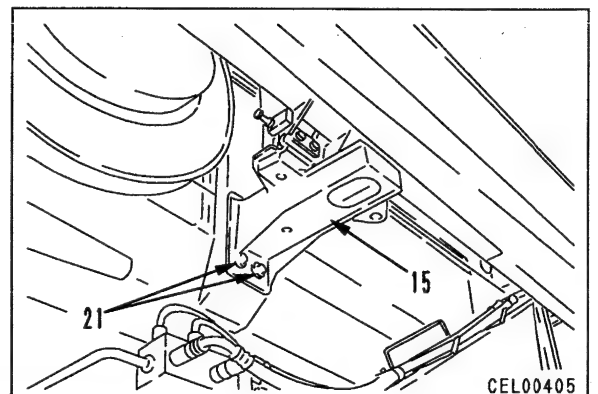
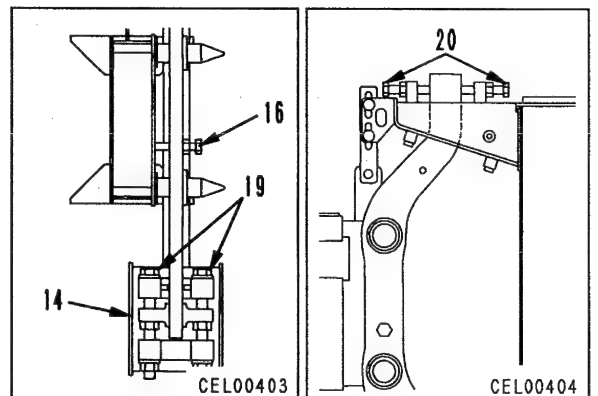
 Left and right adjustment bolt :
 $276.85 \pm 31.85 \text{ Nm } \{28.25 \pm 3.25 \text{ kgm}\}$

- ★ If they are not aligned in the vertical direction, loosen 4 mounting bolts (21) of mount (15) and carry out vertical adjustment.


 Vertical adjustment bolt :
 $276.85 \pm 31.85 \text{ Nm } \{28.25 \pm 3.25 \text{ kgm}\}$

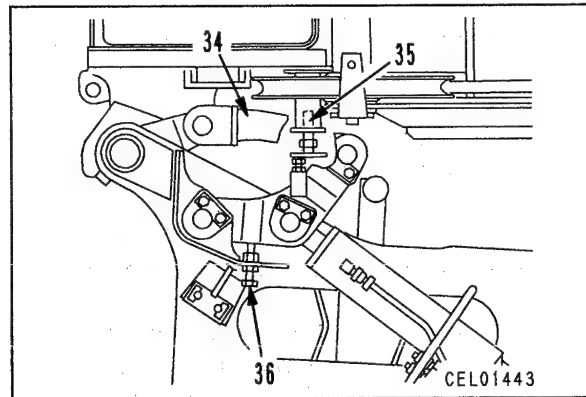
- ★ If they are not adjusted in the fore-and-aft direction, adjust with bolt (16) for adjusting fore-and-aft position of mount (14).

 Fore-and-aft adjustment bolt :
 $276.85 \pm 31.85 \text{ Nm } \{28.25 \pm 3.25 \text{ kgm}\}$



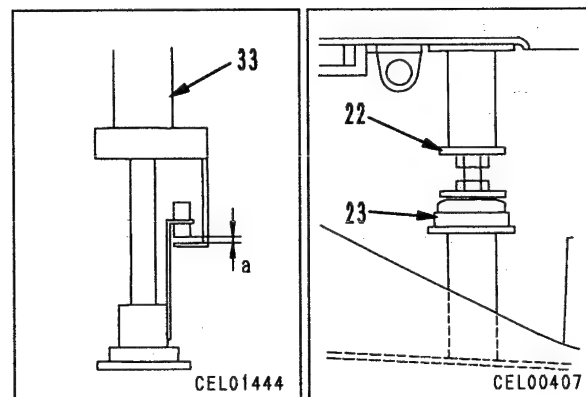
- 3) Check that rotation link (34) enters smoothly.
 ★ If it does not enter smoothly, carry out adjustment with adjustment bolts (35) and (36).

 Adjustment bolt :
107.8 Nm {11 kgm}

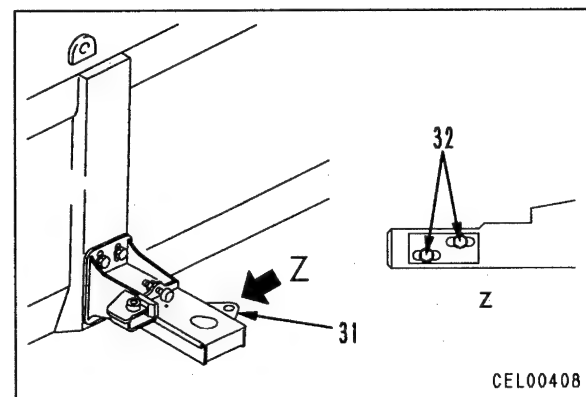


- 4) Adjust stopper for swing-out position.
 i) Insert lock pin cylinder in top booms (17) and (18) at swing-out position.
 ii) Adjust so that clearance a of left jib lock cylinder proximity switch is 2 mm.
 iii) Tighten nut in position where stopper (22) is in contact with jib pad (23).

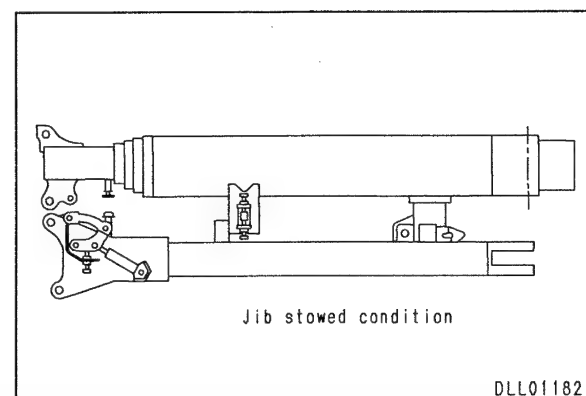
 Nut : **276.85 ± 31.85 Nm**
 $\{28.25 \pm 3.25$ kgm}




- 5) Without inserting lock pin cylinder in top booms (17) and (18) at swing-out position, determine position of mount and check that stowing pin enters bracket (31) (return of jib is stopped).
 ★ If the stowing pin does not go in smoothly, adjust with left and right adjustment bolts (32) so that the clearance is 2 mm.

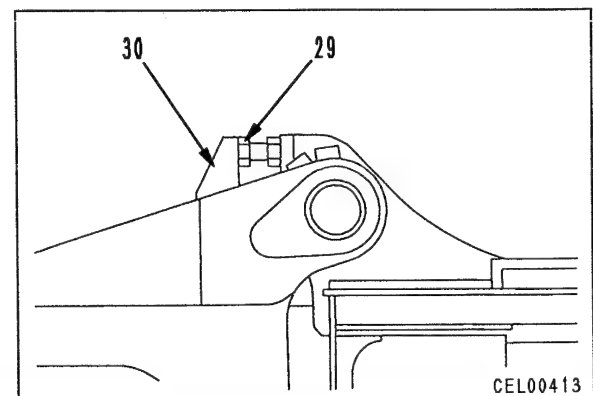
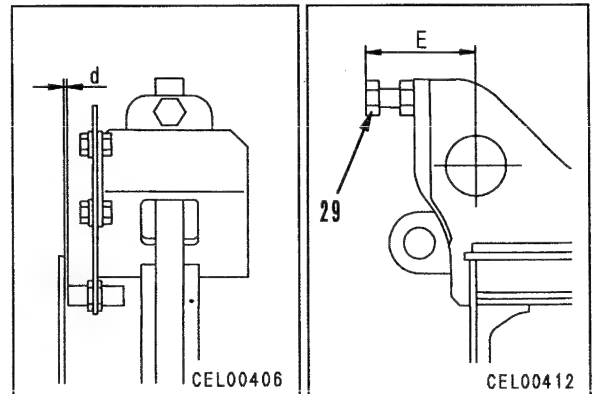
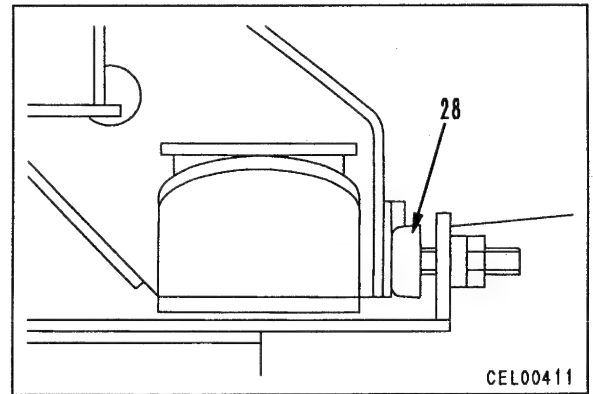
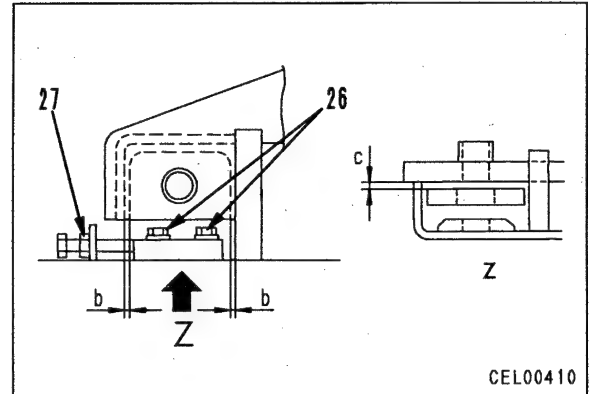


- 6) Stow jib assembly and carry out following checks and adjustments.



023S02

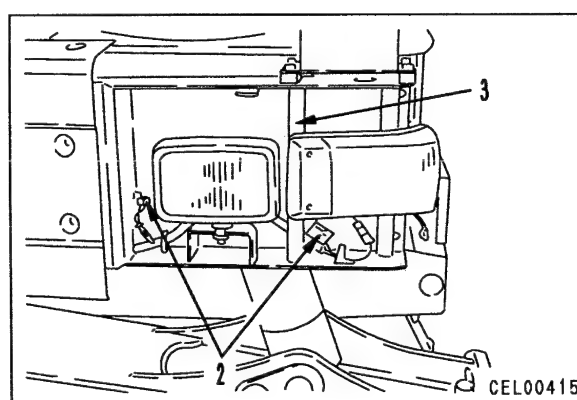
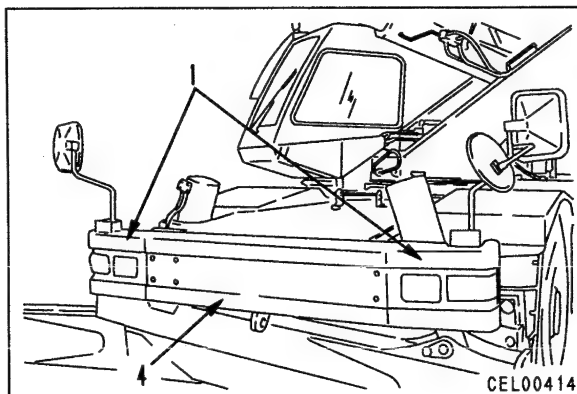
- 1) Check that clearances between jib assembly stow plate (25) and mount (15) are correct.
 - ★ Clearance **b**: 1.5 mm
 - Clearance **c**: 1 mm
 - ★ When adjusting, loosen stow plate mounting bolts (26), move the stow plate, tighten the mounting bolts, then tighten lock bolt (27).
-  **Mounting bolt and lock bolt :**
 $176.4 \pm 19.6 \text{ Nm } \{18 \pm 2 \text{ kgm}\}$
- 2) With stowing pin inserted, adjust so that rubber stopper (28) is in contact.
 - 3) Check again that clearance **d** of proximity switch of mount (14) is 2 mm.
7. Check Steps 5-1), 5-2), and 5-5) again.
 8. Swing out jib assembly and check following.
 - 1) Insert lock pin cylinder into top booms (17) and (18).
 - 2) Set boom angle to 10° and extend boom approx. 1 mm.
 - 3) Retract boom again and check that jib mount enters mounts (14) and (15) smoothly.
 - ★ If it does not enter smoothly, adjust stopper (22) and mount (15), then check again.
 9. Swing out jib to front and adjust as follows.
 - 1) Adjust dimension **E** of stopper bolt (29) to 90 mm at lock pin cylinder top and bottom holes at right side of top boom.
 - 2) Rotate jib to front, then raise it and lower boom:
 - 3) Adjust length of stopper bolt again so that it contacts jib stopper plate (30).
- **Refilling with oil (hydraulic tank)**
 Run the engine to circulate the oil through the system. Then add oil to the specified level.



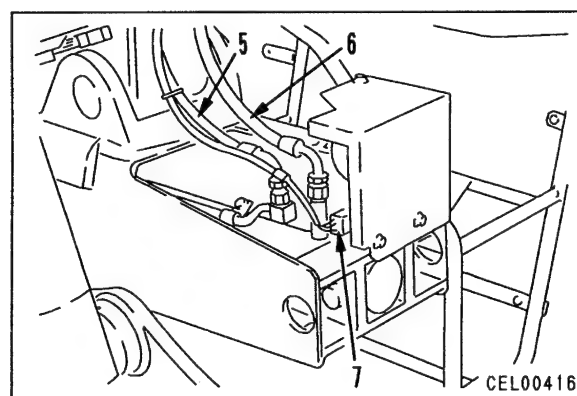
REMOVAL OF OUTRIGGER ASSEMBLY (X-SHAPED)

- ⚠ Set the parking brake switch to PARKING, and set the outriggers lightly in contact with the ground.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove head lamp covers (1).
2. Remove wiring connectors (2) (2 places).
★ Wiring connector Right side: (L46, L48)
Left side : (L49, L51)
3. Remove left and right head lamp and turn signal assemblies (3). (Only when removing front outrigger assembly)
4. Remove front bumper (4). (Only when removing front outrigger assembly)

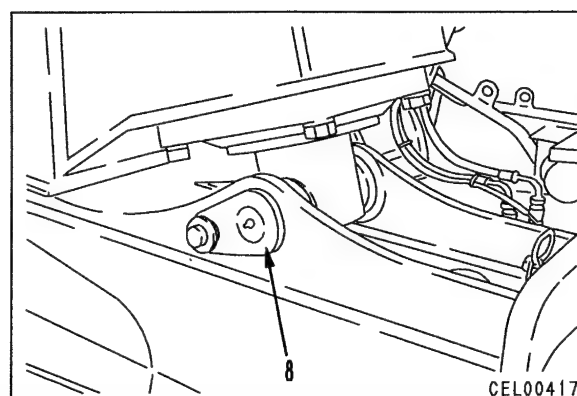


5. Remove hoses (5) and (6), and wiring connector (7) from outrigger to be removed.
★ Wiring connector Front right : (L42)
Front left : (L39)
Rear right : (L33)
Rear left : (L36)



6. Remove pin (8) from outrigger jack cylinder end.

※ 1



023S02

7. Sling outrigger assembly (9) and remove pin (10).

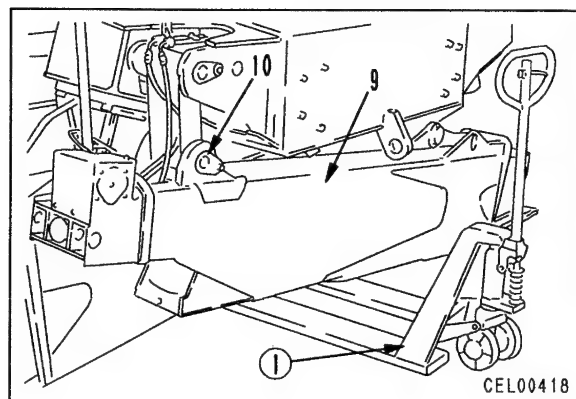
※ 2

8. Lower outrigger assembly on pallet fork ①, then remove from chassis.



Outrigger assembly : **650 kg**

INSTALLATION OF OUTRIGGER ASSEMBLY (X-SHAPED)



- Carry out installation in the reverse order to removal.

※ 1 ※ 2



When aligning the position of the pin hole, never insert your fingers in the pin hole.



Pin portion :

Molybdenum disulphide lubricant (LM-G)

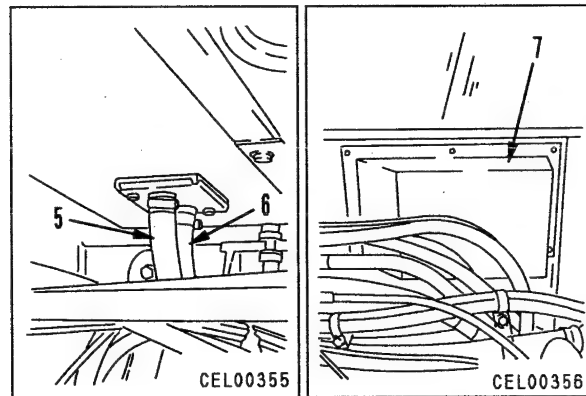
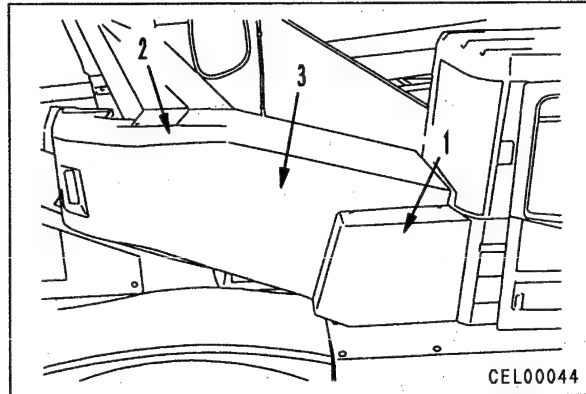
- Bleeding air**
Bleed the air from the outrigger slide cylinder.
For details, see TESTING AND ADJUSTING, Bleeding air.
- Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.

023S02

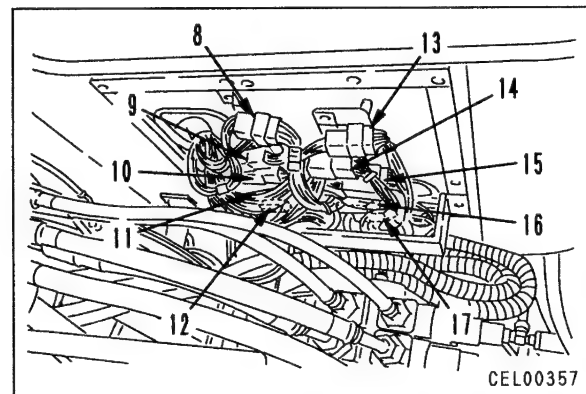
REMOVAL OF OPERATOR'S CAB ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

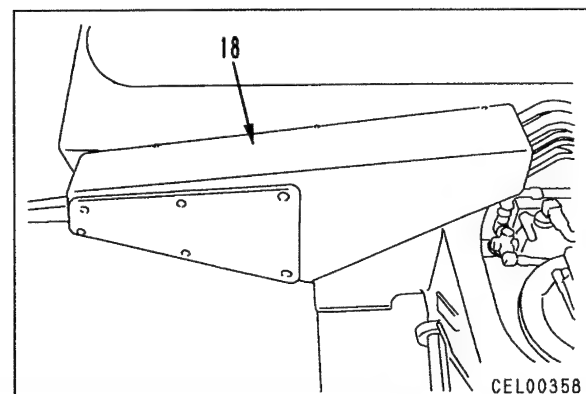
1. Drain coolant.
2. Remove covers (1), (2), and (3) at right side of revolving frame.
 - ★ Disconnect wiring connector (R06) from inside cover.
3. Disconnect heater hoses (5) and (6).
 - ★ Before removing the hoses, fit tags to prevent mistakes in the position of installation.
4. Remove cover (7) from rear side of operator's cab.



5. Disconnect wiring connectors (CR11) (8), (CR10) (9), (CR9) (10), (CR3) (11), (CR5) (12), (CR7) (13), (CR6) (14), (CR4) (15), (CR1) (16), and (CR2) (17).

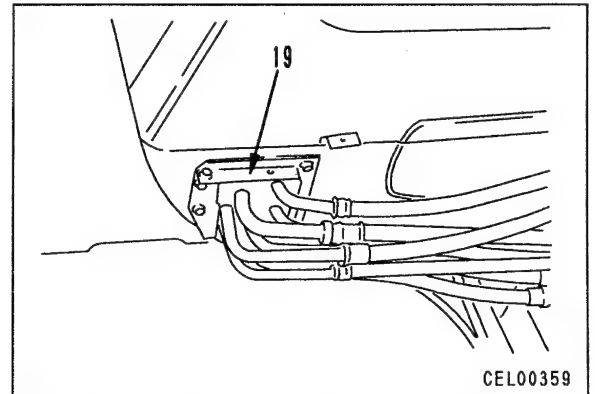


6. Remove cover (18) at left side of operator's cab.

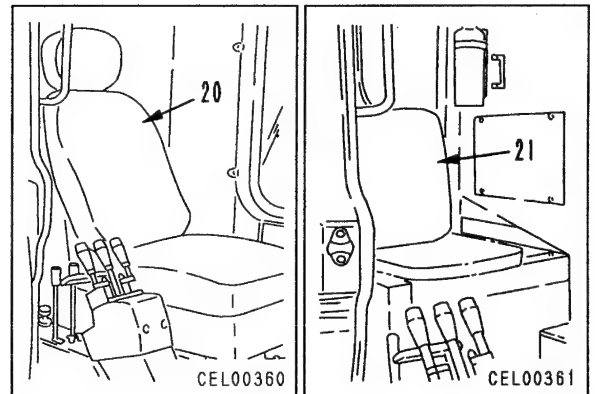


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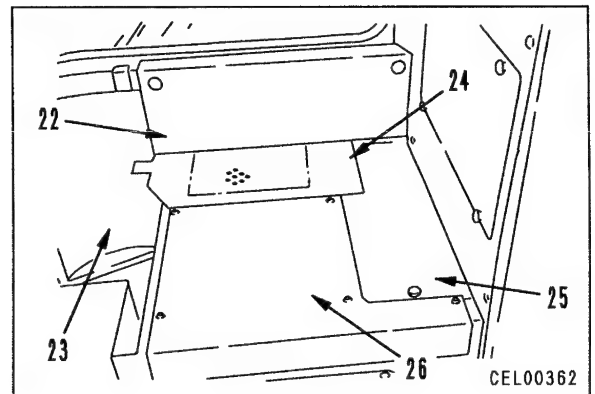
7. Remove mounting bolts of hose bracket (19).
★ Disconnect the hose bracket from the operator's cab.



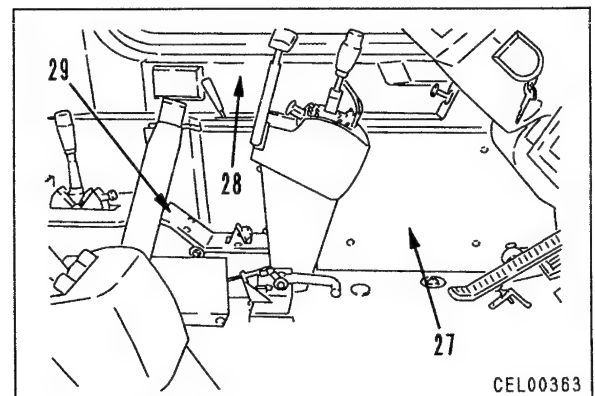
8. Remove operator's seat (20) and rear seat (21).



9. Remove covers (22), (23), (24), (25), and (26) from rear inside compartment.

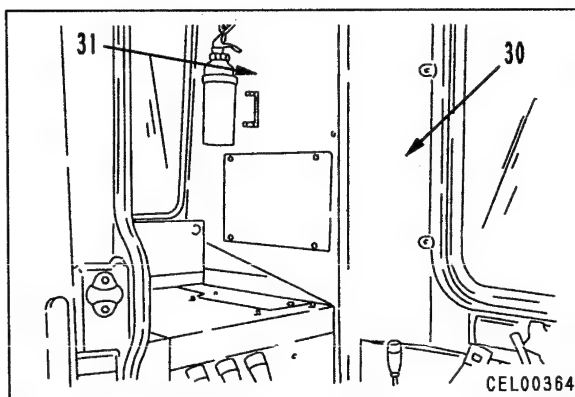


10. Remove covers (27), (28), and (29) from front left inside compartment.

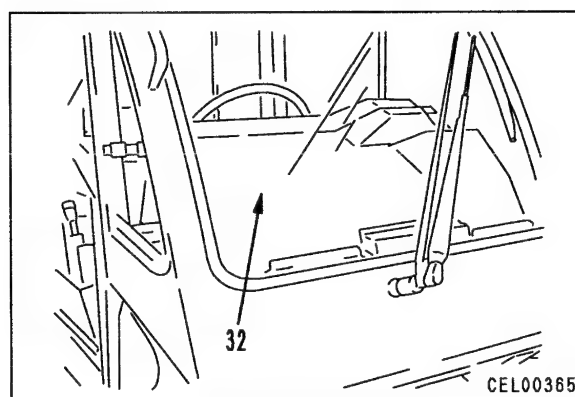


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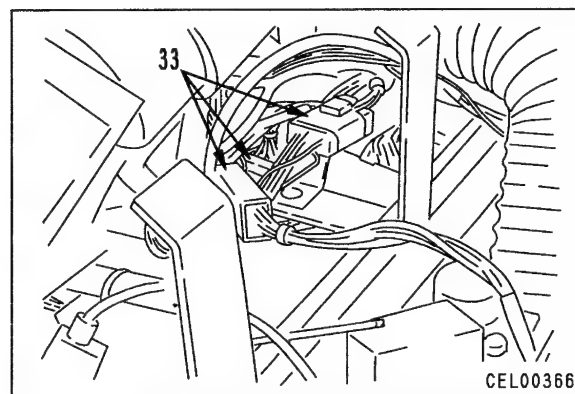
11. Remove covers (30) and (31) from rear left inside compartment.



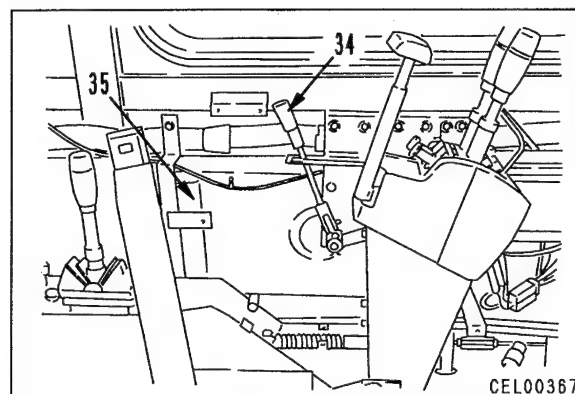
12. Remove dashboard top cover (32).



13. Disconnect wiring connectors (C81), (C82), and (C83) (33) from inside dashboard.



14. Remove swing lock lever (34) and air duct (35).

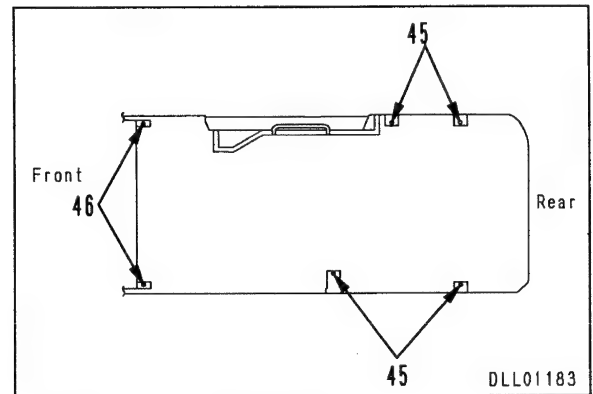
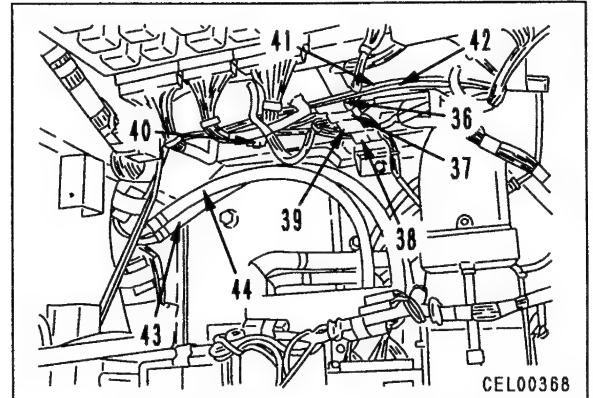


023S02

15. Disconnect wiring connectors (C75) (36), (C74) (37), (C73) (38), (C116) (39), and (C18) (40).
16. Disconnect ground connection (C115).
17. Disconnect washer hoses (41) and (42).
 - ★ Before removing the hoses, fit tags to prevent mistakes in the position of installation.
18. Disconnect heater hoses (43) and (44).
 - ★ Before removing the hoses, fit tags to prevent mistakes in the position of installation.
19. Remove operator's cab mounting bolts (45) and (46).
20. Lift off operator's cab assembly (47).



Operator's cab assembly : 300 kg

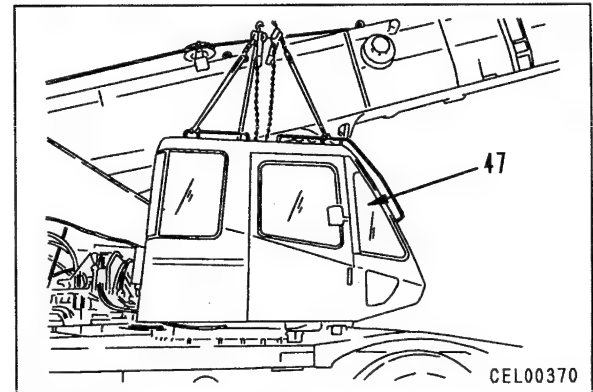


INSTALLATION OF OPERATOR'S CAB ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

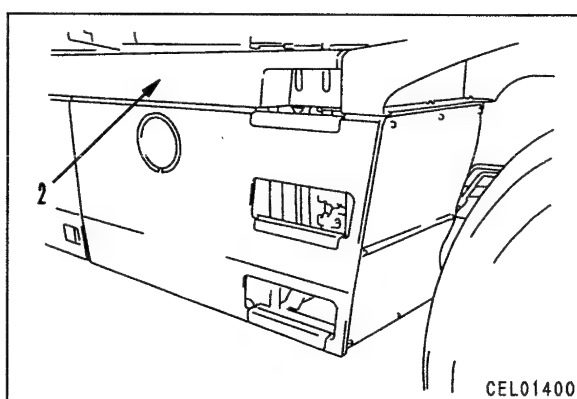
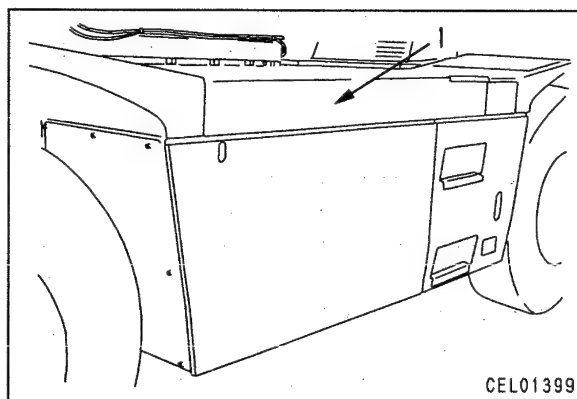
- ★ When installing mounting bolt (46), adjust the clearance between the operator's cab assembly and the floor frame with shims.
- **Refilling with water**
Add water through water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.



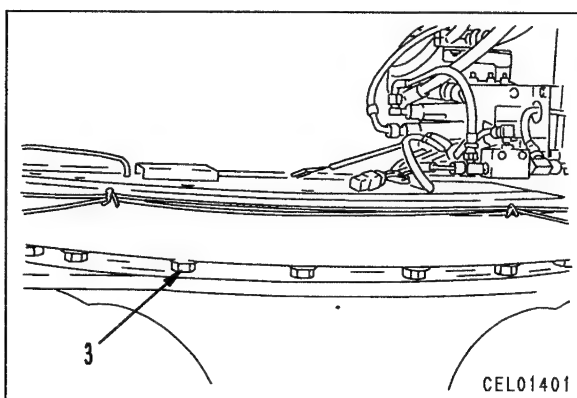
REMOVAL OF REVOLVING FRAME ASSEMBLY

- ⚠ Extend the outriggers and raise the machine.
- ⚠ Open the drain valve of the air tank and drain the air.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

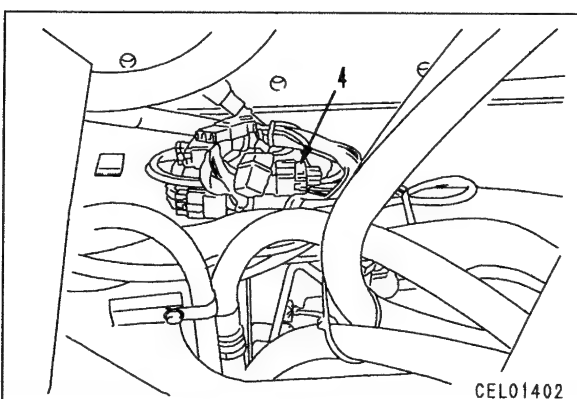
1. Remove boom assembly. For details, see REMOVAL OF BOOM ASSEMBLY.
2. Remove hydraulic tank top cover (1).
3. Remove fuel tank top cover (2).



4. Run engine and rotate revolving frame assembly slowly to remove mounting bolts (3). Leave 4 mounting bolts on left and right and remove all other mounting bolts. ※ 1
5. Drain coolant.
6. Drain oil from hydraulic tank.
 - ⚠ Hydraulic tank: 420 ℓ

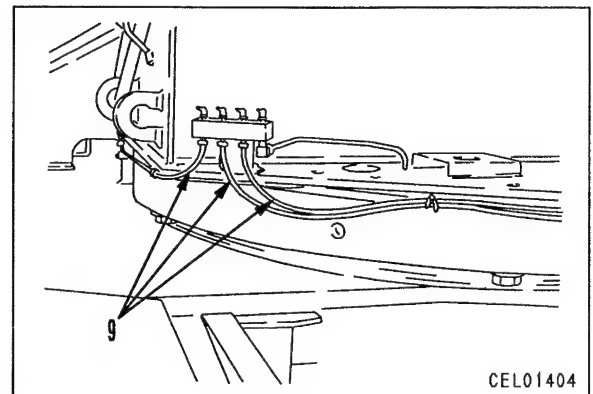
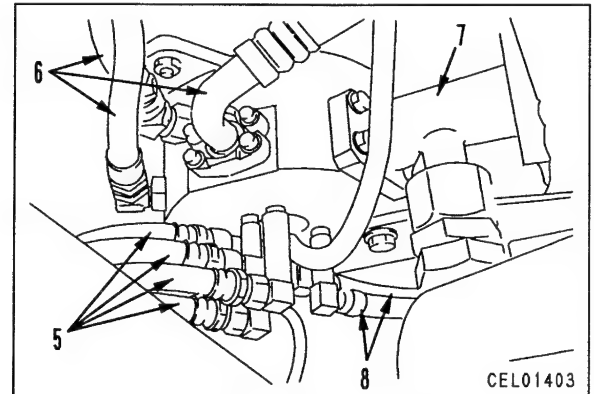


7. Disconnect following wiring and piping from chassis.
 - 1) Disconnect wiring connector (L04) (4).



023S02

- 2) Disconnect 4 air hoses (5).
 - ★ Before removing the hoses, fit tags to prevent mistakes in the position of installation.
- 3) Disconnect 10 oil hoses (6).
 - ★ Before removing the hoses, fit tags to prevent mistakes in the position of installation.
- 4) Disconnect oil tube (7).
- 5) Disconnect 2 heater hoses (8).
 - ★ Before removing the hoses, fit tags to prevent mistakes in the position of installation.
8. Disconnect grease hose (9) of swing circle.



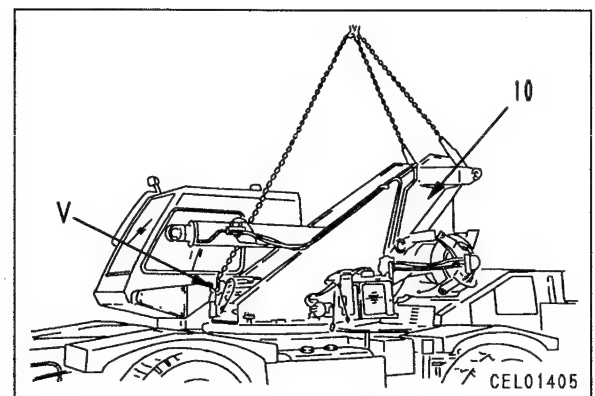
9. Fit tool V and sling revolving frame assembly (10), then remove 8 left and right mounting bolts and lift off slowly.

※ 2

- ★ Use a lever block to adjust the balance of the revolving frame to the front, rear, left, and right, and remove all the mounting bolts.
- ★ When removing the revolving frame assembly, be extremely careful not to damage the piping of the center swivel joint assembly.



Revolving frame assembly : 5,900 kg



023S02

INSTALLATION OF REVOLVING FRAME ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1 ※ 2



Mating surface of swing circle :

Thread tightener (Loctite 648)



Revolving frame mounting bolt :

926.1 ± 102.9 Nm {94.5 ± 10.5 kgm}

- **Refilling with oil (hydraulic tank)**
Add oil through oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- **Refilling with water**
Add water through water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

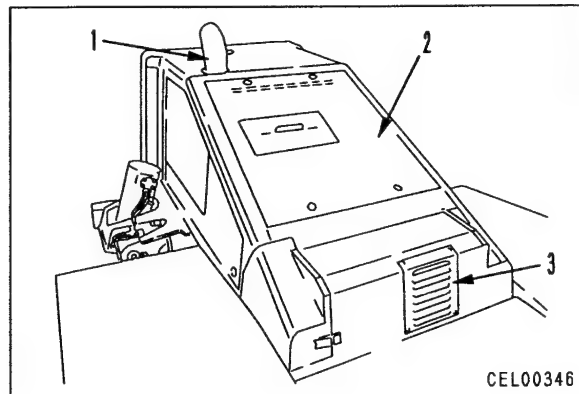
REMOVAL OF HOOD ASSEMBLY

⚠ Extend the outriggers, then raise the machine and swing the revolving frame 90°.

1. Remove exhaust tube (1).
2. Remove covers (2) and (3).
3. Lift off hood assembly (4).

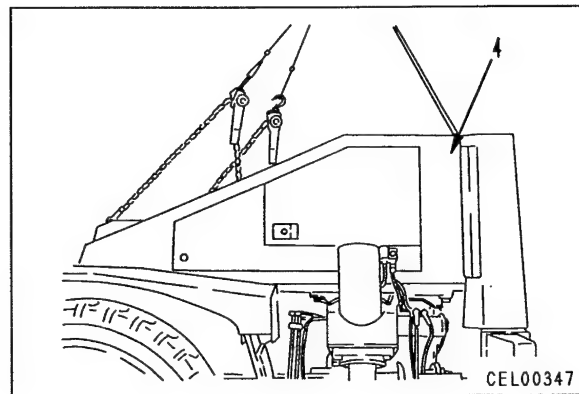


Hood assembly : **120 kg**



INSTALLATION OF HOOD ASSEMBLY

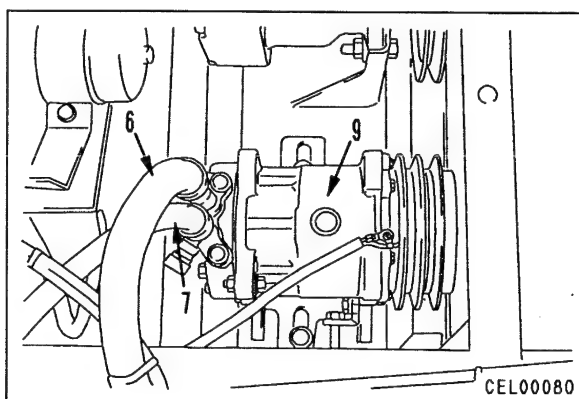
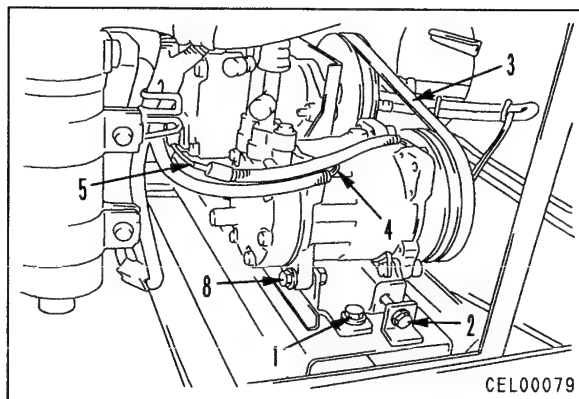
- Carry out installation in the reverse order to removal.



REMOVAL OF AIR CONDITIONER COMPRESSOR ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Open air conditioner compressor top cover.
2. Loosen air conditioner compressor mounting bolt (1), then loosen adjustment bolt (2), and remove air conditioner compressor belt (3). ※ 1
3. Disconnect wiring connectors (4) and (5).
4. Disconnect air conditioner hoses (6) and (7). ※ 2
5. Remove 4 mounting bolts (8), then remove air conditioner compressor (9). ※ 3



INSTALLATION OF AIR CONDITIONER COMPRESSOR ASSEMBLY

- Carry out installation in the reverse order to removal.


※ 1

- ★ Adjust the air conditioner compressor belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.


※ 2

- ★ Install the hoses without twisting or interference.
- ★ When installing the air conditioner circuit hoses, be careful not to let any dirt, dust, or water get inside the hoses.
- ★ Check that there is an O-ring at the joint of the air conditioner hose piping when installing.

 O-ring : Compressor oil (ST-20)

 Air conditioner hose mounting bolt :
22.05 ± 2.45 Nm {2.25 ± 0.25 kgm}

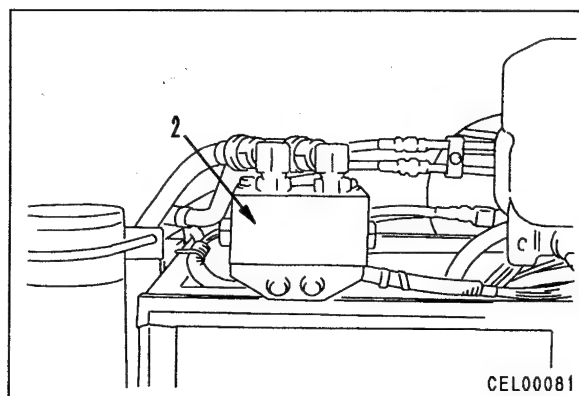
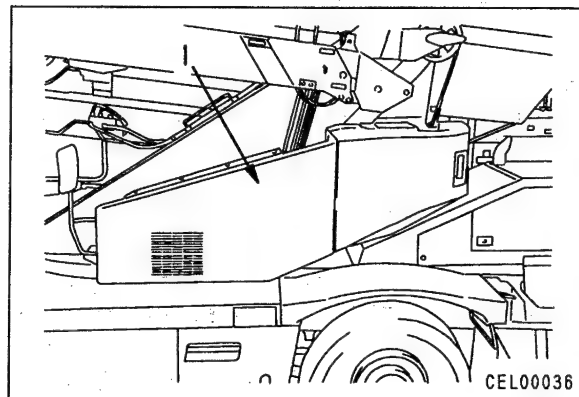
※ 3

 Air conditioner compressor mounting bolt :
41.25 ± 2.45 Nm {4.25 ± 0.25 kgm}

- **Charging with air conditioner gas**
Using tool X2, charge the air conditioner circuit with air conditioner gas (R134a).

REMOVAL OF AIR CONDITIONER CONDENSER ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.
- 1. Remove side cover (1) at left side of revolving frame.
- 2. Open air conditioner compressor top cover.
- 3. Remove 2 air conditioner valve mounting bolts (2) and move air conditioner valve.
- 4. Disconnect wiring connector (R16) (3).
- 5. Disconnect air conditioner hose (4) and air conditioner tube (5). ※ 1
- 6. Remove 2 receiver tank mounting nuts (6).
- 7. Turn back sponge, remove 4 mounting bolts (8), then remove air conditioner condenser assembly (9).



INSTALLATION OF AIR CONDITIONER CONDENSER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

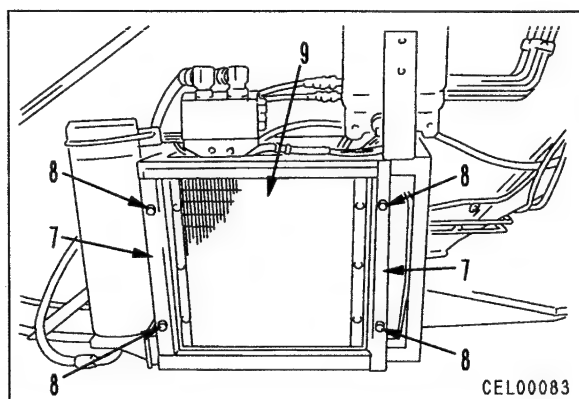
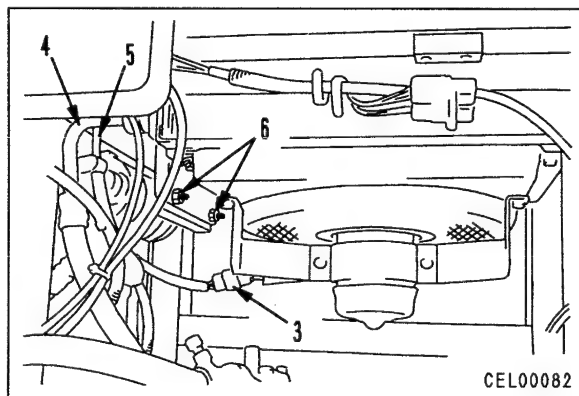
- ★ Install the hoses without twisting or interference.
- ★ When installing the air conditioner circuit hoses, be careful not to let any dirt, dust, or water get inside the hoses.

O-ring : **Compressor oil (ST-20)**

Hose sleeve nut :
 $13.23 \pm 1.47 \text{ Nm}$ { $1.35 \pm 0.15 \text{ kgm}$ }

Tube mounting bolt :
 $9.8 \pm 1.96 \text{ Nm}$ { $1 \pm 0.2 \text{ kgm}$ }

- **Charging with air conditioner gas**
Using tool X2, charge the air conditioner circuit with air conditioner gas (R134a).

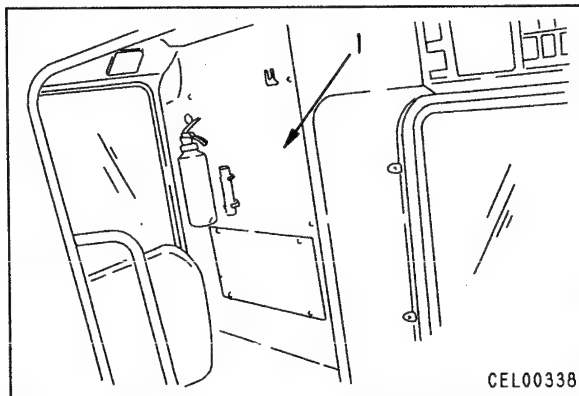


023S02

REMOVAL OF UPPER MDT CONTROLLER ASSEMBLY

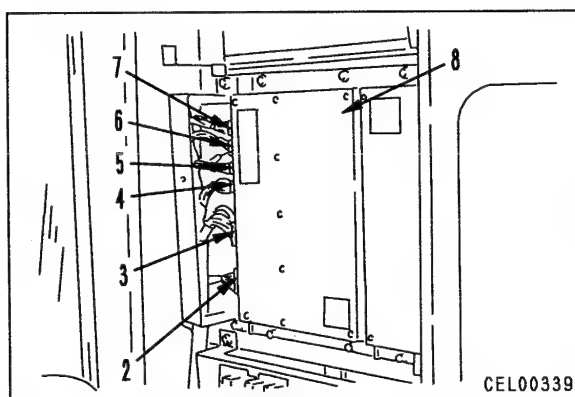
- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove cover (1) inside compartment.
2. Remove wiring connectors (C01) (2), (C02) (3), (C03) (4), (C04) (5), (C05) (6), and (C06) (7).
3. Remove upper MDT controller assembly (8).



INSTALLATION OF UPPER MDT CONTROLLER ASSEMBLY

- Carry out installation in the reverse order to removal.

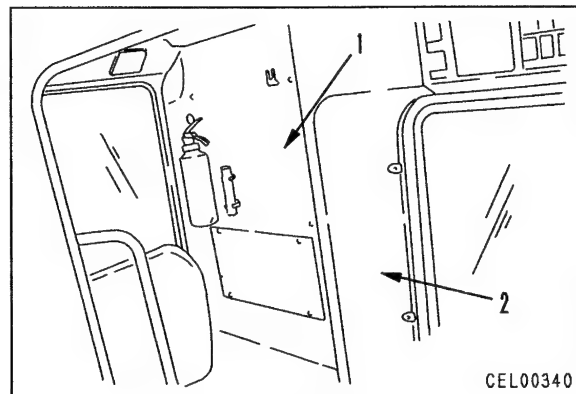


023S02

REMOVAL OF MOMENT LIMITER CONTROLLER ASSEMBLY

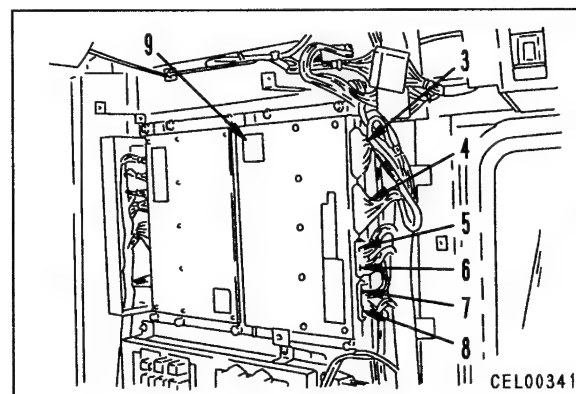
- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Remove covers (1) and (2) inside compartment.
2. Remove wiring connectors (C11) (3), (C12) (4), (C13) (5), (C14) (6), (C15) (7), and (C16) (8).
3. Remove moment limiter controller assembly (9).



INSTALLATION OF MOMENT LIMITER CONTROLLER ASSEMBLY

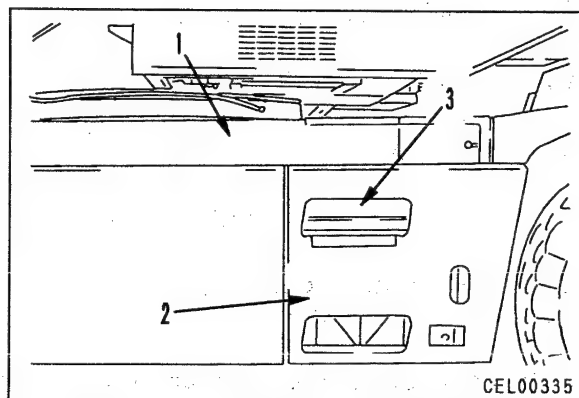
- Carry out installation in the reverse order to removal.



REMOVAL OF LOWER MDT CONTROLLER ASSEMBLY

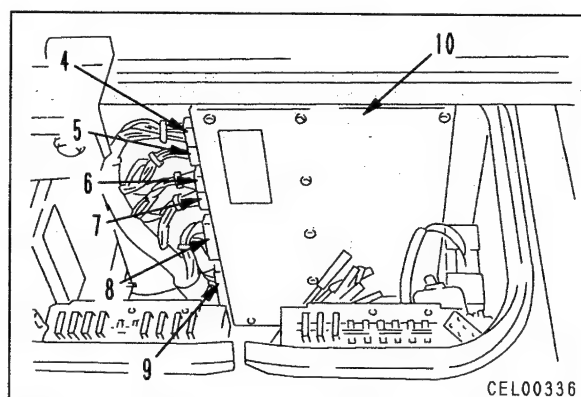
- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove hydraulic tank top cover (1), then open cover (2) and remove cover (3).
2. Remove wiring connectors (M01) (4), (M02) (5), (M03) (6), (M04) (7), (M05) (8), and (M06) (9).
3. Remove lower MDT controller assembly (10).





INSTALLATION OF LOWER MDT CONTROLLER ASSEMBLY

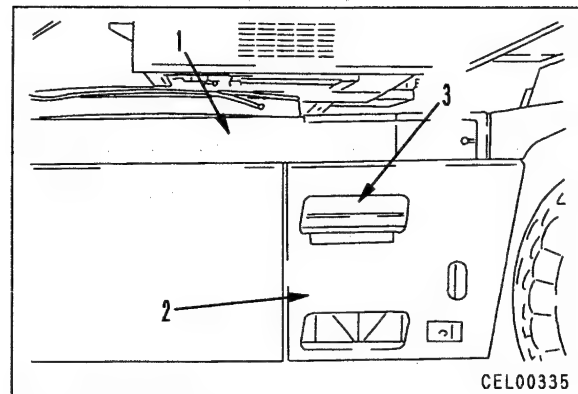
- Carry out installation in the reverse order to removal.



023S02

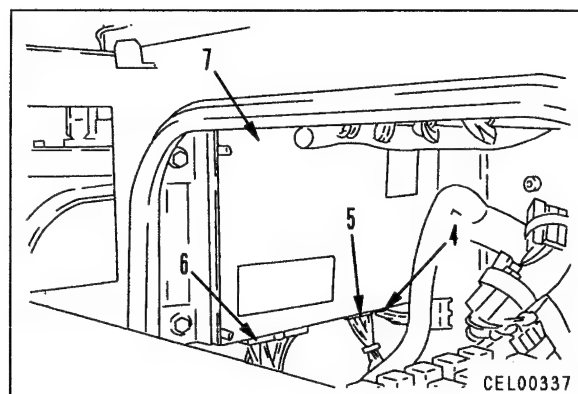
REMOVAL OF TRANSMISSION CONTROLLER ASSEMBLY

-  Set the parking brake switch to PARKING.
 -  Disconnect the cable from the negative (-) terminal of the battery.
1. Remove hydraulic tank top cover (1), then open cover (2) and remove cover (3).
 2. Remove wiring connectors (M13) (4), (M14) (5), and (M15) (6).
 3. Remove transmission controller assembly (7).



INSTALLATION OF TRANSMISSION CONTROLLER ASSEMBLY

- Carry out installation in the reverse order to removal.

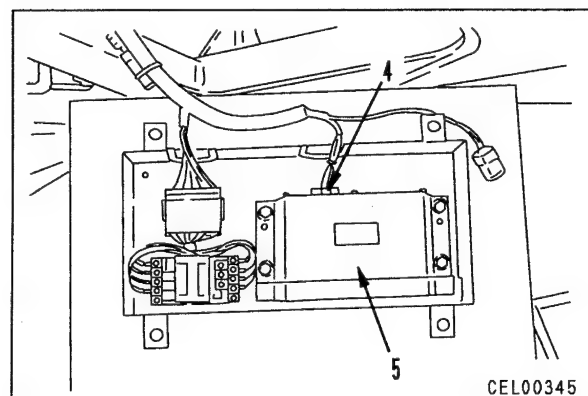
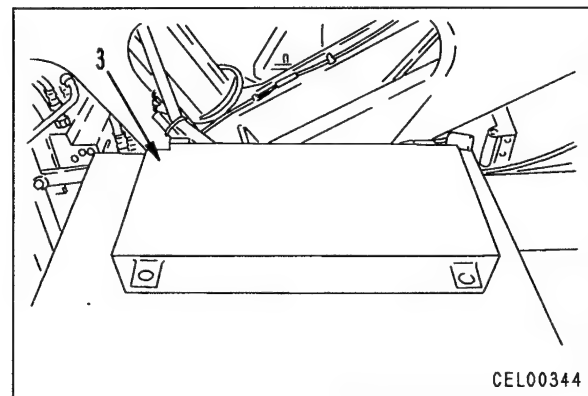
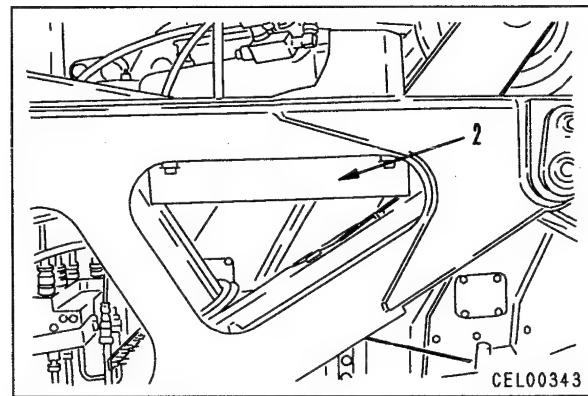
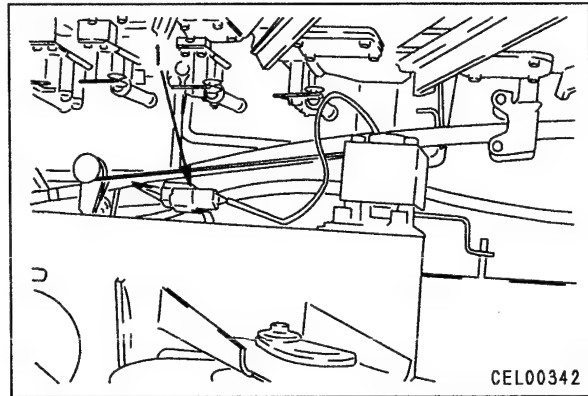


023S02

REMOVAL OF JIB TRANSMISSION MODULE ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (J103) (1).
2. Remove jib transmission module assembly (2) from jib.
3. Remove cover (3) from jib transmission module assembly (2).
4. Disconnect wiring connector (J01) (4).
5. Remove jib transmission module assembly (5).



INSTALLATION OF JIB TRANSMISSION MODULE ASSEMBLY

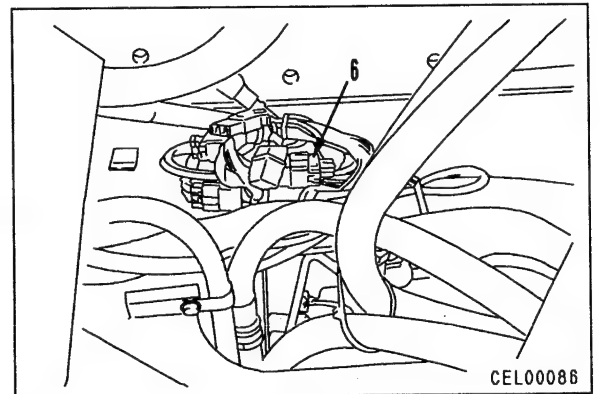
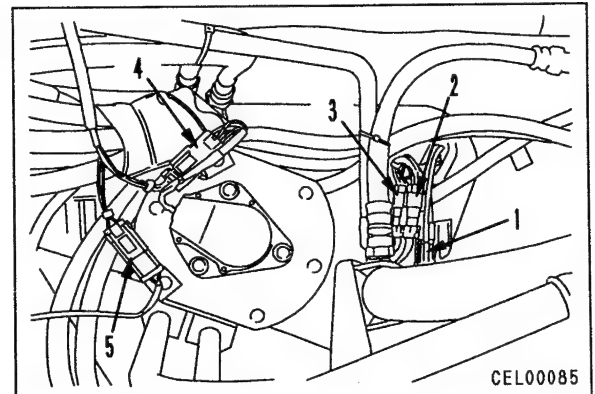
- Carry out installation in the reverse order to removal.

023S02

REMOVAL OF SLIP RING ASSEMBLY

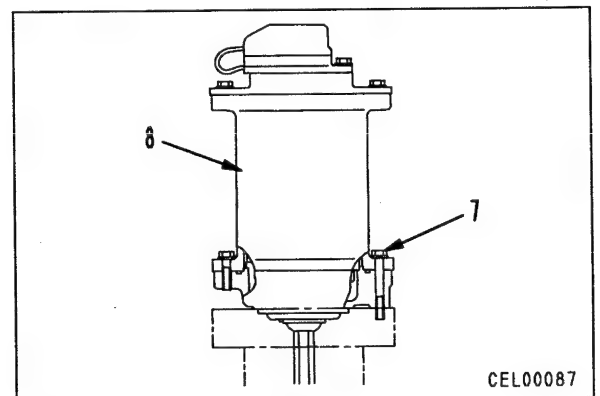
- ⚠ Extend the outriggers and set securely in contact with the ground.
- ⚠ Raise the boom to the maximum height.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connectors (R01) (1), (R03) (2), (R04) (3), and (R05) (4).
 - ★ Remove wiring connector (R42) (5) from the bracket.
2. Disconnect wiring connector (L04) (6) from bottom of center swivel joint.
3. Remove 3 slip ring mounting bolts (7), then remove slip ring (8).



INSTALLATION OF SLIP RING ASSEMBLY

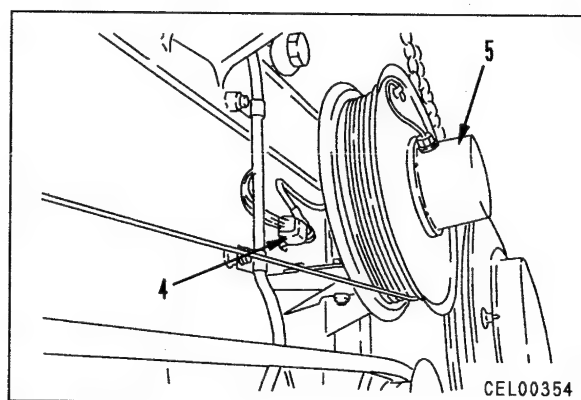
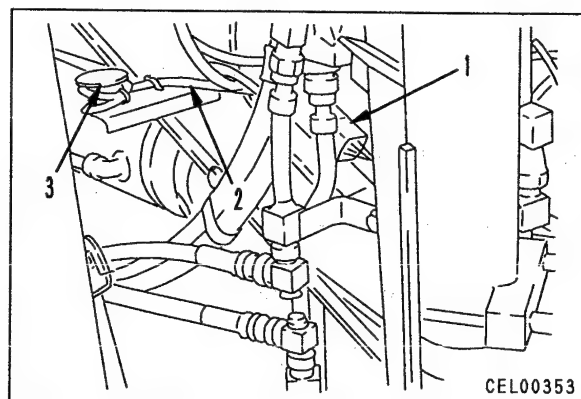
- Carry out installation in the reverse order to removal.



REMOVAL OF JIB TILT CORD REEL ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (BJ1) (1).
2. Remove output cable (2) from hook (3), then wind on to cord reel.
3. Disconnect wiring connector (B11) (4).
4. Remove jib tilt cord reel assembly (5).

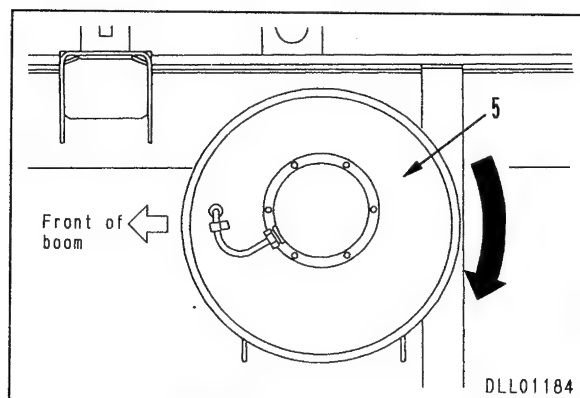


INSTALLATION OF JIB TILT CORD REEL ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ Wind 3 or 4 turns in the direction shown in the diagram on the right, then install the output cable to the hook.

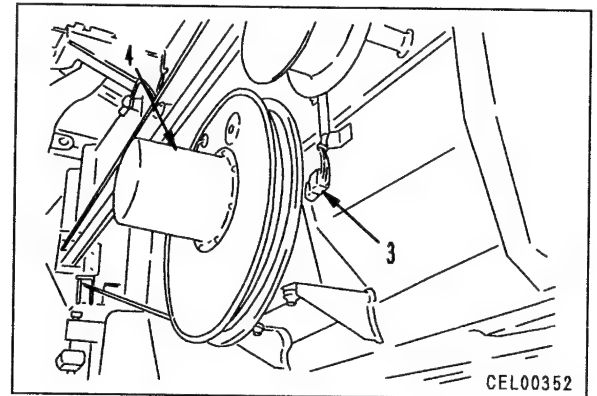
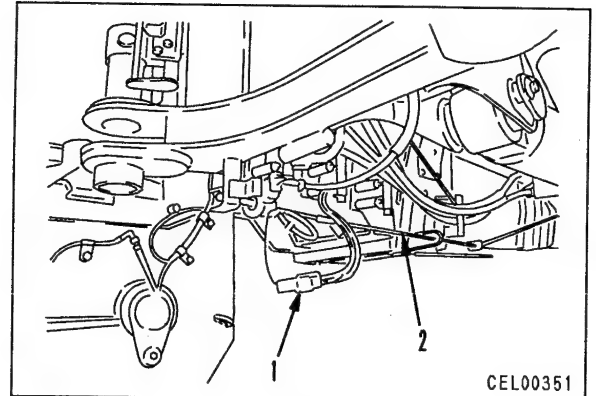


023S02

REMOVAL OF JIB EXTEND CORD REEL ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (BJ2) (1).
2. Remove output cable (2) from hook, then wind on to cord reel. ※ 1
3. Disconnect wiring connector (B05) (3).
4. Remove jib EXTEND cord reel assembly (4).

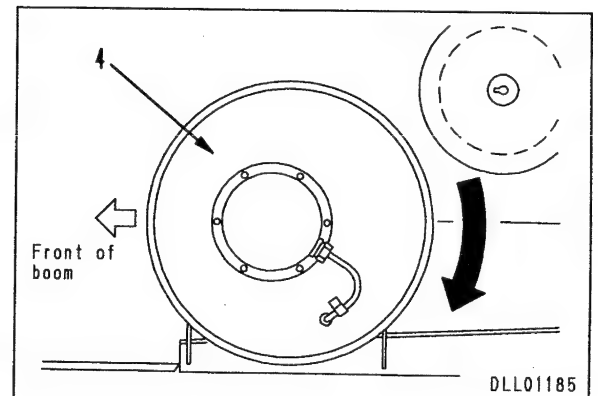


INSTALLATION OF JIB EXTEND CORD REEL ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

- ★ Wind 3 or 4 turns in the direction shown in the diagram on the right, then install the output cable to the hook.

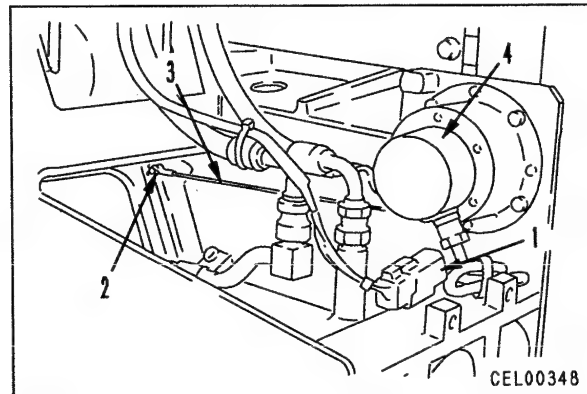


023S02

REMOVAL OF OUTRIGGER LENGTH SENSOR ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Extend outrigger approx. 30 cm.
2. Disconnect wiring connectors (1).
 - ★ Wiring connector Front right : (L42)
 - Front left : (L39)
 - Rear right : (L33)
 - Rear left : (L36)
3. Remove pin (2), then remove wire (3).
4. Remove outrigger length sensor assembly (4).



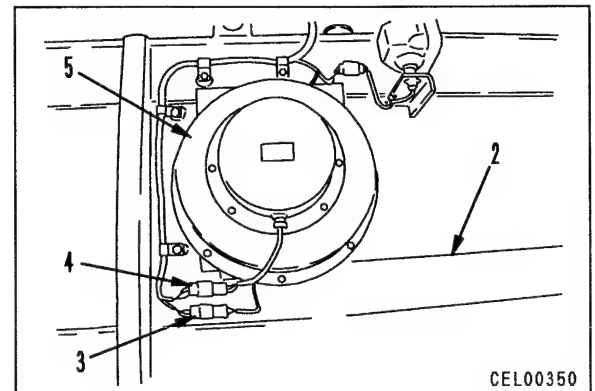
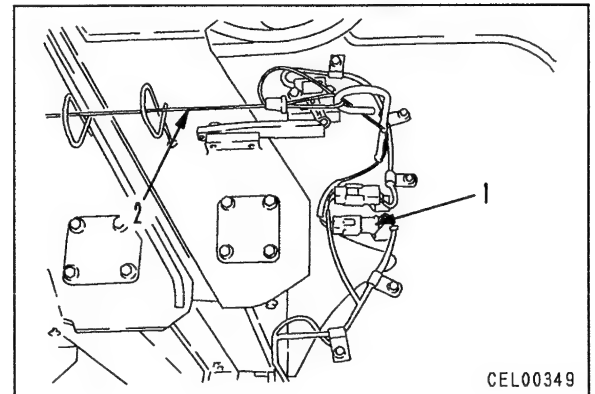
INSTALLATION OF OUTRIGGER LENGTH SENSOR ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF BOOM LENGTH SENSOR ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
- ⚠ The operation requires working at high places, so be extremely careful during the operation.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Disconnect wiring connector (B01) (1).
2. Remove output cable (2) from hook.
 - ★ Remove 1 mounting bolt for boom length sensor assembly, pass a wire through, and fix the output cable hook in position.
3. Disconnect wiring connectors (B13) (3) and (B14) (4).
4. Remove boom length sensor assembly (5).



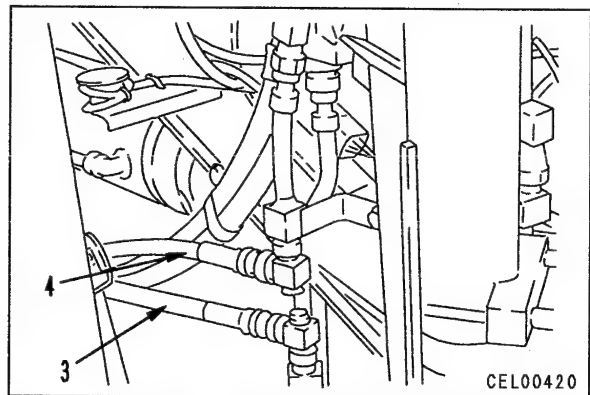
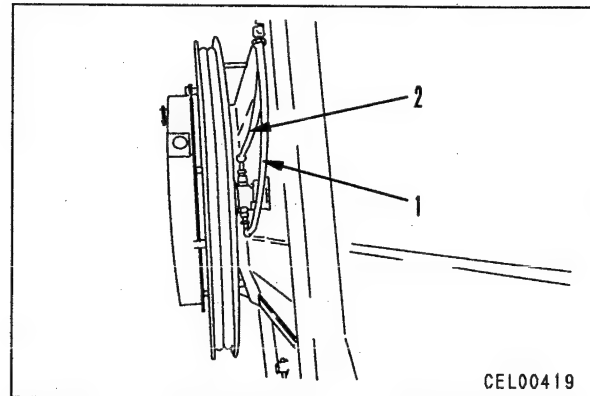
INSTALLATION OF BOOM LENGTH SENSOR ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF FRONT HOSE REEL ASSEMBLY

⚠ Set the parking brake switch to PARKING.

1. Disconnect hoses (1) and (2) at tube end.
2. Disconnect hoses (3) and (4). ※ 1
 - ★ The disconnected hoses are under the force of the spring, so tie a rope to the hoses, then gradually loosen the rope and wind on to the front hose reel.
3. Remove front hose reel assembly (5).

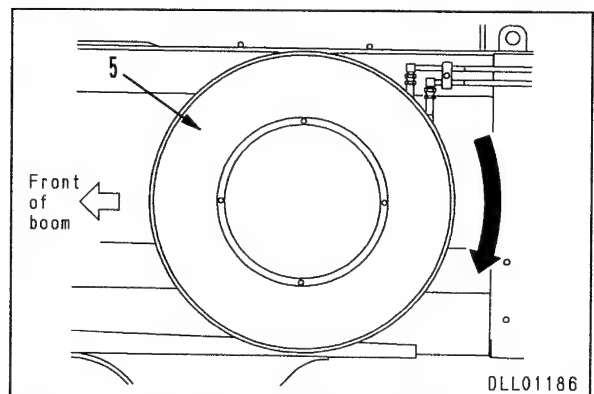


INSTALLATION OF FRONT HOSE REEL ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

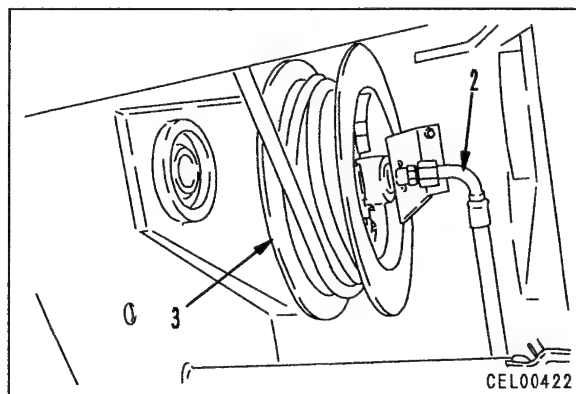
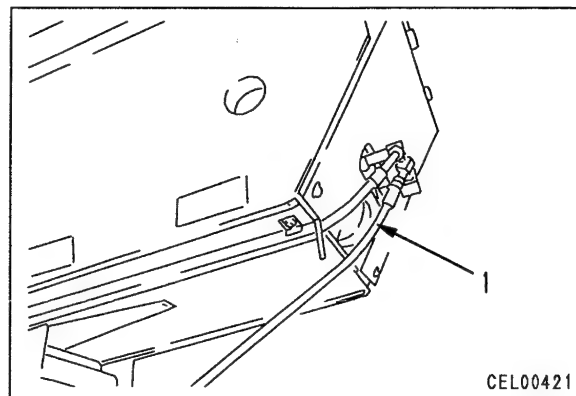
- ★ Wind 3 or 4 turns in the direction shown in the diagram on the right, then install the hoses.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



023S02

REMOVAL OF REAR HOSE REEL ASSEMBLY

- ⚠ Set the parking brake switch to PARKING.
 - ⚠ Lower the work equipment to the ground completely and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.
1. Disconnect hose (1).
 - ★ The disconnected hose is under the force of the spring, so tie a rope to the hose, then gradually loosen the rope and wind on to the rear hose reel.
 2. Disconnect hose (2).
 3. Remove rear hose reel assembly (3).

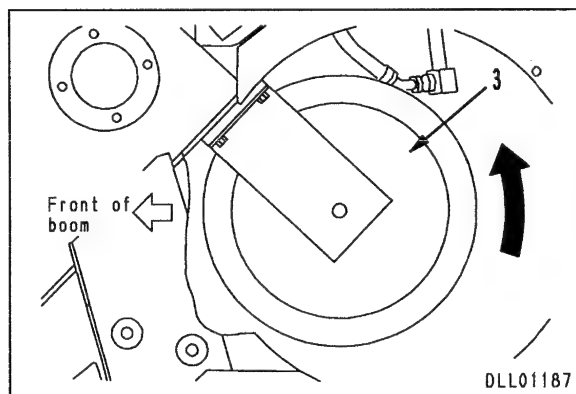


INSTALLATION OF REAR HOSE REEL ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

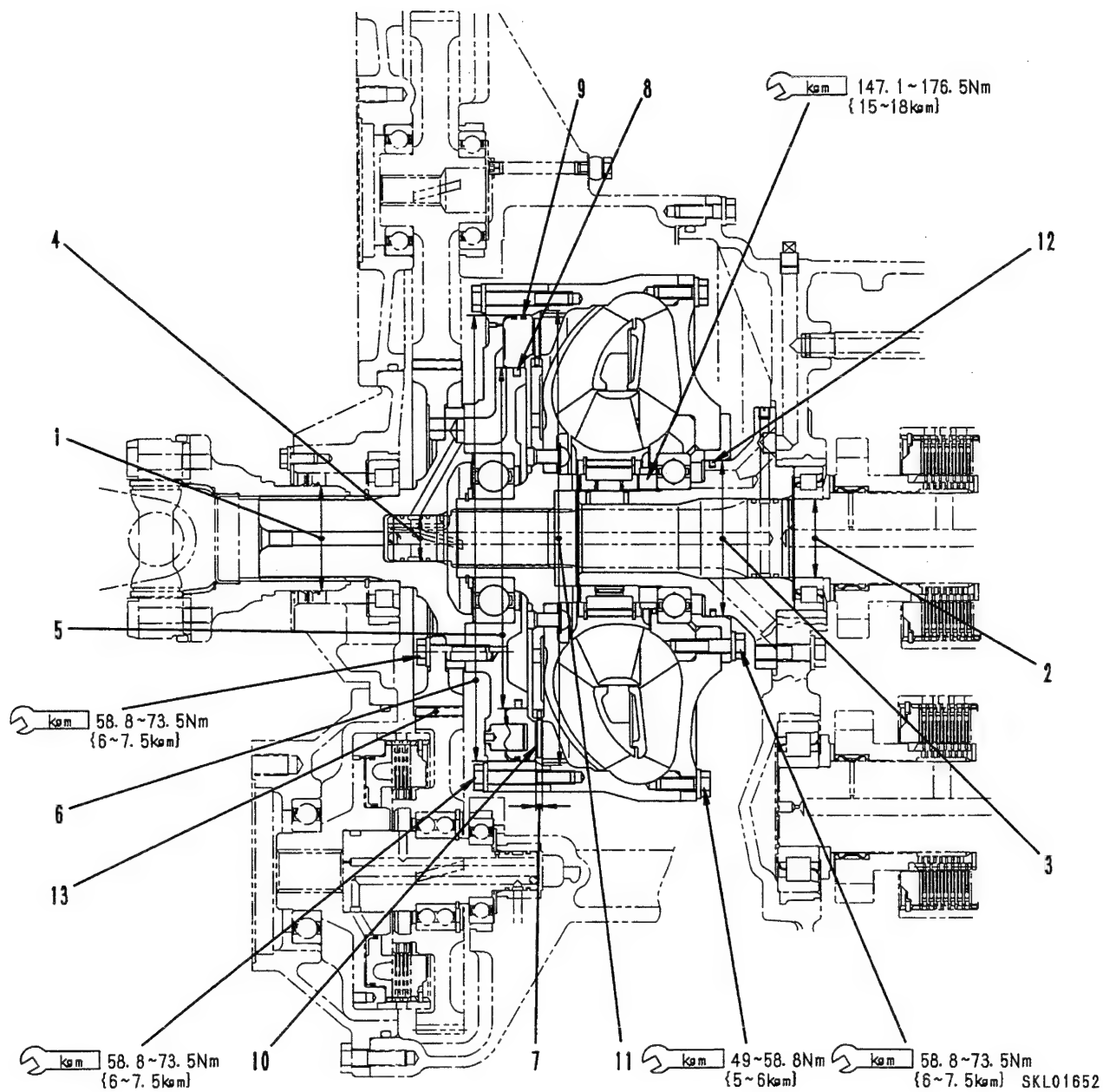
- ★ Wind 3 or 4 turns in the direction shown in the diagram on the right, then install the hose.
- **Refilling with oil (hydraulic tank)**
Run the engine to circulate the oil through the system. Then add oil to the specified level.



40 MAINTENANCE STANDARD

Torque convertor	40-1- 1
PTO clutch	40-1- 3
Transmission	40-1- 5
Transmission control valve	40-1-13
Axle	40- 2
Check valve	40- 6
Suspension system	40- 7
Brakes	40- 8
Parking brake	40- 9
Boom cylinder	40-10
Power tilt cylinder	40-12
Lever PPC valve	40-13
Pedal PPC valve	40-14
Relief valve	40-15
Swing control valve	40-16
Boom	40-17
Jib	40-23
Hook	40-24
Winch drum and machinery	40-25
Winch brake	40-26
Winch clutch	40-27
Chassis, H-shaped outrigger	40-28
Chassis, X-shaped outrigger	40-30
Guide sheave	40-32
Revolving frame	40-33

TORQUE CONVERTER



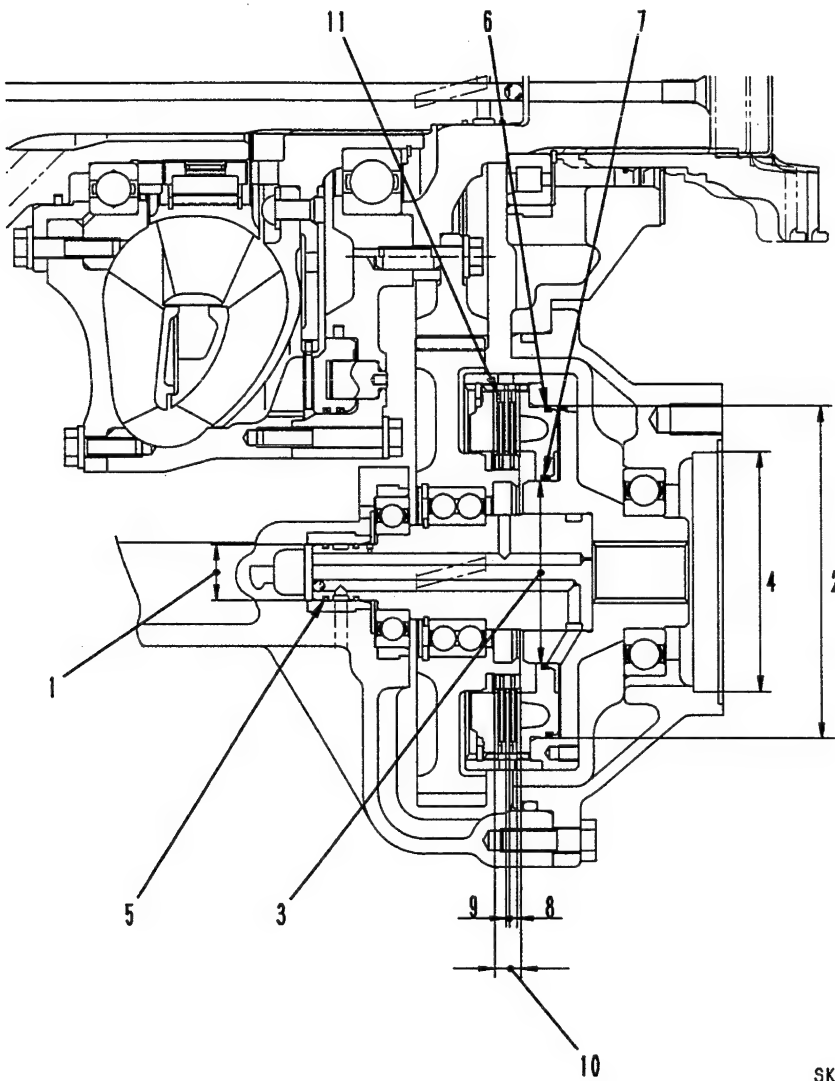
023S05

023S05

Unit: mm

No.	Check item	Criteria		Remedy
1	Outside diameter of coupling oil seal contact surface	Standard size	Repair limit	Repair hard chrome plating or replace
		80.0	79.8	
2	Inside diameter of stator shaft seal ring contact surface	60.0	60.1	
3	Inside diameter of PTO drive gear seal ring contact surface	120.0	120.5	
4	Inside diameter of pilot seal ring contact surface	35.0	35.1	
5	Inside diameter of clutch piston seal ring contact surface	260.0	260.1	
6	Inside diameter of clutch housing seal ring contact surface	340.0	340.5	Replace
7	Thickness of clutch disc	5.0		
8	Thickness × width of clutch housing seal ring	5.0 × 5.0	4.5 × 4.5	
9	Thickness × width of clutch housing seal ring	2.8 × 3.25	2.5 × 3.1	
10	Stepped wear of clutch piston friction surface	—	1.5	
11	Stepped wear of drive case friction surface	—	1.5	
12	Thickness × width of stator shaft seal ring	3.0 × 3.7	2.7 × 3.3	
13	Backlash of PTO gear	Standard clearance	Clearance limit	
		0.13 – 0.31	—	

PTO CLUTCH



SKL01653

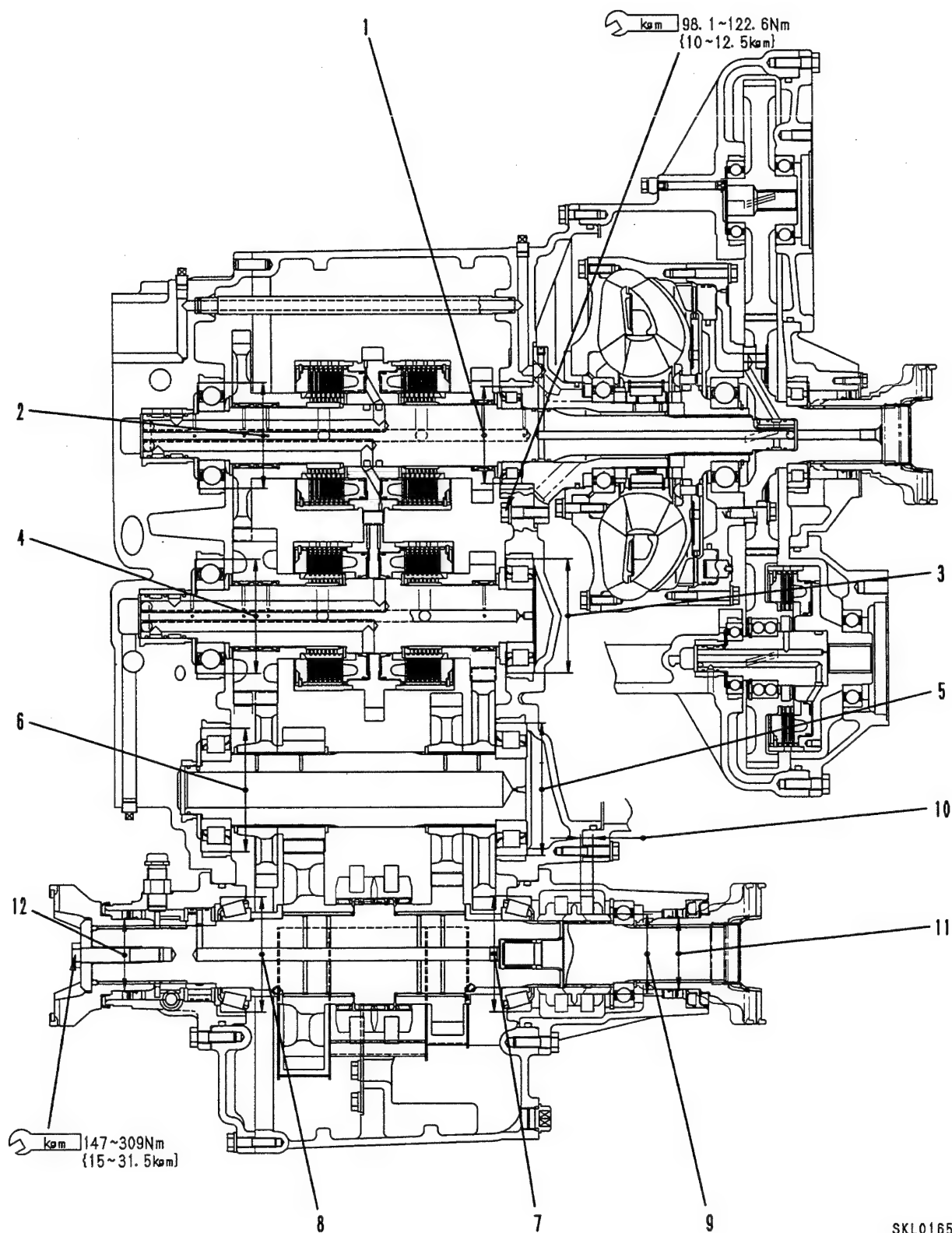
023S05

023S05

Unit: mm

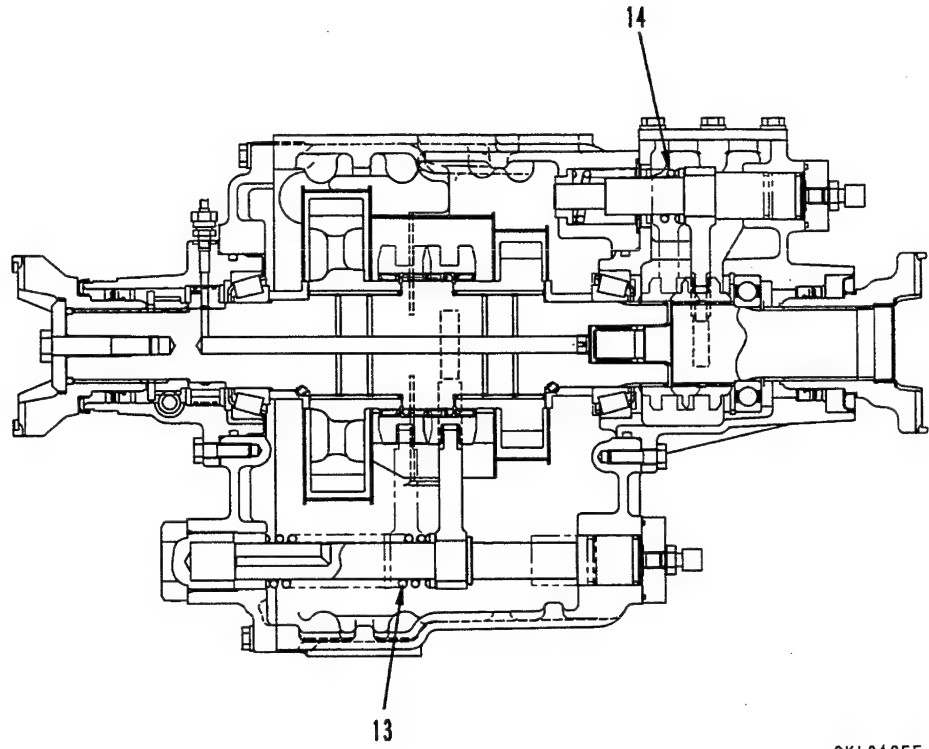
No.	Check item	Criteria					Remedy
1	Inside diameter of oil seal contact surface of clutch case	Standard size		Tolerance		Repair limit	Replace
		30.0		+0.05 0		30.15	
2	Inside diameter of seal ring contact surface of input shaft	176.0		+0.13 0		176.23	
3	Inside diameter of seal ring contact surface of clutch piston	96.78		+0.13 0		97.0	
4	Fitting between pump mount and adapter	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole			
		127	0 −0.050	+0.079 +0.025	0.025−0.129	—	
5	Thickness x width of input shaft seal ring	Standard size		Tolerance		Repair limit	
		2.5		0 −0.10		2.25	
6	Thickness x width of clutch piston seal ring	2.8		±0.1		2.52	
7	Thickness x width of clutch piston seal ring	2.8		±0.1		2.52	
8	Thickness of clutch disc	3.0		+0.05 −0.10		2.73	
9	Thickness of clutch plate	1.8		±0.06		1.62	
10	Assembled thickness of disc and plate	12.4		±0.31		11.8	
11	Clutch spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		6.33	3.8	901 N {91.1 kg}	—	—	

TRANSMISSION



023S05

SKL01654



023S05

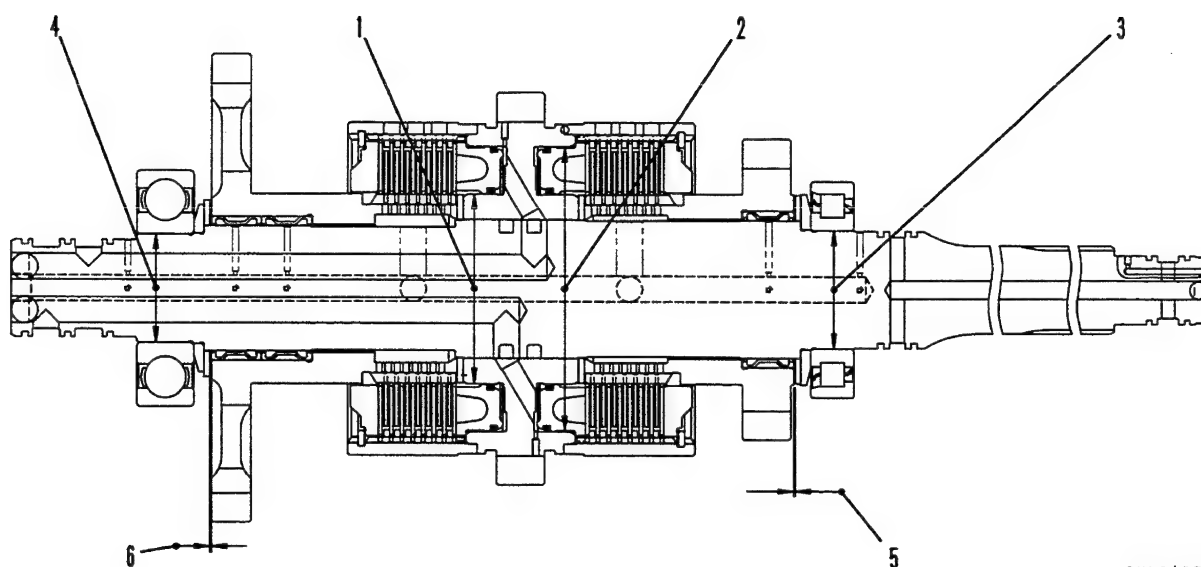
SKL01655

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between R/3rd shaft bearing and housing	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		110	0 -0.018	+0.03 0	0 - 0.048	—	
2	Clearance between R/3rd shaft bearing and housing	120	0 -0.018	+0.03 0	0 - 0.048	—	
3	Clearance between 1st/2nd shaft bearing and housing	130	0 -0.018	+0.03 0	0 - 0.048	—	
4	Clearance between 1st/2nd shaft bearing and housing	130	0 -0.018	+0.03 0	0 - 0.048	—	
5	Clearance between Hi/Lo shaft bearing and housing	150	0 -0.018	+0.03 0	0 - 0.048	—	
6	Clearance between Hi/Lo shaft bearing and housing	140	0 -0.018	+0.03 0	0 - 0.048	—	
7	Clearance between output shaft bearing and housing	130	0 -0.018			—	
8	Clearance between output shaft bearing and housing	130	0 -0.018			—	
9	Clearance between 2/4-wheel drive shifter fork and coupling	90	-0.3 -0.5	+0.2 0	0.3 - 0.7	—	
10	Clearance between 2/4-wheel drive shifter fork (width) and coupling	16	-0.2 -0.5	+0.2 +0.1	0.3 - 0.5	—	
11	Outside diameter of coupling oil seal contact surface	Standard size		Tolerance		Repair limit	
		80					
12	Outside diameter of coupling oil seal contact surface	80					
13	Hi/Lo selector spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		172.9	142.5	931 N {95.0 kg}	166.0	838 N {85.5 kg}	
14	2/4 wheel drive selector spring	111	92	742 N {75.7 kg}	106.6	668 N {68.1 kg}	

023S05

R/3rd CLUTCH



SKL01656

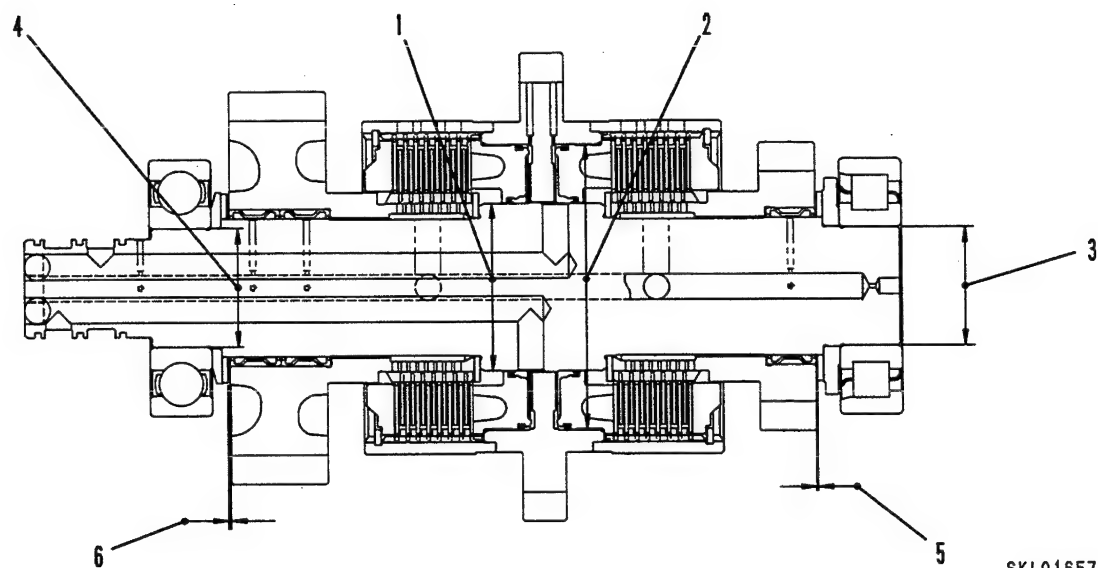
023S05

Unit: mm

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between piston and cylinder (inside diameter)	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		96.78	-0.05 -0.065	+0.13 +0.05	0.05 - 0.195	—	
2	Clearance between piston and cylinder (outside diameter)	145	-0.3 -0.35	+0.13 0	0.3 - 0.48	—	
3	Clearance of R/3rd clutch shaft bearing press fit portion	60	0.023 -0.022	0 -0.015	- 0.022 - - 0.048	—	
4	Clearance of R/3rd clutch shaft bearing press fit portion	55	-0.029 -0.016	0 -0.015	- 0.016 - - 0.044	—	
5	End play of R gear	0.07 - 1.33					
6	End play of 3rd gear	0.1 - 1.3					

1st/2nd CLUTCH



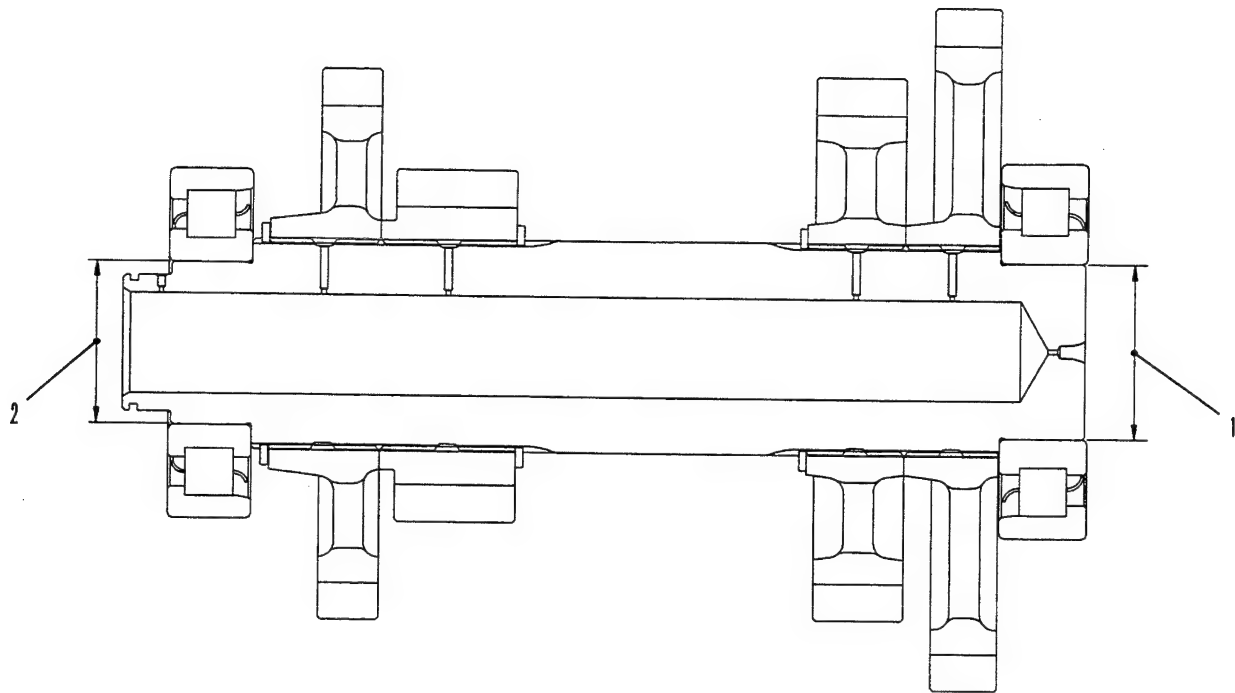
SKL01657

023S05

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between piston and cylinder (inside diameter)	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
2	Clearance between piston and cylinder (outside diameter)	85.15	-0.2 -0.25	+0.13 0	0.2 – 0.38	—	
3	Clearance of 1st/2rd clutch shaft bearing press fit portion	145	-0.3 -0.35	+0.13 0	0.3 – 0.48	—	
4	Clearance of 1st/2rd clutch shaft bearing press fit portion	60	+0.034 +0.021	0 -0.015	-0.021 -0.049	—	
5	End play of R gear	60	+0.034 +0.021	0 -0.015	-0.021 -0.049	—	
		0.27 – 1.13					
		0.44 – 1.56					

Hi/Lo SHAFT

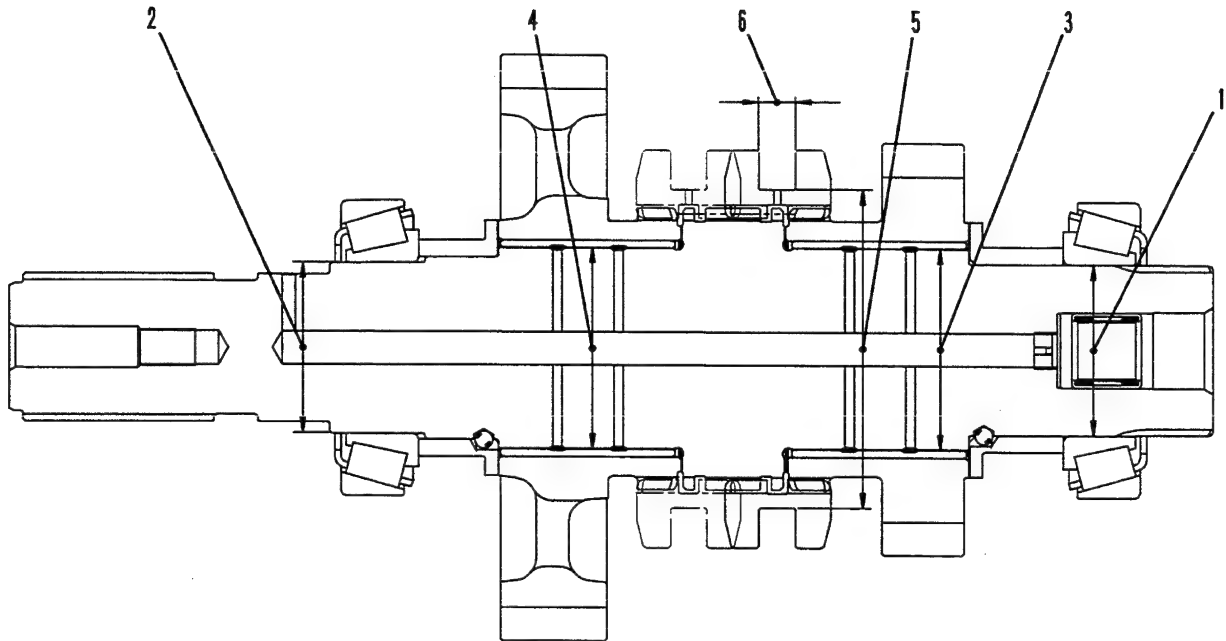


023S05

SKL01658

Unit: mm							
No.	Check item	Criteria					Remedy
1	Clearance of bearing press fit portion	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		70	+0.043 +0.030	0 −0.015	0.03 – 0.058		
2	Clearance of bearing press fit portion	65	+0.038 +0.025	0 −0.015	0.025 – 0.058		

OUTPUT SHAFT



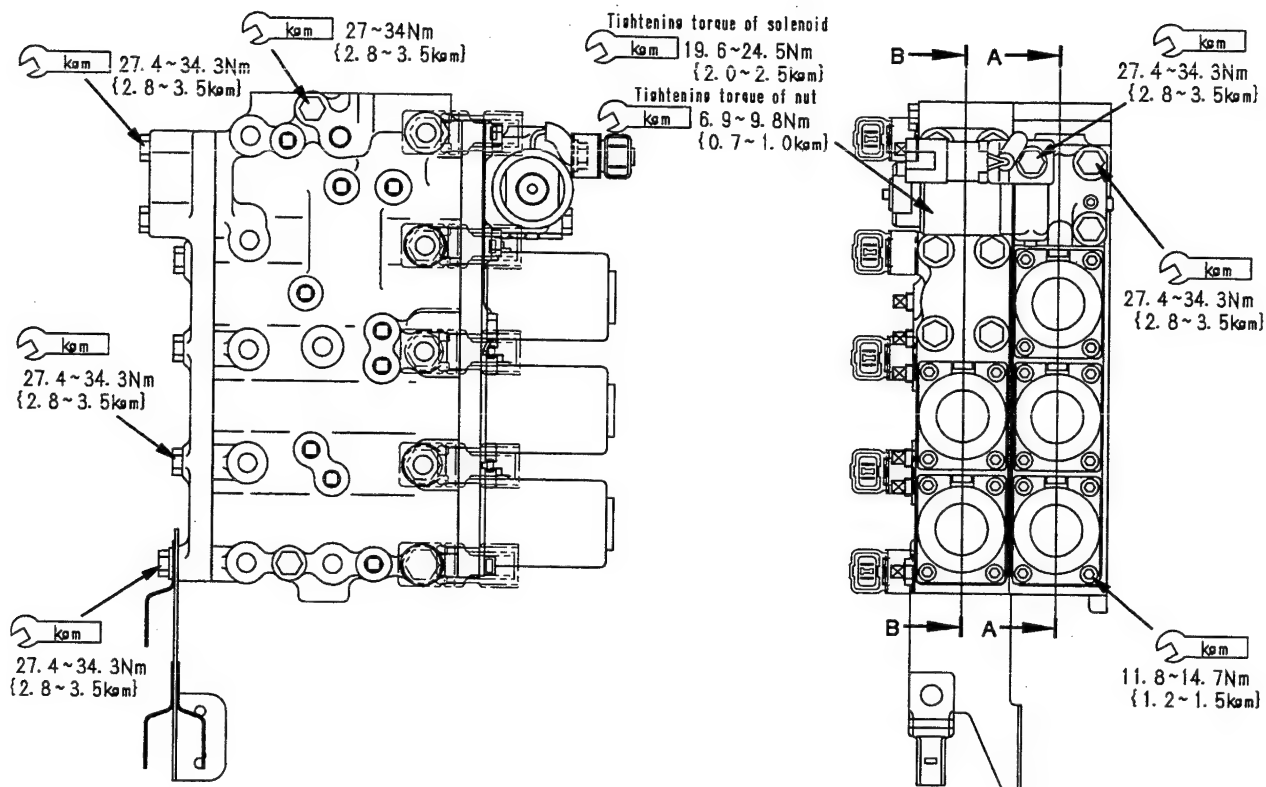
SKL01659

023S05

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance of output shaft bearing press fit portion	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		75	+0.030 +0.011	0 -0.015	-0.011 -0.045	—	
2	Clearance of output shaft bearing press fit portion	75	+0.030 +0.011	0 -0.015	-0.011 -0.045	—	
3	Clearance of Hi gear bushing portion	88	-0.100 -0.135	+0.075 0	0.1 – 0.21	—	
4	Clearance of Lo gear bushing portion	88	-0.100 -0.135	+0.075 0	0.1 – 0.21	—	
5	Clearance between Hi/Lo shifter fork and coupling	140	-0.3 -0.5	+0.2 0	0.3 – 0.7	—	
6	Clearance between Hi/Lo shifter fork (width) and coupling	16	-0.2 -0.3	+0.2 +0.1	0.3 – 0.5	—	

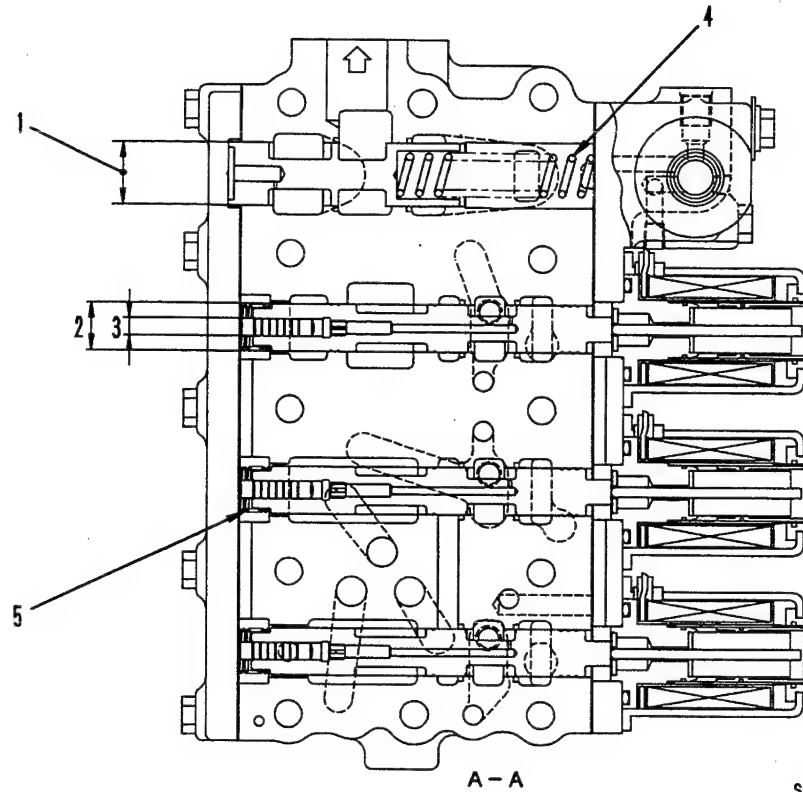
TRANSMISSION CONTROL VALVE



SVL01716

023S05

LOWER VALVE



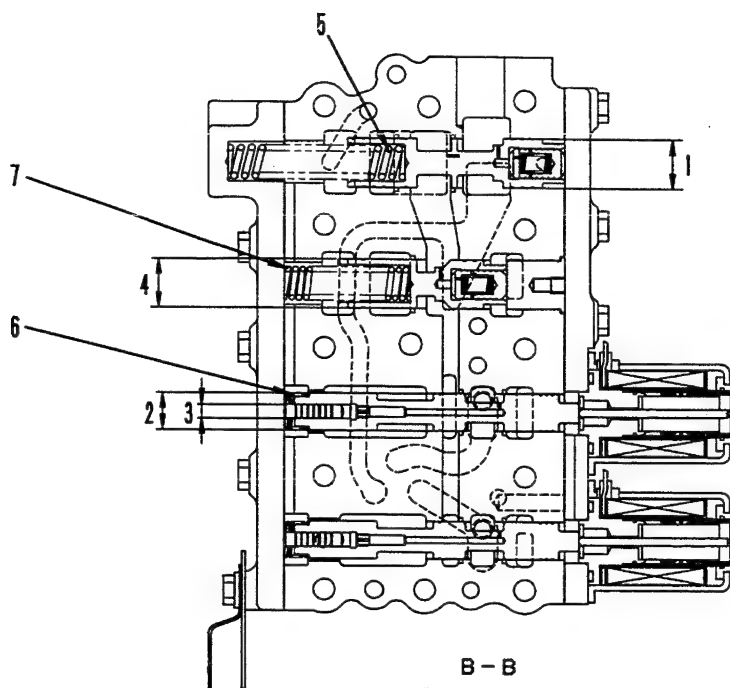
SKL01661

Unit: mm

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between torque converter outlet valve and body	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		25	-0.035 -0.045	+0.013 0	0.035 – 0.058	0.07	
2	Clearance between ECMV and body	19	-0.02 -0.03	+0.013 0	0.02 – 0.043	0.05	
3	Clearance between ECMV spool and body	7	-0.035 -0.045	+0.012 0	0.035 – 0.057	0.07	
4	Torque converter outlet valve spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		84.6	78.3	147.1 N {15.0 kg}	81.2	132.4 N {13.5 kg}	
5	ECMV spring	23.8	13	8.9 N {0.91 kg}	22.8	8.0 N {0.82 kg}	

UPPER VALVE



SKL01662

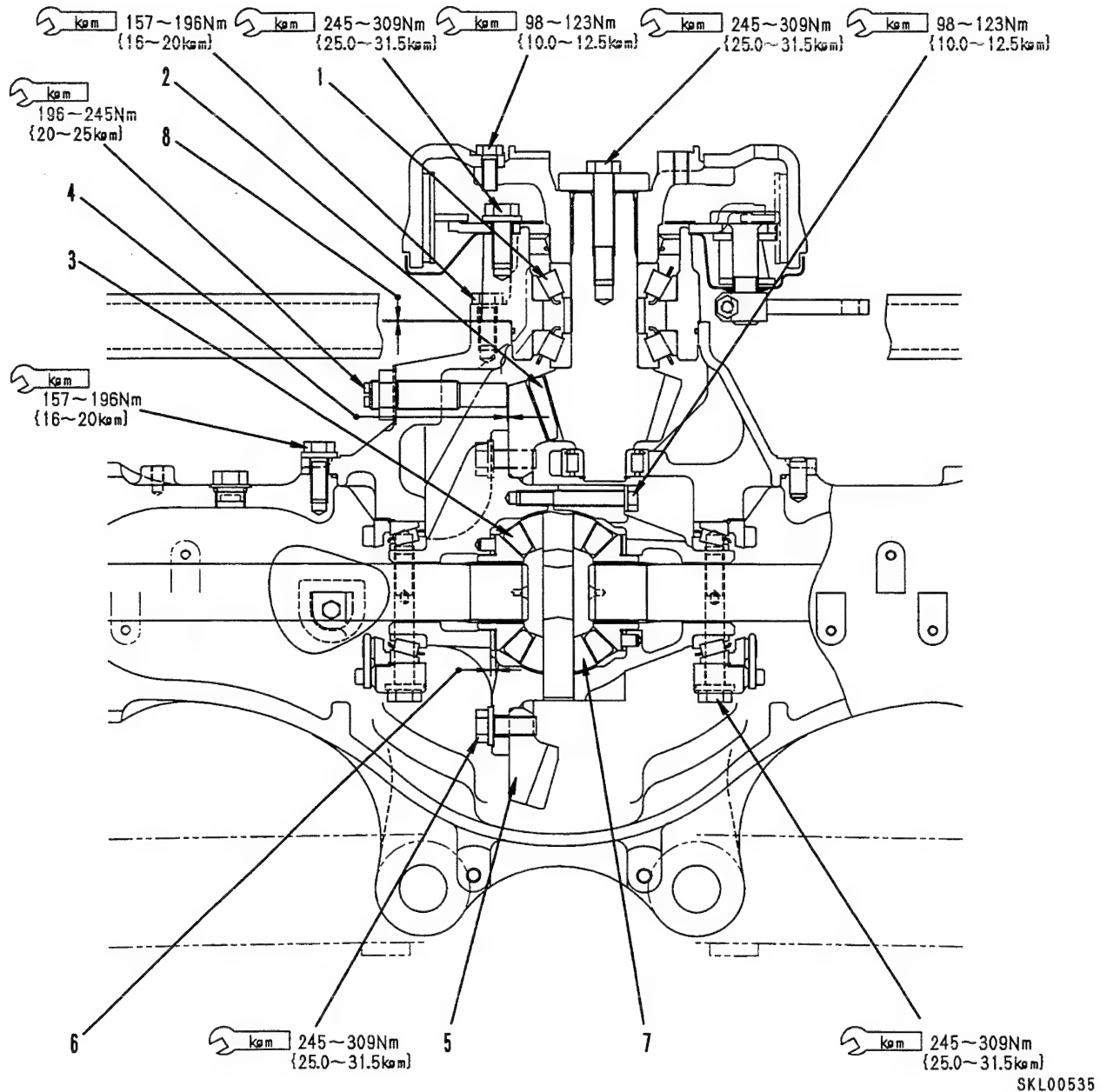
023S05

Unit: mm

Unit: mm							
No.	Check item	Criteria					Remedy
1	Clearance between priority valve and body	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
2	Clearance between ECMV and body	25	-0.035 -0.045	+0.013 0	0.035 – 0.058	0.07	
3	Clearance between ECMV and load piston	19	-0.02 -0.03	+0.013 0	0.02 – 0.043	0.05	
4	Clearance between ECMV and load piston	7	-0.035 -0.045	+0.012 0	0.035 – 0.057	0.07	
5	Clearance between main relief valve and body	25	-0.035 -0.045	+0.013 0	0.035 – 0.058	0.07	
5	Priority valve spring	Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
		111	88.1	403.1 N {41.1 kg}	106.6	—	
6	ECMV spring	23.8	13	8.9 N {0.91 kg}	22.8	8.0 N {0.82 kg}	
7	Main relief valve spring	92.2	63.3	410.9 N {41.9 kg}	88.5	369.7 N {37.7 kg}	

AXLE

DIFFERENTIAL



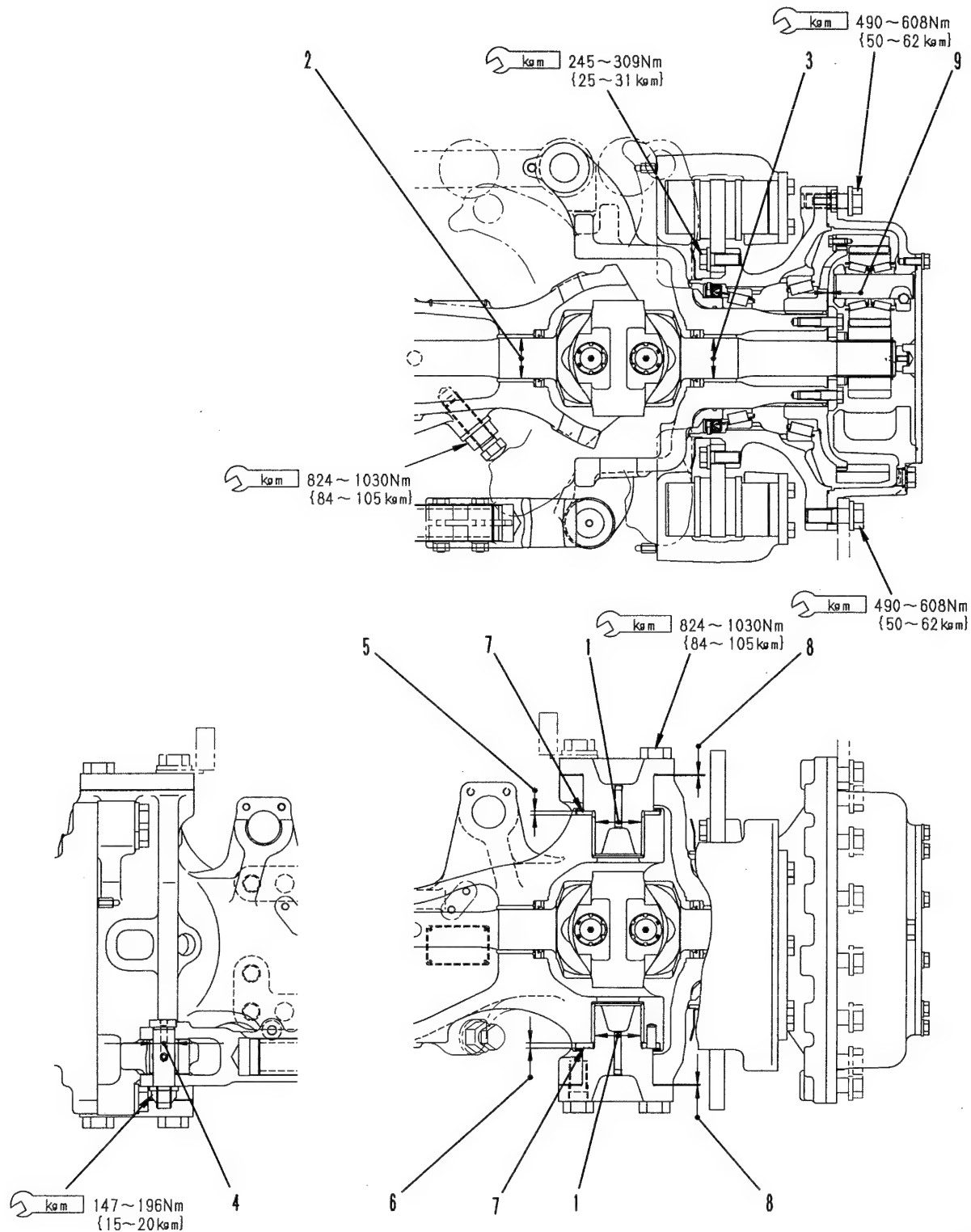
023S05

023S05

Unit: mm

No.	Check item	Criteria			Remedy
1	End play of pinion shaft bearing	Standard clearance		Clearance limit	Adjust
		0.010 – 0.168		0.168	
2	Backlash between bevel pinion and bevel gear	0.25 – 0.33		0.33	
3	Backlash of differential gear	0.10 – 0.25		0.30	
4	Clearance between adjusting bolt and back face of bevel gear	0.25 – 0.50		0.50	
5	Runout of back face of bevel gear	Standard size		Repair limit	Replace
		0.1		0.2	
6	Thickness of side gear thrust washer	Standard size	Tolerance	Repair limit	
		4.0	±0.05	3.80	
7	Thickness of pinion thrust washer	1.5	+0.09 –0.01	1.35	
8	Standard shim thickness for bearing housing	0.85			Adjust

FINAL DRIVE



023S05

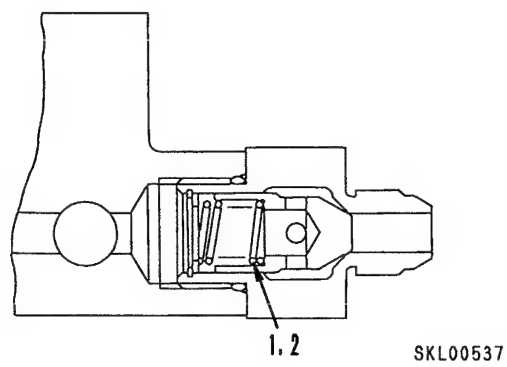
SKL00536

023S05

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between king pin and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
2	Clearance between U-joint (inside) and bushing	62	0 -0.019	+0.151 +0.098	0.098 – 0.170	0.2	
3	Clearance between U-joint (outside) and bushing	55	0 -0.019	+0.385 +0.231	0.231 – 1.404	0.4	
4	Clearance between tie rod pin and bushing	55	0 -0.019	+0.385 +0.231	0.231 – 0.404	0.4	
5	Clearance between king pin and bushing	30	-0.020 -0.041	+0.117 +0.080	0.100 – 0.157	0.2	
5	Thickness of king pin (top) thrust washer	Standard size		Tolerance		Repair limit	Replace. However, if end play of king pin in vertical direction is less than 0.25, it can be used again
		5		0 -0.1		4.8	
6	Thickness of king pin (bottom) thrust washer	7		0 -0.1		6.8	
7	End play of king pin in vertical direction	Standard size			Repair limit		Adjust
		0.01 – 0.15			0.25		
8	Standard shim thickness for king pin	1.0					
9	Standard shim thickness for final drive hub	1.163					

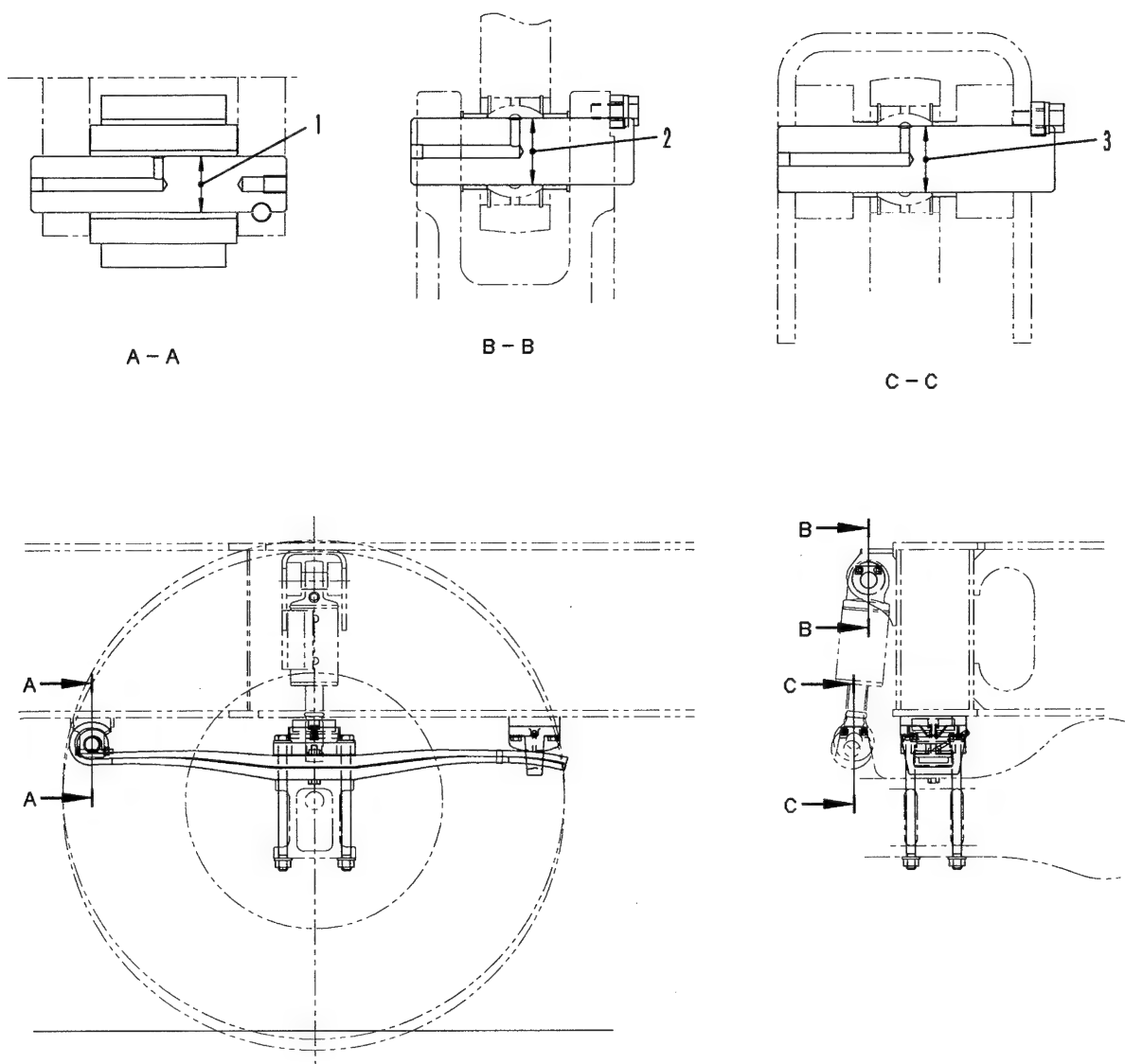
CHECK VALVE (STEERING CIRCUIT)



023S05

Unit: mm							
No.	Check item	Criteria					Remedy
1	Check valve spring (for steering pump)	Standard size			Repair limit		Replace
		Free length	Installed length	Installed load	Free length	Installed load	
		27.1	23.7	8.92 N {0.91 kg}	24.7	6.18 N {0.63 kg}	
2	Check valve spring (for emergency steering pump)	17.9	15.8	3.04 N {0.31 kg}	16.8	1.57 N {0.16 kg}	

SUSPENSION SYSTEM

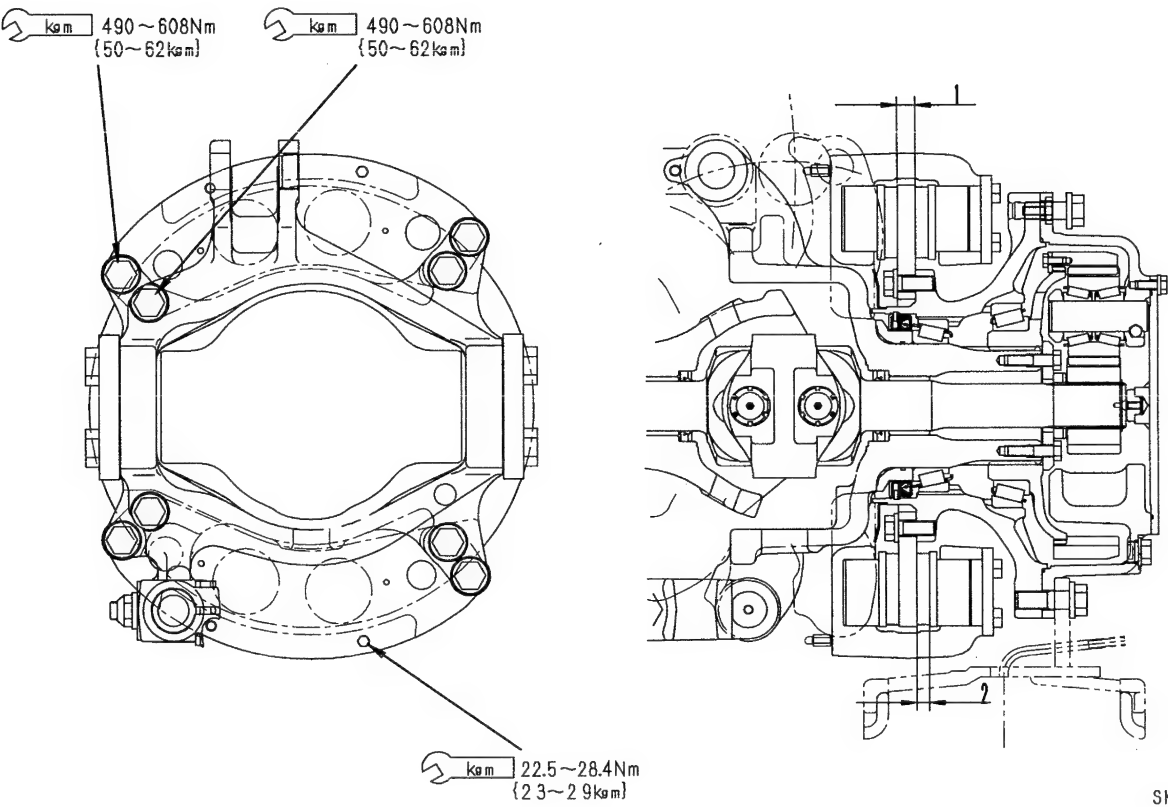


SDL00538

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between leaf spring and boss	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
			Shaft	Hole			
		38	-0.025 -0.064	+0.100 0	0.025-0.164	—	
2	Clearance between suspension lock cylinder pin and bushing	45	-0.025 -0.064	+0.003 -0.015	0.010-0.067	1.0	
3	Clearance between suspension lock cylinder pin and bushing	45	-0.025 -0.064	+0.003 -0.015	0.010-0.067	1.0	

BRAKES



SKL00539

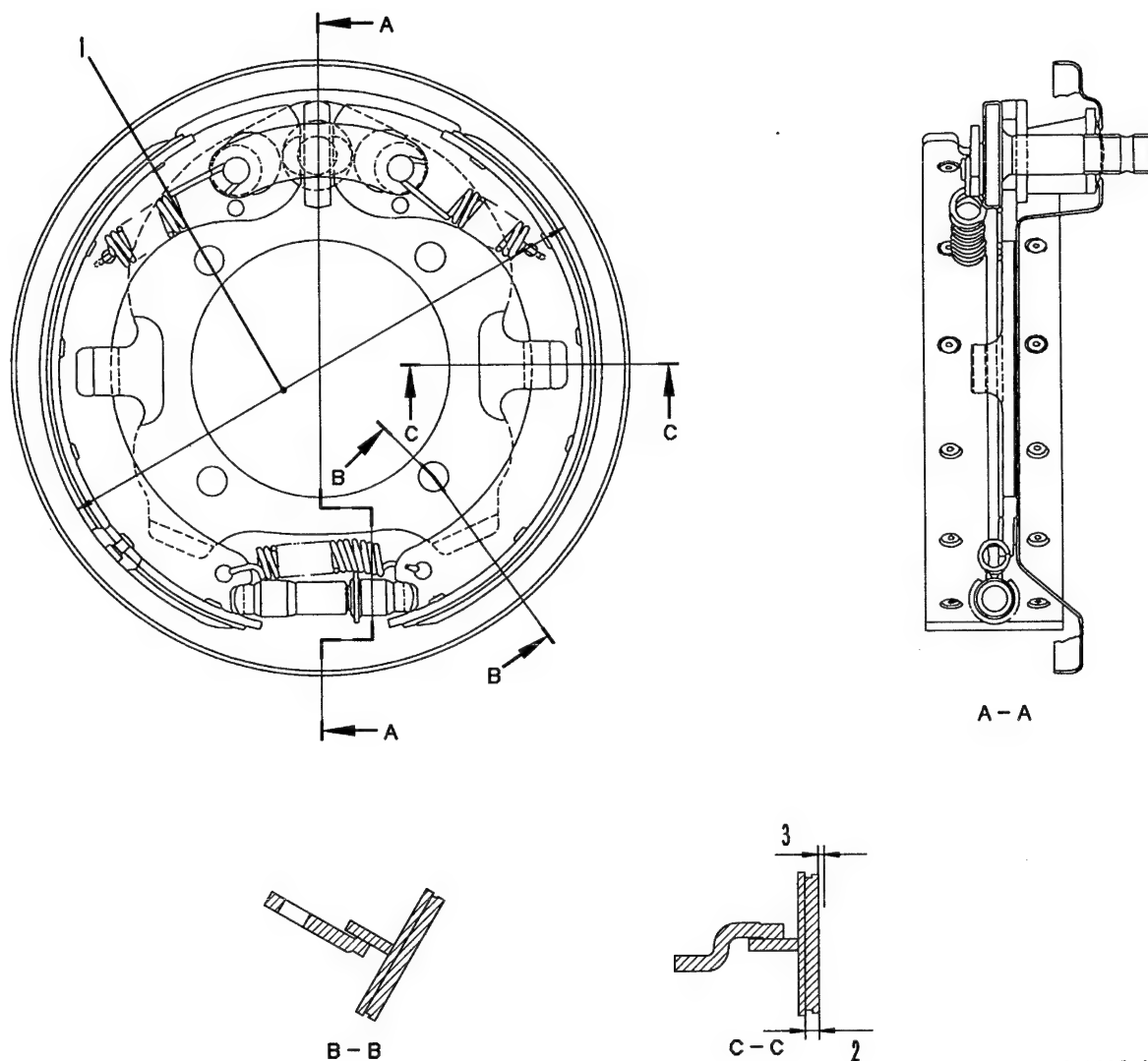
023S05

Unit: mm

No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Thickness of brake rotor	20.0	17.5	Replace
2	Thickness of brake pad	14.0	2.0 (Remainder when pad groove has disappeared)	

PARKING BRAKE

023S05

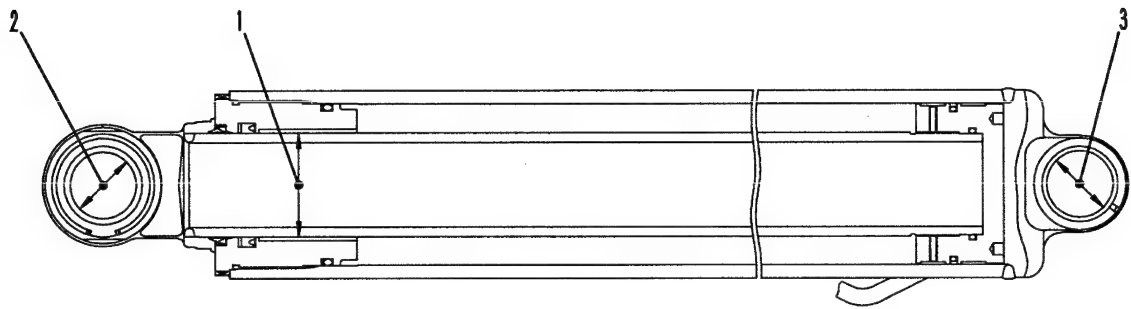


SLL00540

Unit: mm

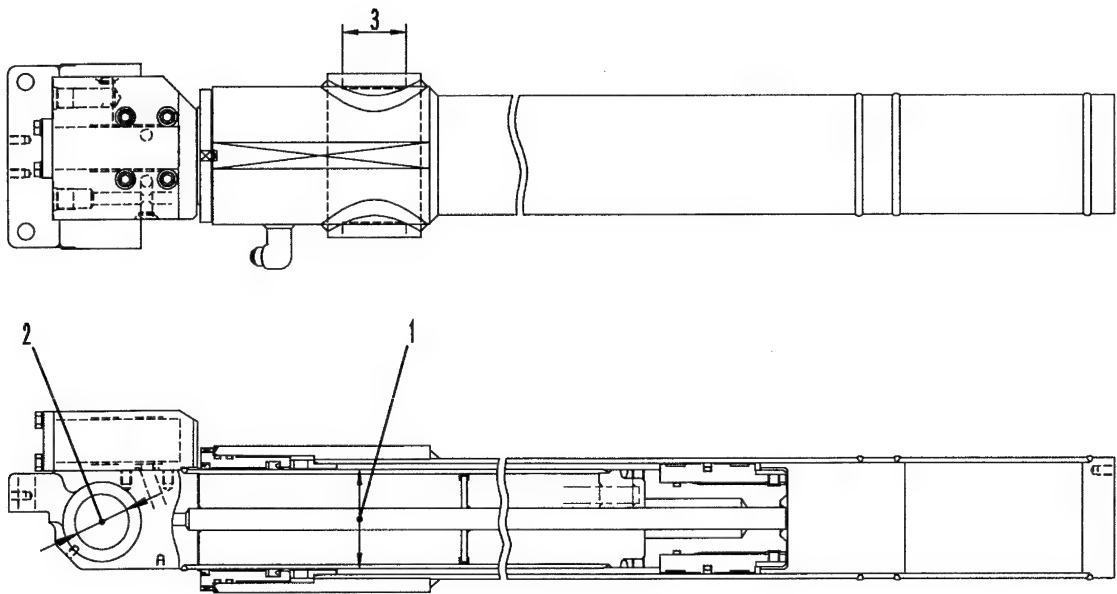
No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Inside diameter of brake drum	304.8	307.0	Replace
2	Thickness of brake lining	6.2	3.2	
3	Clearance between inside diameter of brake drum and brake shoe	0.23 (Turn adjustment screw fully to bring shoe into tight contact with drum, then turn back 8 notches)		Adjust

BOOM CYLINDER
BOOM HOIST CYLINDER



SDL00541

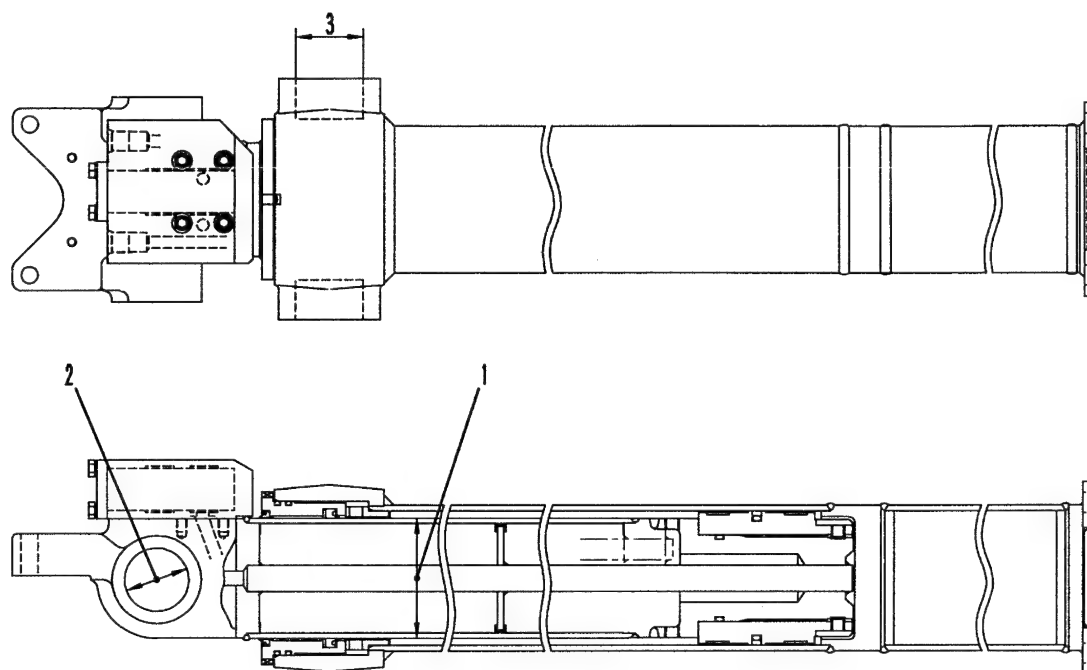
BOOM TELESCOPE CYLINDER 1



SDL00542

023S05

BOOM TELESCOPE CYLINDER 2

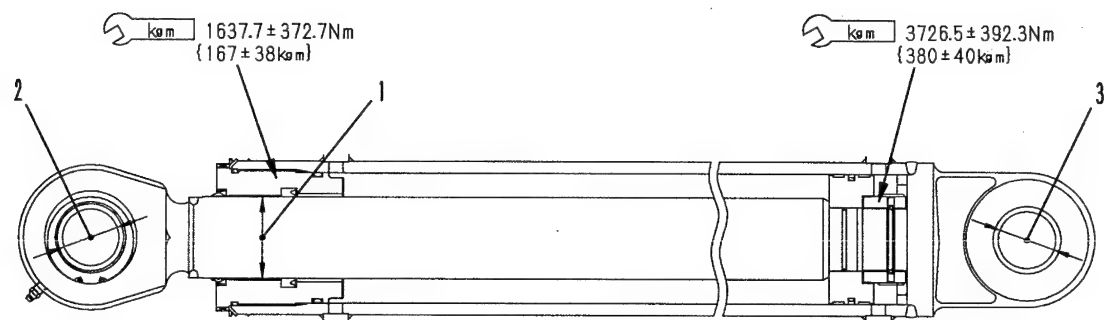


SDL00543

Unit: mm

No.	Check item	Criteria						Remedy
		Name of cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
1	Clearance between piston rod and bushing	Boom hoist	210			0.110 – 0.368	0.85	Replace
		Boom telescope 1	110			0.132 – 0.354	0.80	
		Boom telescope 2	135			0.132 – 0.354	0.80	
2	Clearance between piston rod bushing and pin	Boom hoist	110	-0.072 -0.126	+0.005 -0.065	0.007 – 0.131	1.0	
		Boom telescope 1	65	-0.060 -0.134	+0.250 +0.050	0.110 – 0.384	1.0	
		Boom telescope 2	75	-0.060 -0.134	+0.250 +0.050	0.110 – 0.384	1.0	
3	Clearance between cylinder support and pin	Boom hoist	110	-0.072 -0.126	+0.143 +0.023	0.095 – 0.269	1.0	
		Boom telescope 1	65	-0.060 -0.134	+0.200 0	0.060 – 0.334	1.0	
		Boom telescope 2	80	-0.060 -0.134	+0.200 0	0.060 – 0.334	1.0	

POWER TILT CYLINDER (POWER TILT SPECIFICATION MACHINES)



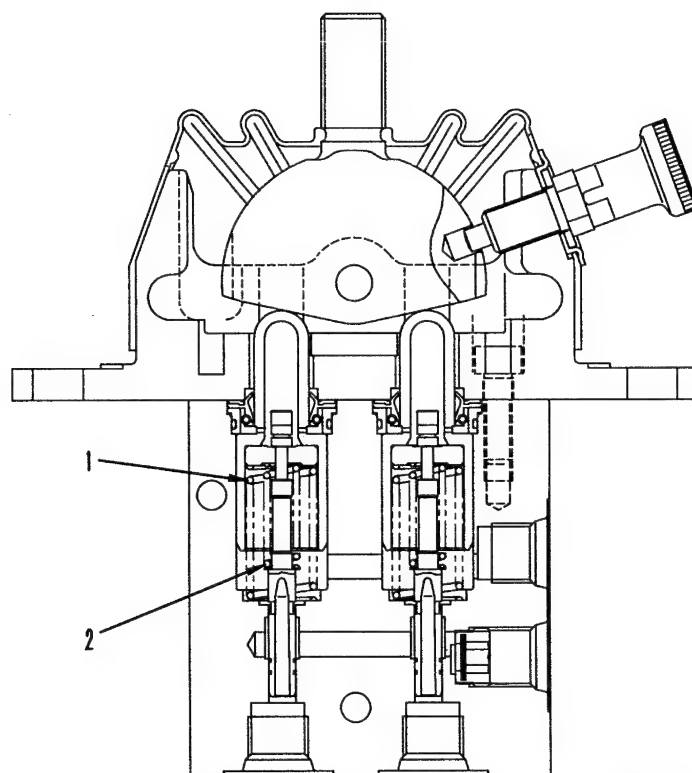
SDL00544

023S05

Unit: mm							
No.	Check item	Criteria					Remedy
1	Clearance between piston rod and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		65			0.091–0.375	0.675	
2	Clearance between piston rod support shaft and bushing	55		+0.004 –0.059		1.0	
3	Clearance between cylinder bottom support shaft and bushing	55		+0.250 +0.050		1.0	

LEVER PPC VALVE

FOR TELESCOPE
FOR HOIST, MAIN WINCH, AUXILIARY WINCH
FOR TILT, SWING



SKL00545

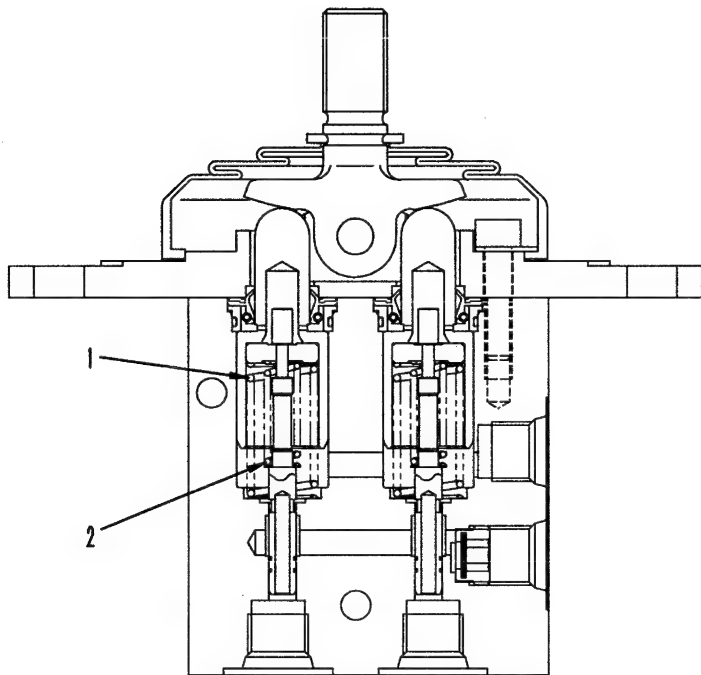
023S05

Unit: mm

No.	Check item	Criteria					Remedy
1	Centering spring	Standard size			Repair limit		Replace spring if damaged or deformed
		Free length × O.D.	Installed length	Installed load	Free length	Installed load	
		42.5 × 15.5	29.6	26.5 N {2.7 kg}	—	21.6 N {2.2 kg}	
2	Metering spring	23.9 × 8.1	22.9	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

PEDAL PPC VALVE

AUXILIARY WINCH AND TELESCOPE



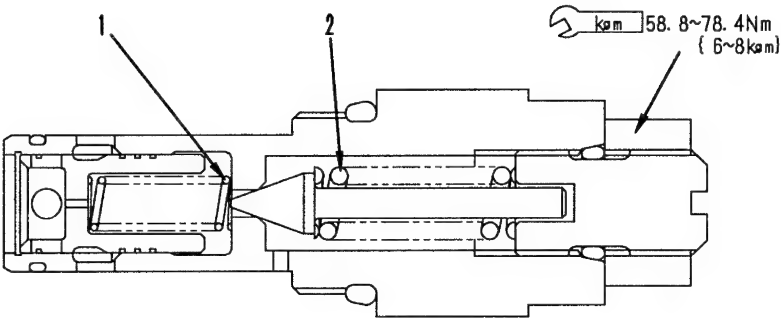
SKL00546

023S05

Unit: mm

No.	Check item	Criteria					Remedy
1	Centering spring	Standard size			Repair limit		Replace spring if damaged or deformed
		Free length × O.D.	Installed length	Installed load	Free length	Installed load	
		42.5 × 15.5	29.6	26.5 N {2.7 kg}	—	21.6 N {2.2 kg}	
2	Metering spring	23.9 × 8.1	22.9	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

RELIEF VALVE
(FOR PPC PILOT CIRCUIT)

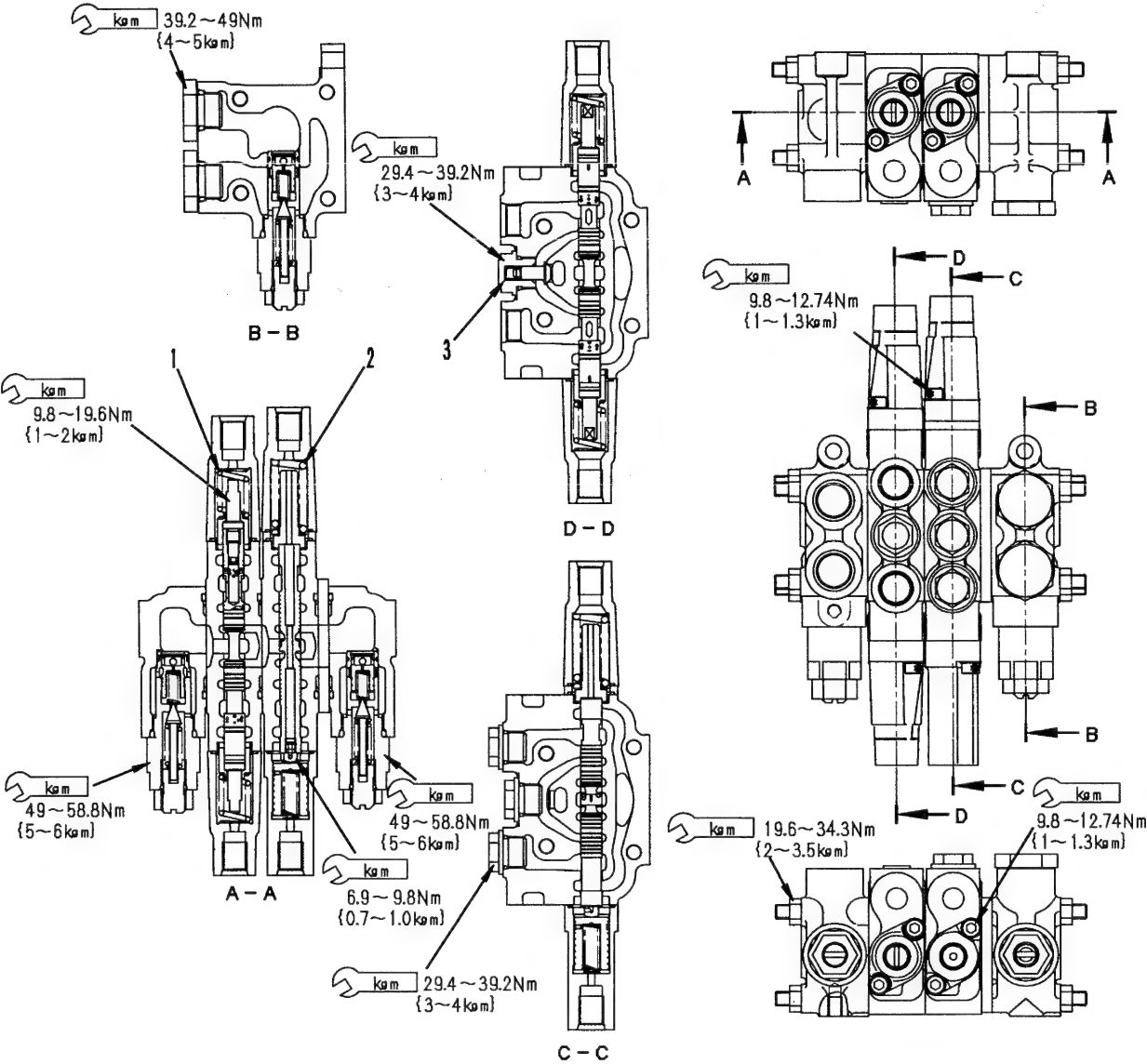


SKL00547

023S05

Unit: mm						
No.	Check item	Criteria				Remedy
1	Main valve spring	Standard size			Repair limit	Replace
		Free length × O.D.	Installed length	Installed load	Installed load	
		20.9 × 7.2	17	19.6 N {2 kg}	15.7 N {1.6 kg}	
2	Poppet spring	31.0 × 8.4	26.7	37.0 N {3.77 kg}	29.6 N {3.02 kg}	

SWING CONTROL VALVE



SKL00548

Unit: mm

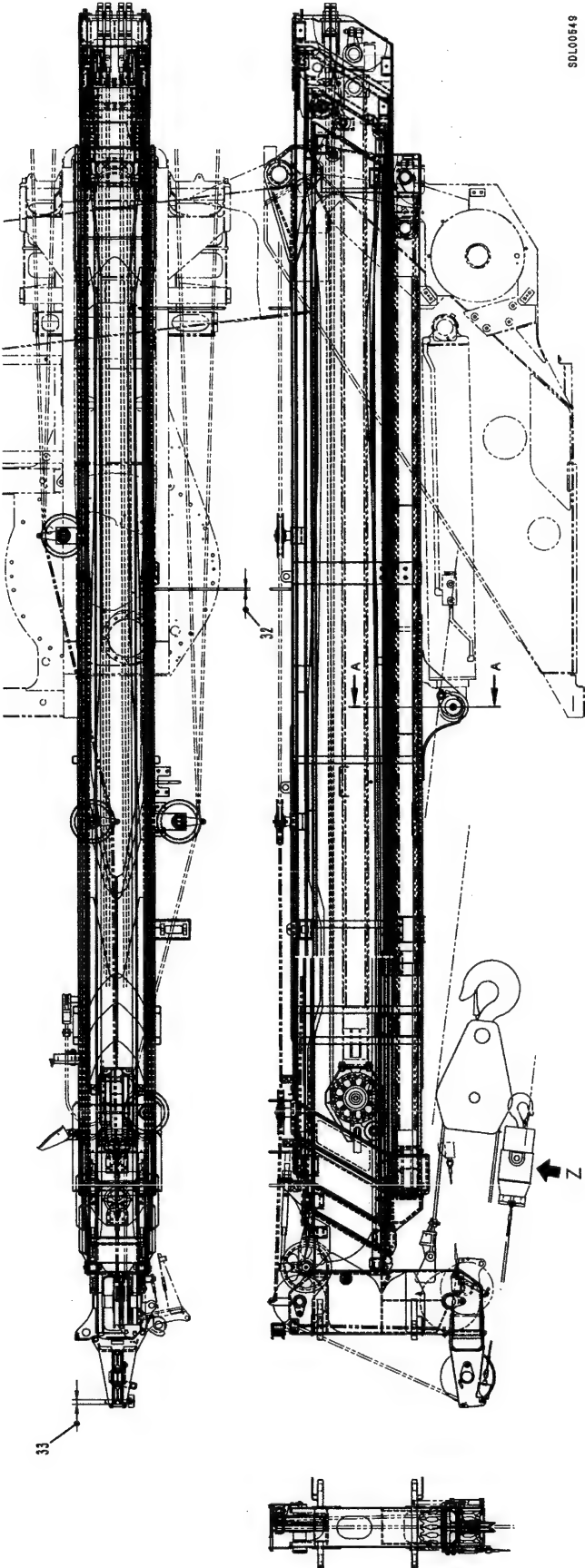
No.	Check item	Criteria					Remedy
1	Spool return spring	Standard size			Repair limit		Replace spring if damaged or deformed
		Free length	Installed length	Installed load	Free length	Installed load	
		29.8	28.5	49 N {5.0 kg}	—	39.2 N {4.0 kg}	
2	Spool return spring	43.3	42.5	49.7 N {10.2 kg}	—	79.8 N {8.2 kg}	
3	Check valve spring	13	6	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	

023S05

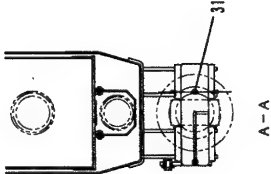
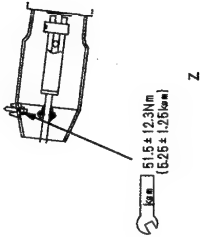
BOOM (1/4)

★ For details of this page, see page 90-401.

023S05

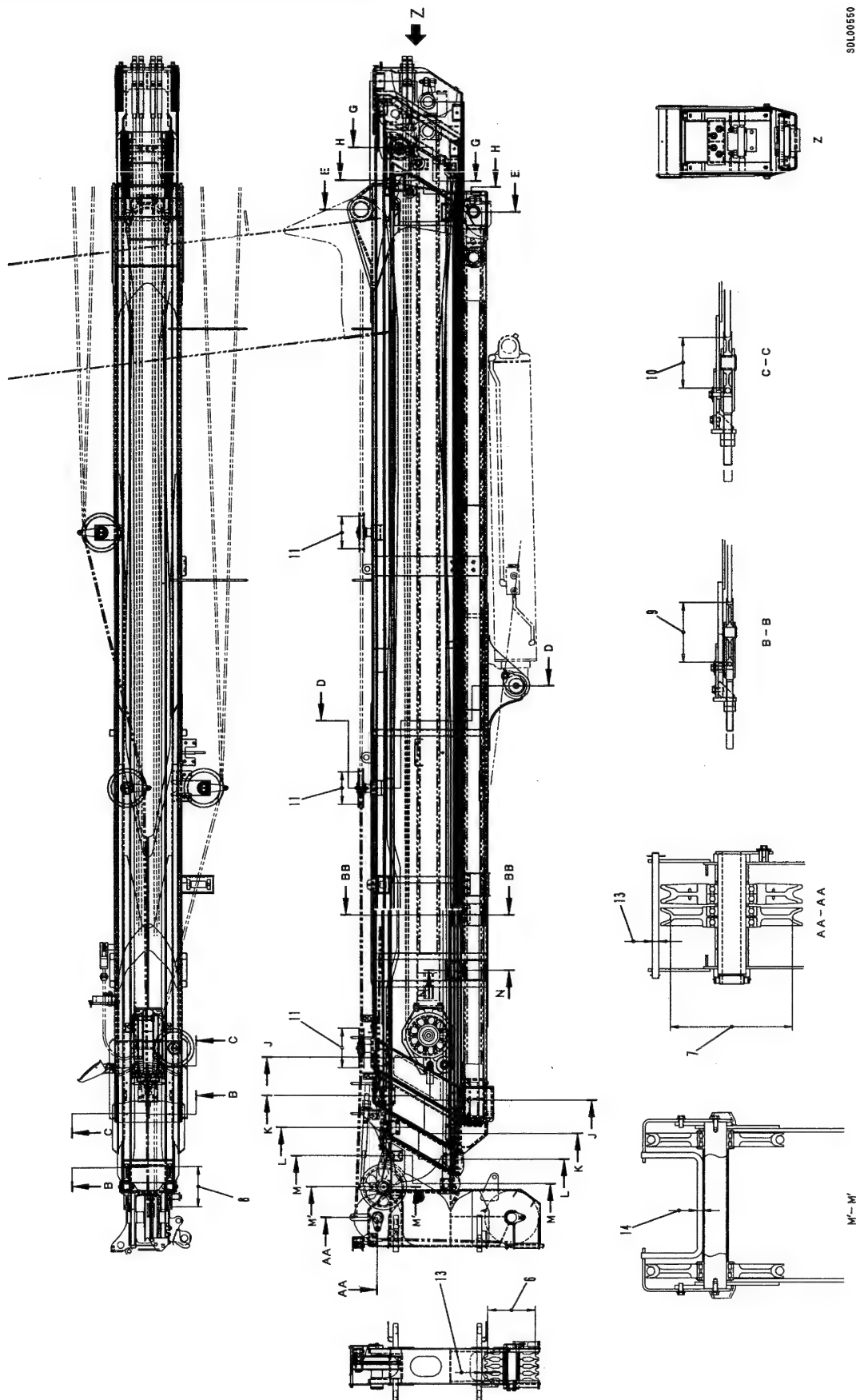


SDLO0549



BOOM (2/4)

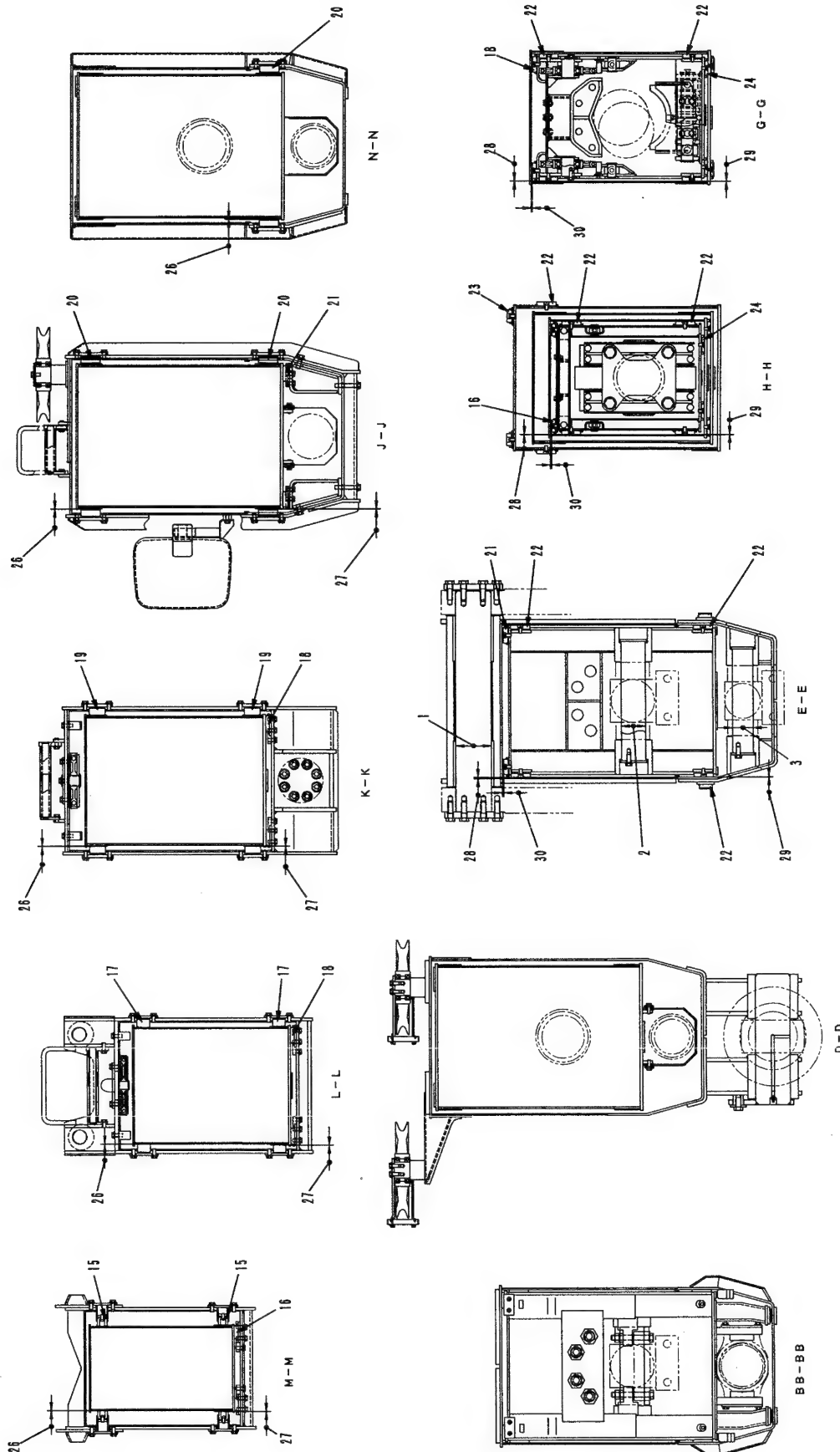
★ For details of this page, see page 90-403.



023S05

BOOM (3/4)

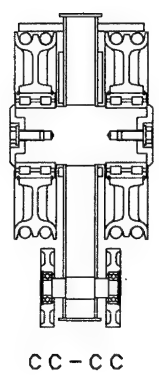
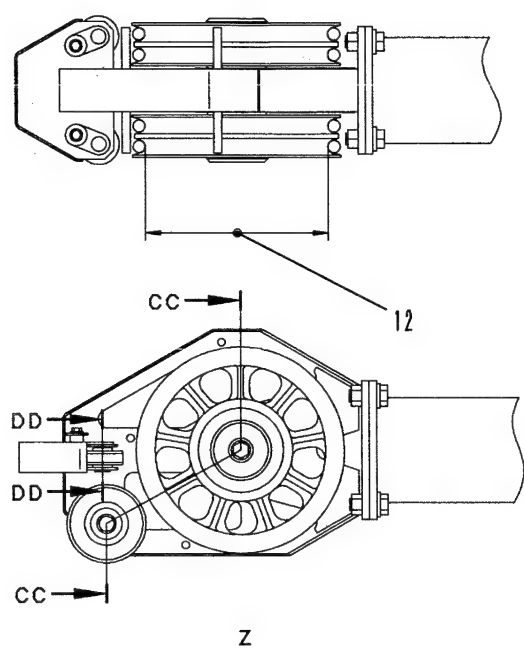
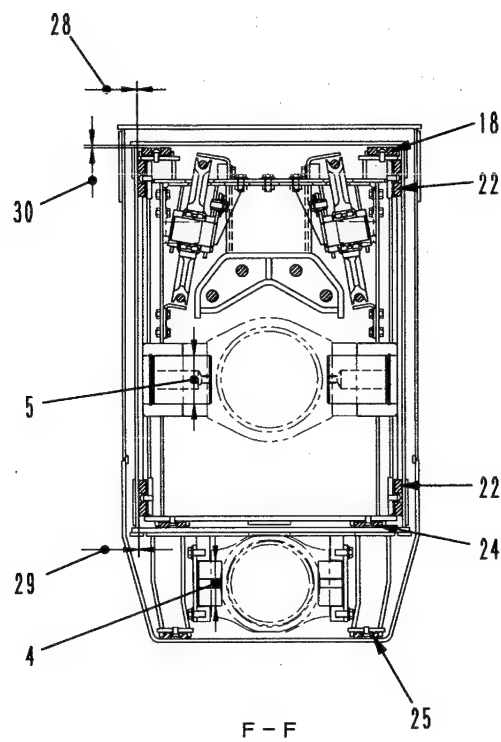
★ For details of this page, see page 90-405.



80L00551

023S05

BOOM (4/4)



023S05

SDL00552

Unit: mm

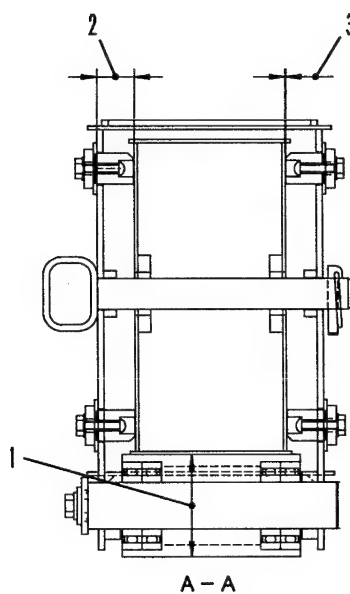
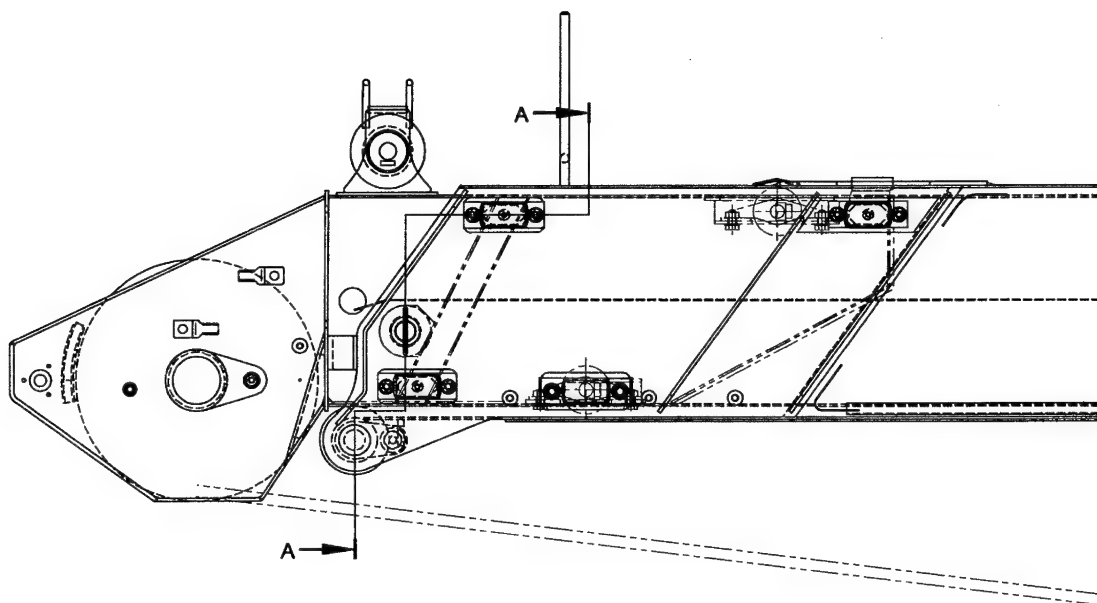
No.	Check item	Criteria					Remedy
1	Clearance between boom foot pin and bushing	Standard size		Tolerance		Standard clearance	Clearance limit
				Shaft	Hole		
2	Clearance between telescope cylinder mounting pin and piston rod	110		-0.072 -0.126	+0.143 +0.023	0.049 – 0.269	1.0
3	Clearance between telescope cylinder mounting pin and cylinder support	75		-0.060 -0.134	+0.300 0	0.060 – 0.434	1.0
4	Clearance between telescope cylinder mounting pin and cylinder support	65		-0.060 -0.134	+0.300 0	0.060 – 0.434	1.0
5	Clearance between telescope cylinder mounting pin and cylinder support	Shaft	Hole	-0.060 -0.134	+0.02 0	1.06 – 1.334	2
		74	75				
6	Clearance between telescope cylinder mounting pin and piston rod	80		-0.060 -0.134	+0.35 0	0.06 – 0.484	1.0
7	Diameter of boom load sheave groove	Standard size			Repair limit		
		352.0 ⁺¹ ₀			348.0		
8	Diameter of boom idler sheave groove	304 ⁺¹ ₀			300		
9	Diameter of boom EXTEND sheave groove	300 ^{+2.5} ₀			293.5		
10	Diameter of boom RE-TRACT sheave groove	150 ^{+2.5} ₀			146.5		
11	Diameter of boom RE-TRACT sheave groove	126 ^{+2.5} ₀			122.5		
12	Diameter of boom guide sheave groove	244 ⁺¹ ₀			240		
13	Diameter of boom EXTEND sheave groove	300 ^{+2.5} ₀			293.5		
14	Outside diameter of top boom rope stopper bar	16.0			11.0		
15	Outside diameter of 4th boom top rope guide bar	13			8		
16	Thickness of pad at front side face of 4th boom	25			23		
17	Thickness of pad at front bottom face of 4th boom, pad at rear top face of top boom	12			10		
18	Thickness of pad at front side face of 3rd boom	22			20		
19	Thickness of pad at front bottom face of 3rd, 2nd boom, rear top face of 3rd, 4th boom	12			10		
20	Thickness of pad at front side face of 2nd boom	22			20		
21	Thickness of pad at front side face of base boom	22			20		

023S05

Unit: mm

No.	Check item	Criteria				Remedy	
21	Thickness of pad at front bottom face of base boom, rear top face of 2nd boom	Standard size		Clearance limit		Replace	
		15		13			
22	Thickness of pad at rear side face of top, 4th, 3rd, 2nd, base boom	12		10			
23	Thickness of pad at rear top face of 2nd boom	15		13			
24	Thickness of pad at rear bottom face of top boom	9		7			
25	Thickness of pad at rear bottom face of 2nd boom	9		7			
26	Clearance between boom and pad at top of front side face of top, 4th, 3rd, 2nd, base boom	0.3 – 0.5					
27	Clearance between boom and pad at bottom of front side face of top, 4th, 3rd, 2nd, base boom	0.3 – 0.5					
28	Clearance between boom and pad at top of rear side face of top, 4th, 3rd, 2nd boom	0.3 – 0.5					
29	Clearance between boom and pad at bottom of rear side face of top, 4th, 3rd, 2nd boom	0.3 – 0.5					
30	Clearance between boom and pad at rear top face of top, 4th, 3rd, 2nd boom	0.4					
31	Clearance between boom hoist cylinder mounting pin and piston rod	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		110	–0.072 –0.126	+0.260 +0.120	0.192 – 0.386	1.0	
32	Outside diameter of rope guide bar at top of base boom	Standard size		Repair limit			
		16		11			
33	Outside diameter of single top rope stopper bar	16		11			

023S05

JIB


SDL00553

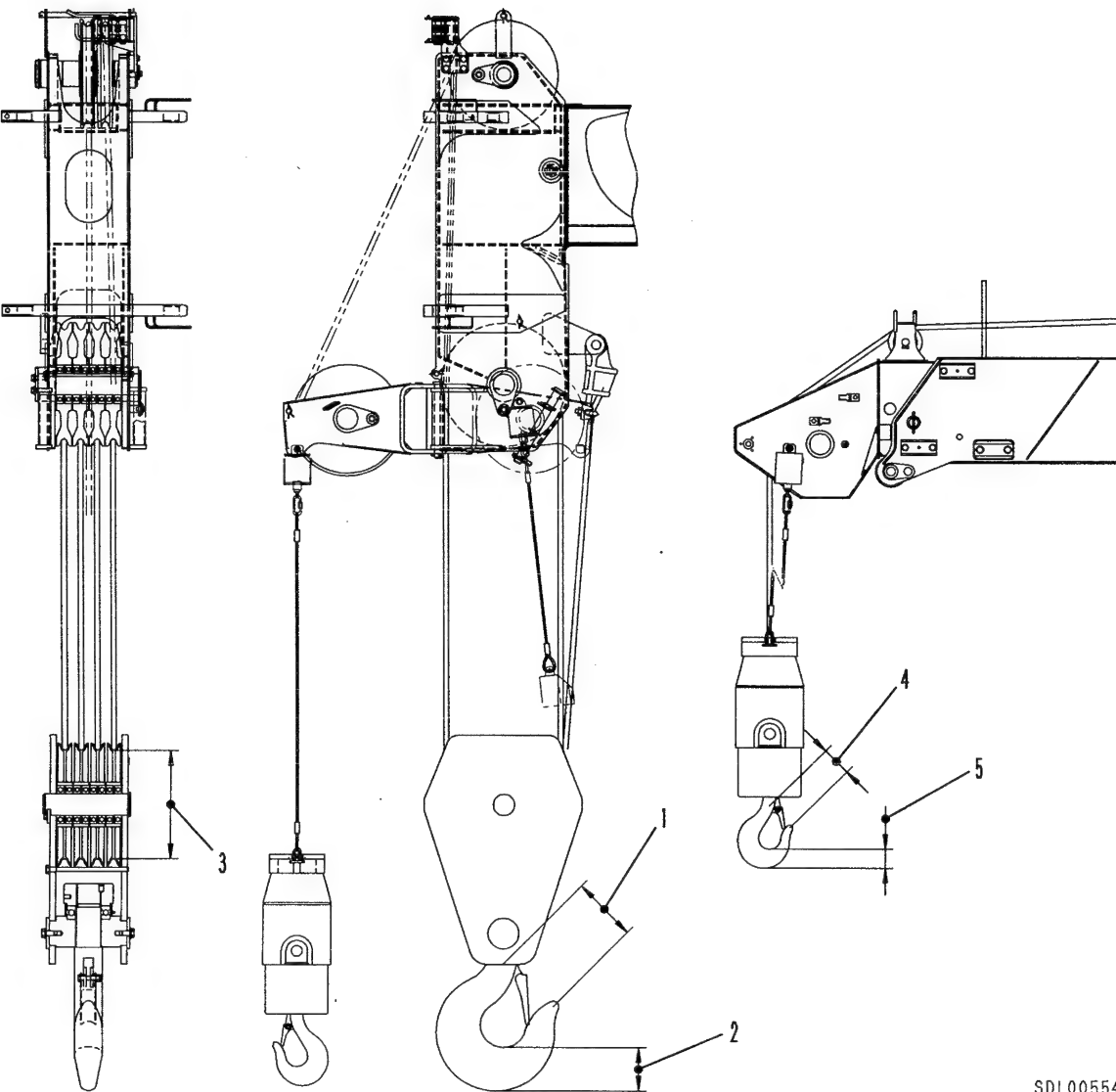
Unit: mm

No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Outside diameter of 2nd jib roller	99	96	Replace
2	Thickness of pad at side face of jib	35	33	
3	Clearance between pad at side face of jib and 2nd jib	0.5 - 1.0		Adjust shim

HOOK

MAIN HOOK

AUXILIARY HOOK

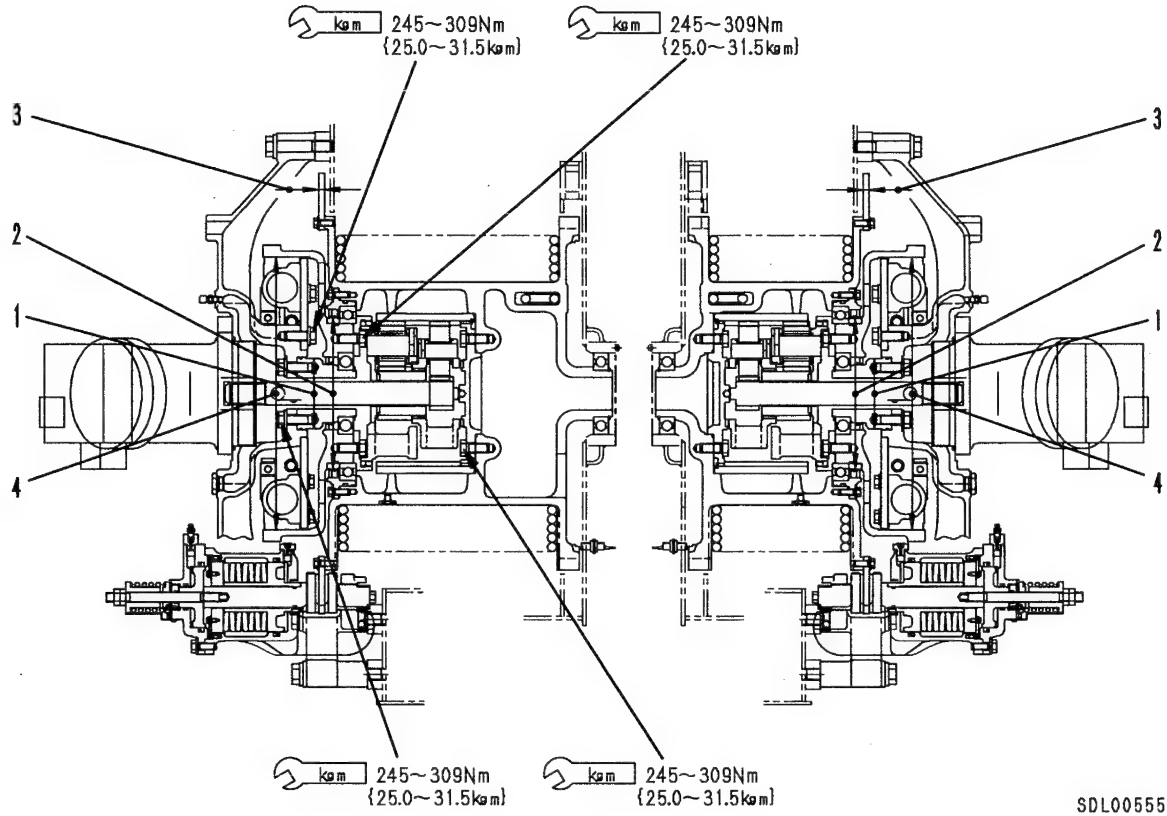


SDL00554

Unit: mm

No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Opening of main hook	210.0	215.0	Replace
2	Wear of main hook	139.5	135.5	
3	Diameter of main hook sheave groove	352.0	348.0	
4	Opening of auxiliary hook	95.0	97.5	
5	Wear of auxiliary hook	60.0	58.2	

WINCH DRUM AND MACHINERY

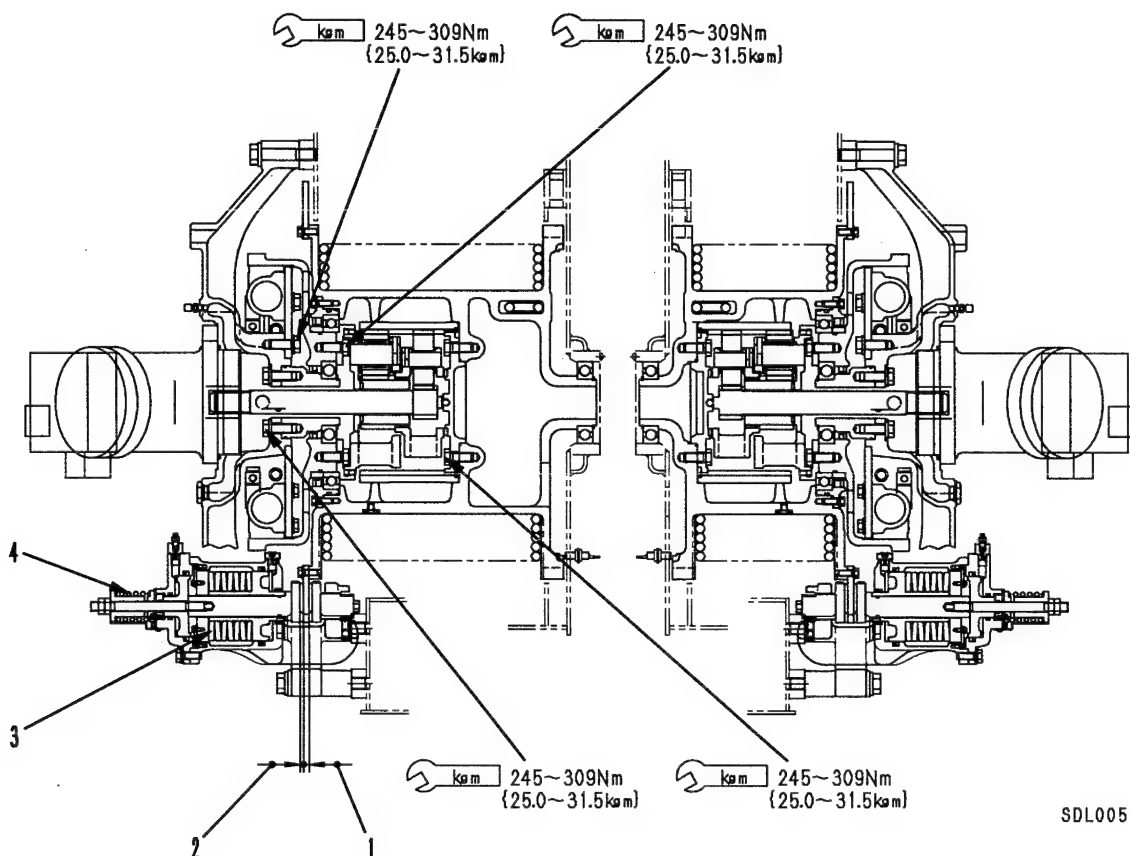


SDL00555

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Outside diameter of oil seal contact surface	100	0 -0.087	-0.12	Replace
2	Outside diameter of oil seal contact surface	260	0 -0.130	-0.18	
3	Thickness of disc (brake)	10	± 0.3	8	
4	Inside diameter of drum (clutch)	470	+0.2 0	472	

WINCH BRAKE



SDL00556

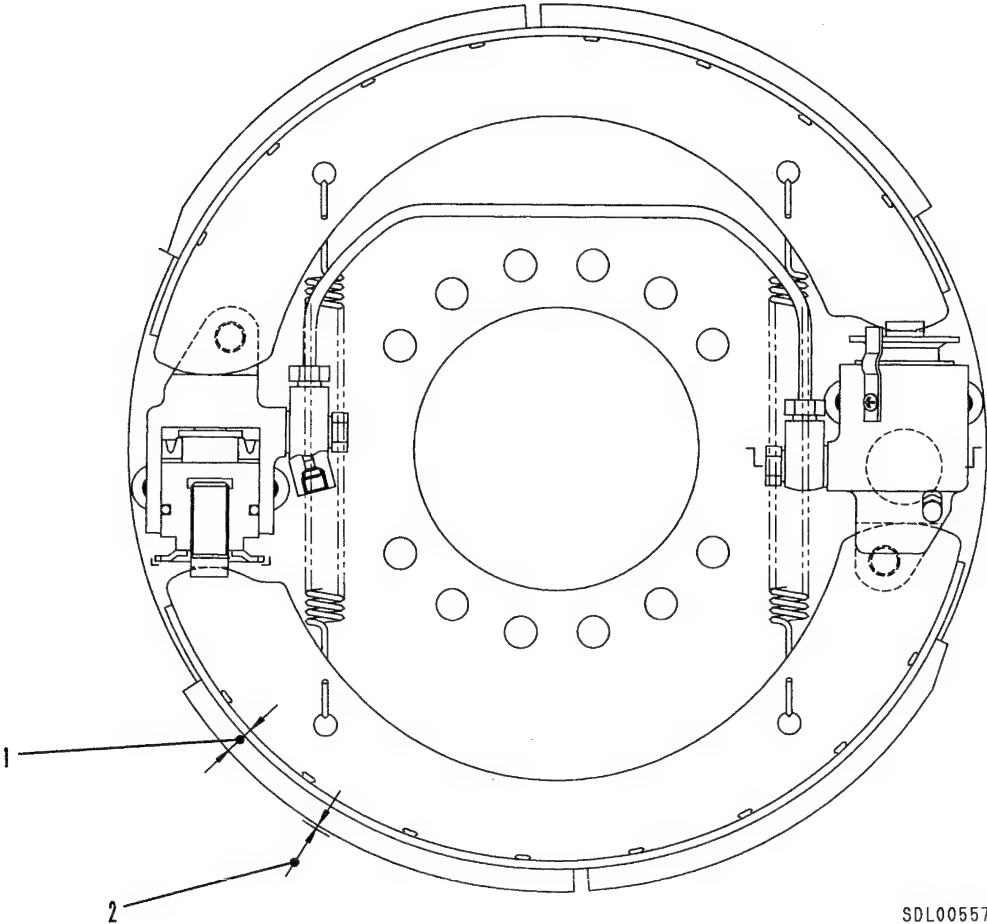
023S05

Unit: mm

No.	Check item	Criteria					Remedy
1	Thickness of brake pad	Standard size			Repair limit		Replace
		5.0			2.0		
2	Clearance between brake pad and disc	0.45 – 0.6	Tighten adjustment screw with a wrench until it becomes heavy, bring drum and lining into tight contact, then turn adjustment screw back 3 - 4 notches				Adjust
3	Brake spring	Standard size			Repair limit		Replace
		Free length	Installed length	Installed load	Free length	Installed load	
		80.5	(Brake ON) 75.0	73,030 N {7,447 kg}	79.7		
4	Return spring	77	64	1,402.4 N {143 kg}	74.7		

WINCH CLUTCH

023S05

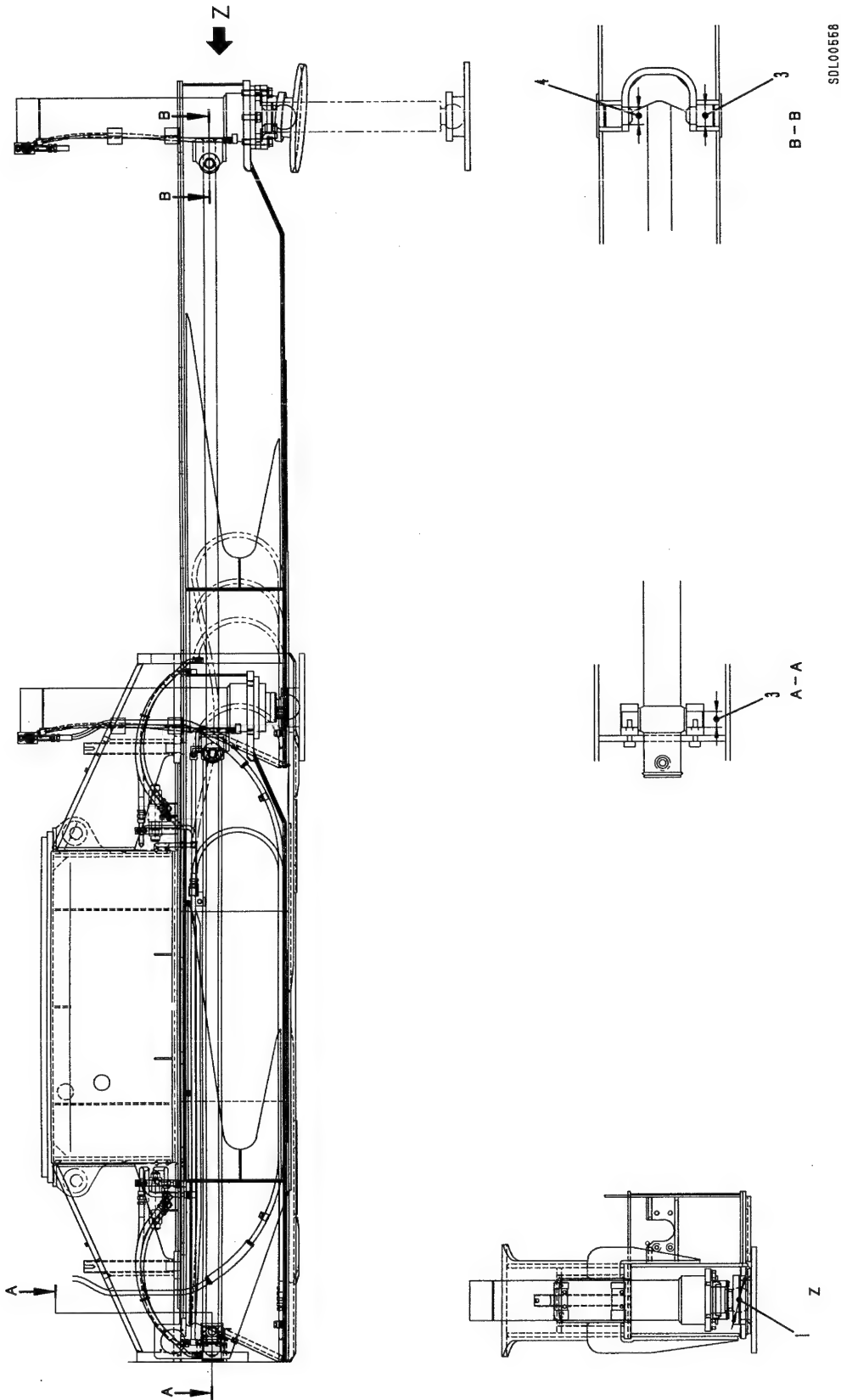


SDL00557

Unit: mm				
No.	Check item	Criteria		Remedy
1	Thickness of clutch lining	Standard size	Repair limit	Replace
		12	7.5	
2	Clearance between clutch lining and drum	0.75 ^{+1.0} _{-0.55} (Bring lining into close contact with drum, then turn back adjusting wheel 20 notches (1 turn).)		Adjust

CHASSIS, H-SHAPED OUTRIGGER

★ For details of this page, see page 90-407.



023S05

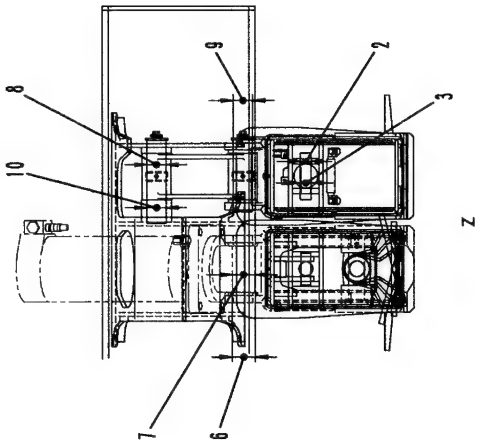
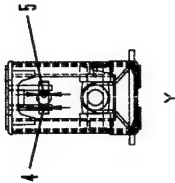
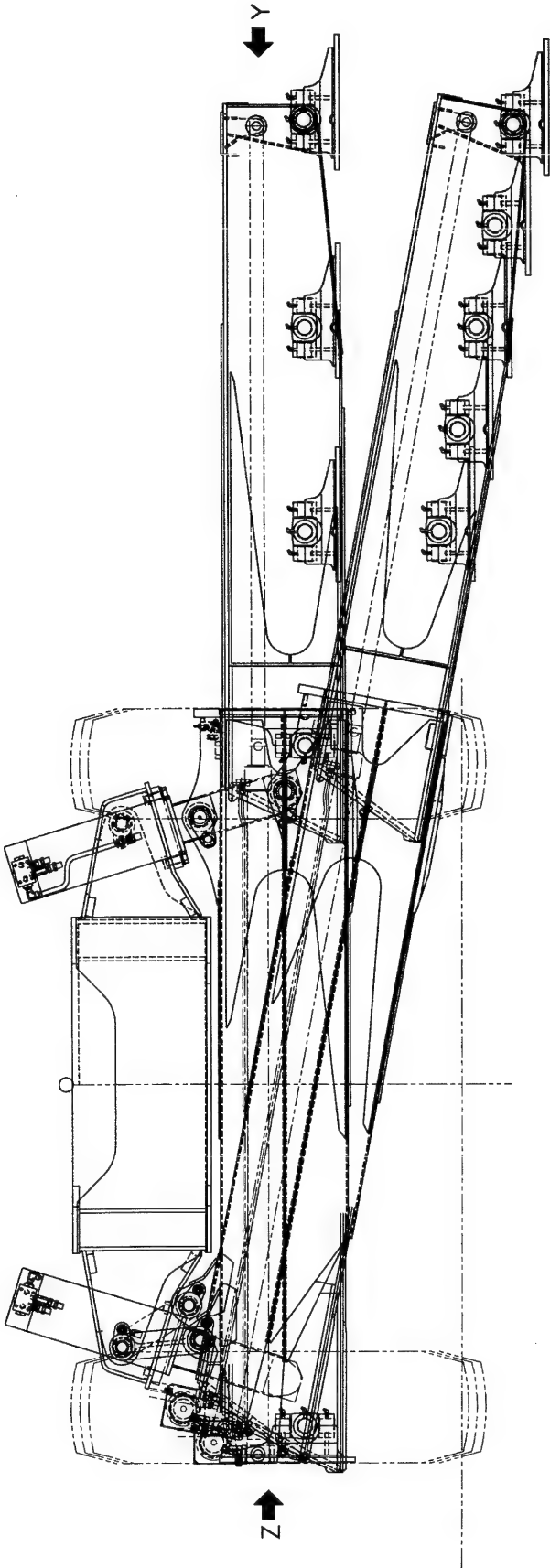
023S05

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
1	Clearance between jack cylinder spherical surface and float	Spherical 90	-0.100 -0.500	+1.000 0	0.100 – 1.500	—	Replace
2	Clearance between slide cylinder mounting pin and outrigger outer frame	30	-0.1 -0.300	+0.300 +0.100	0.200 – 0.600	—	
3	Clearance between slide cylinder mounting pin and outrigger inner frame	40	0 -0.062	+0.35 +0.30	0.300 – 0.412	—	
4	Clearance between slide cylinder mounting pin and cylinder	30	-0.100 -0.200	+0.800 +0.400	0.500 – 1.000	—	

CHASSIS, X-SHAPED OUTRIGGER

★ For details of this page, see page 90-409.



SDL00669

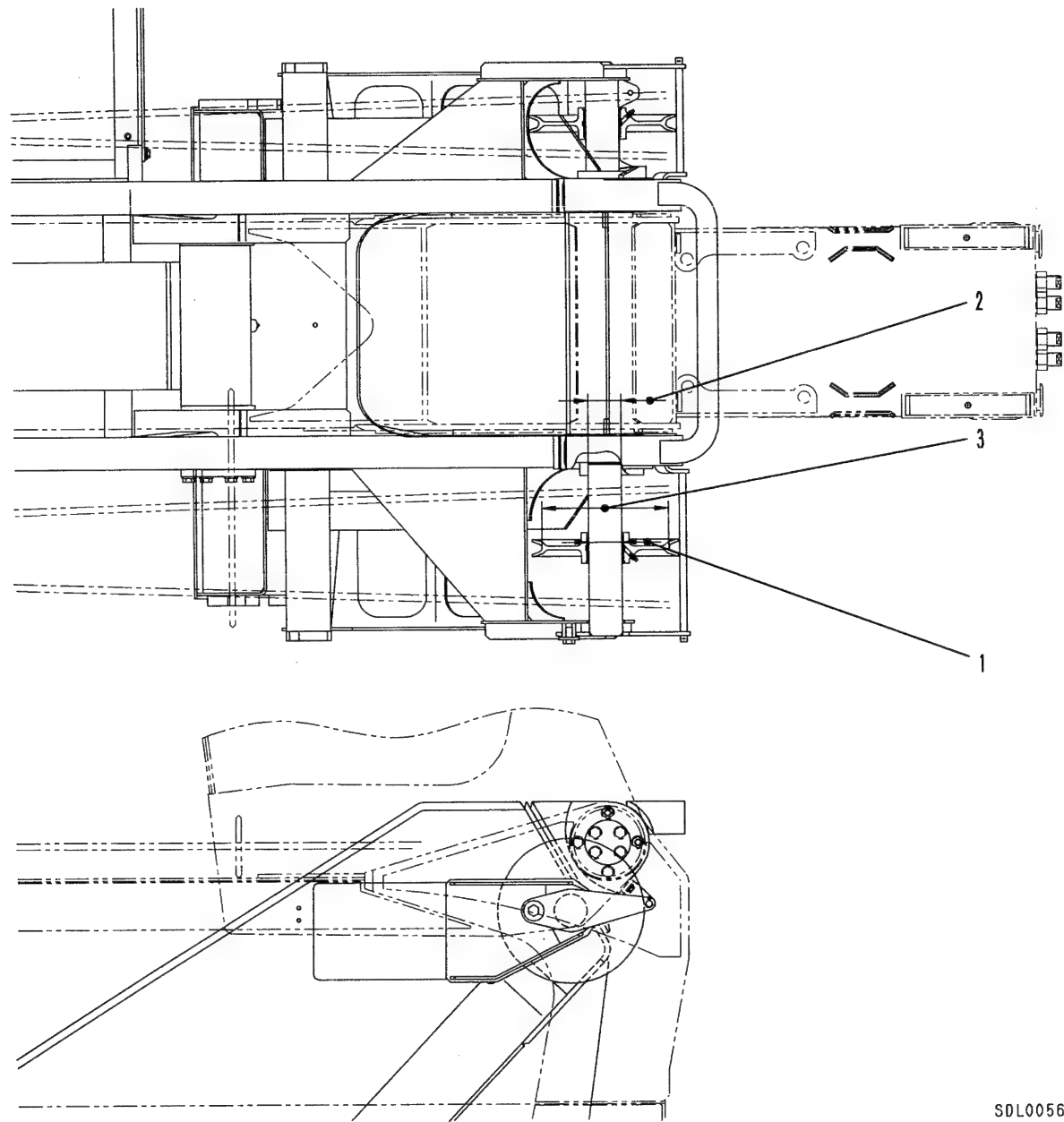
023S05

023S05

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between shaft and float	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		50	-0.025 -0.050	+0.039 0	0.025 – 0.089	—	
2	Clearance between slide cylinder mounting pin and outrigger outer frame	30	0 -0.100	+0.200 +0.100	0.100 – 0.300	—	
3	Clearance between slide cylinder mounting pin and cylinder	30	0 -0.100	+0.200 +0.100	0.100 – 0.300	—	
4	Clearance between slide cylinder mounting pin and outrigger inner frame	30	0. -0.100	+0.200 +0.100	0.100 – 0.300	—	
5	Clearance between slide cylinder mounting pin and cylinder	30	0 -0.100	+0.250 +0.100	0.100 – 0.350	—	
6	Clearance between jack cylinder mounting pin and outrigger outer frame	70	-0.030 -0.070	+0.150 0	0.030 – 0.220	—	
7	Clearance between jack cylinder mounting pin and cylinder	70	-0.030 -0.070	+0.170 +0.120	0.150 – 0.240	—	
8	Clearance between out-rigger outer frame mount-ing pin and lever	60	-0.030 -0.060	+0.030 0	0.030 – 0.090	—	
9	Clearance between out-rigger outer frame mount-ing pin and outer frame	60	-0.030 -0.060	+0.150 +0.050	0.080 – 0.210	—	
10	Clearance between outrigger outer frame mounting pin and frame	60	-0.030 -0.060	+0.150 0	0.030 – 0.210	—	

GUIDE SHEAVE



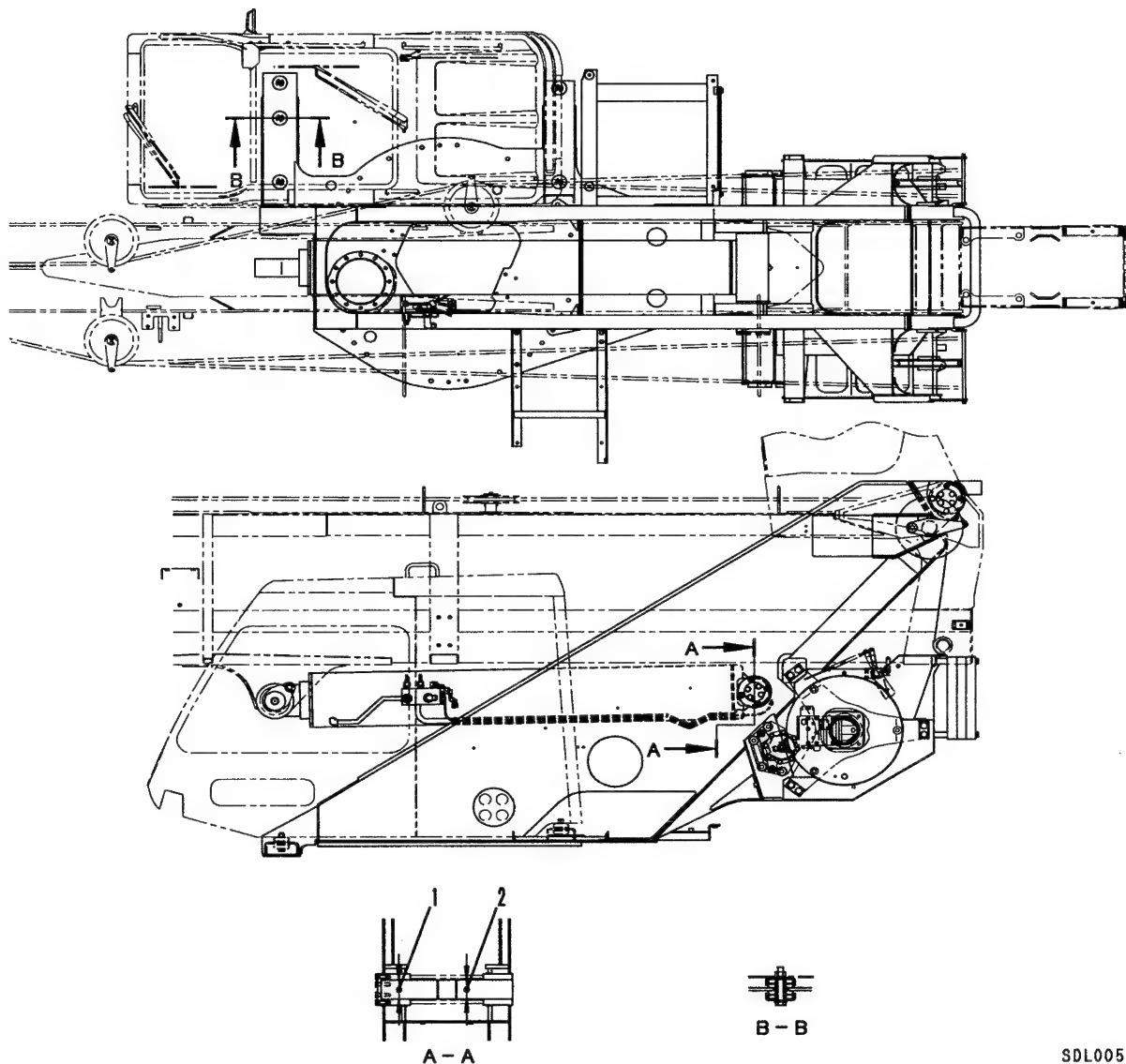
023S05

S0L00560

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between guide sheave slide shaft and sheave bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
2	Clearance between guide sheave slide shaft and support	80	0.030 −0.076	+0.174 +0.110	0.130–0.244	0.8	
		80	0.030 −0.076	+0.074 0	0.030–0.150	—	
3	Diameter of guide sheave groove	Standard size			Repair limit		
		306			302		

REVOLVING FRAME



023S05

SDL00561

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
1	Clearance between boom hoist cylinder mounting pin and frame	110	+0.072 +0.126	+0.260 +0.120	0.192 – 0.386	—	Replace
2	Clearance between boom hoist cylinder mounting pin and cylinder bushing	110	–0.072 –0.126	+0.143 +0.023	0.095 – 0.269	—	

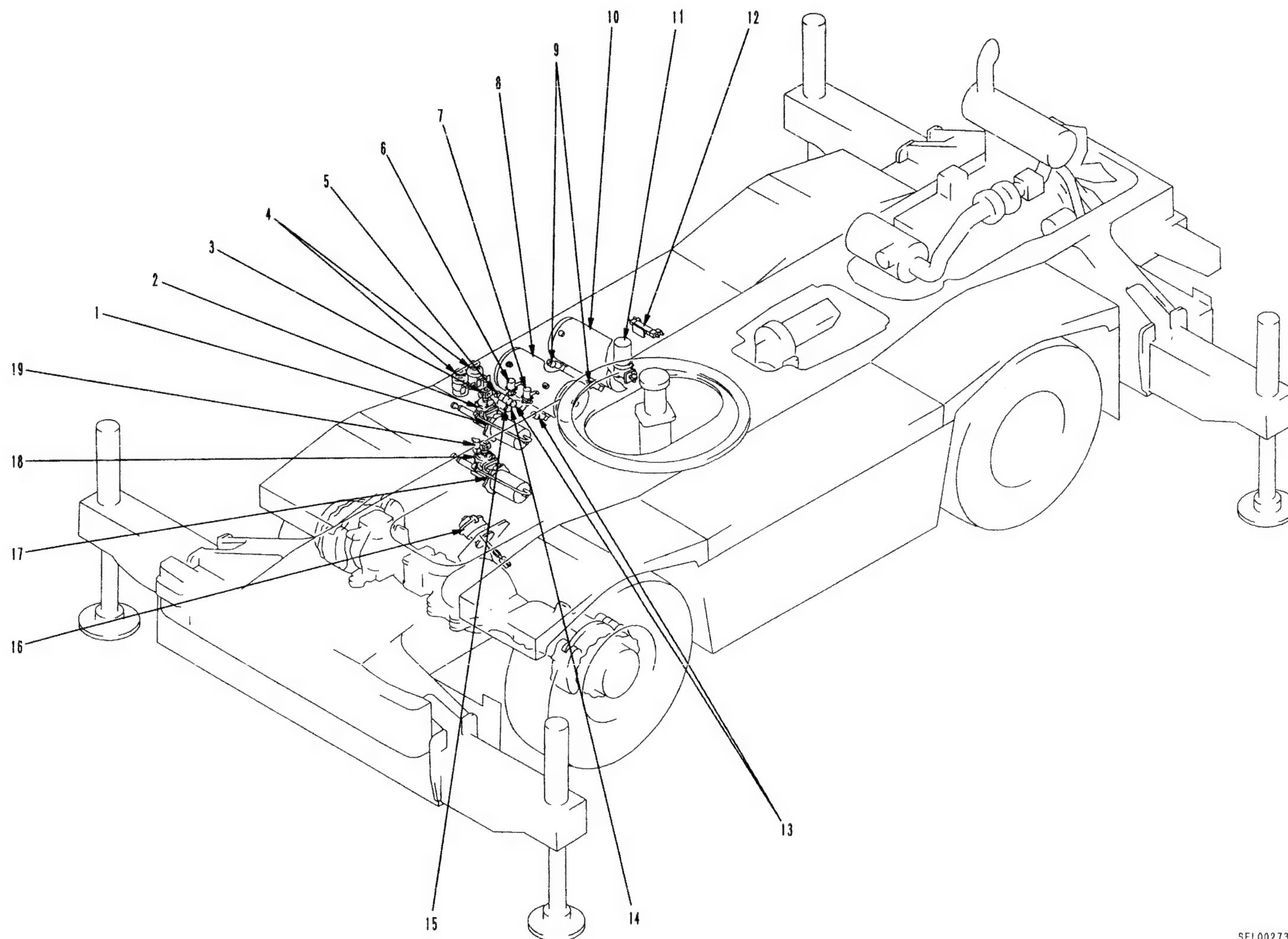
90 OTHERS

023S05

Air equipment piping drawing	
Undercarriage	90- 3
Upper structure	90- 5
Hydraulic circuit diagram	
(Steering, swing, suspension, work equipment)	
Upper structure	90- 11
Lower	90- 13
Work equipment, steering hydraulic equipment drawing	
Upper structure	90- 15
Undercarriage (H-shaped outrigger specification)	90- 17
Undercarriage (X-shaped outrigger specification)	90- 19
Boom	90- 21
Jib (machine with power tilt)	90- 23
Jib (machine with manual tilt jib)	90- 25
Electrical circuit diagram	
Upper structure (1/4)	90- 51
Upper structure (2/4)	90- 53
Upper structure (3/4)	90- 55
Upper structure (4/4)	90- 57
Work equipment (1/2)	90- 59
Work equipment (2/2)	90- 61
Panel (1/2)	90- 63
Panel (2/2)	90- 65
Undercarriage (1/4)	90- 67
Undercarriage (2/4)	90- 69
Undercarriage (3/4)	90- 71
Undercarriage (4/4)	90- 73
Electrical component diagram	
Upper structure	90- 75
Cab	90- 77
Upper structure top view	90- 79
Overwind prevention system drawing	90- 81
Overload safety system drawing	90- 83
System construction chart	90- 85
Connector allocation diagram	90-201
Moment limiter system electrical circuit diagram	90-207
Boom	90-401
Chassis, H-shaped outrigger	90-407
Chassis, X-shaped outrigger	90-409

AIR EQUIPMENT PIPING DRAWING (1/2)

UNDERCARRIAGE



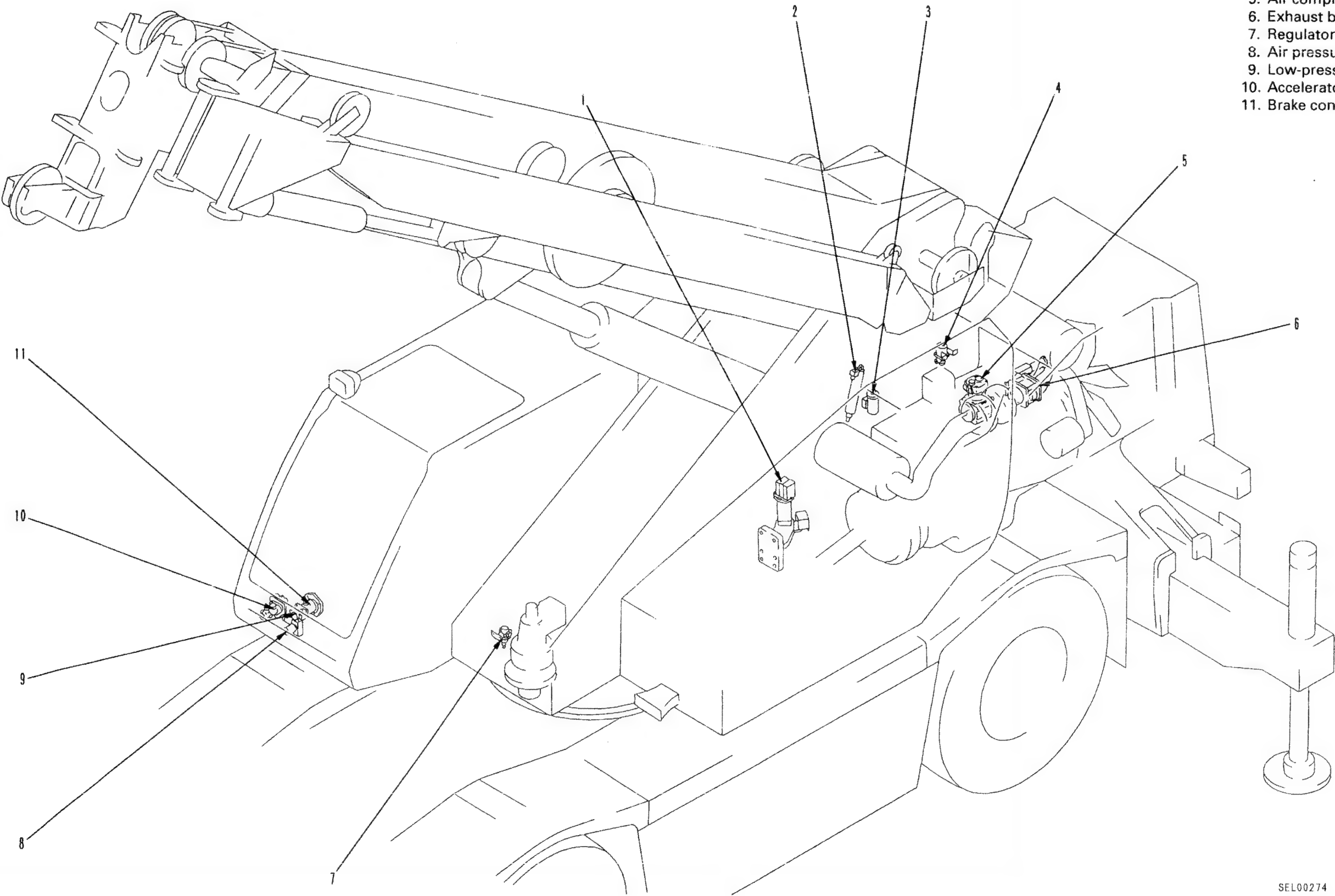
1. Brake booster (for rear brake)
2. Relay valve (for rear brake)
3. Shuttle valve (for rear brake)
4. Brake oil reservoir
5. Safety valve
6. Auxiliary brake valve
7. Parking brake valve
8. Dry tank
9. Check valve
10. Wet tank, dry tank for auxiliary equipment
11. Centralized greasing pump
12. Rear steering lock valve
13. Check valve
14. Cap
15. Socket
16. Parking brake chamber
17. Brake booster (for front brake)
18. Relay valve (for front brake)
19. Shuttle valve (for front brake)

SEL00273

AIR EQUIPMENT PIPING DRAWING (2/2)

UPPER STRUCTURE

- 1. Rear steering lock cylinder
- 2. Accelerator control cylinder
- 3. Air governor
- 4. Exhaust brake valve
- 5. Air compressor
- 6. Exhaust brake butterfly valve
- 7. Regulator
- 8. Air pressure sensor
- 9. Low-pressure sensor
- 10. Accelerator control valve
- 11. Brake control valve

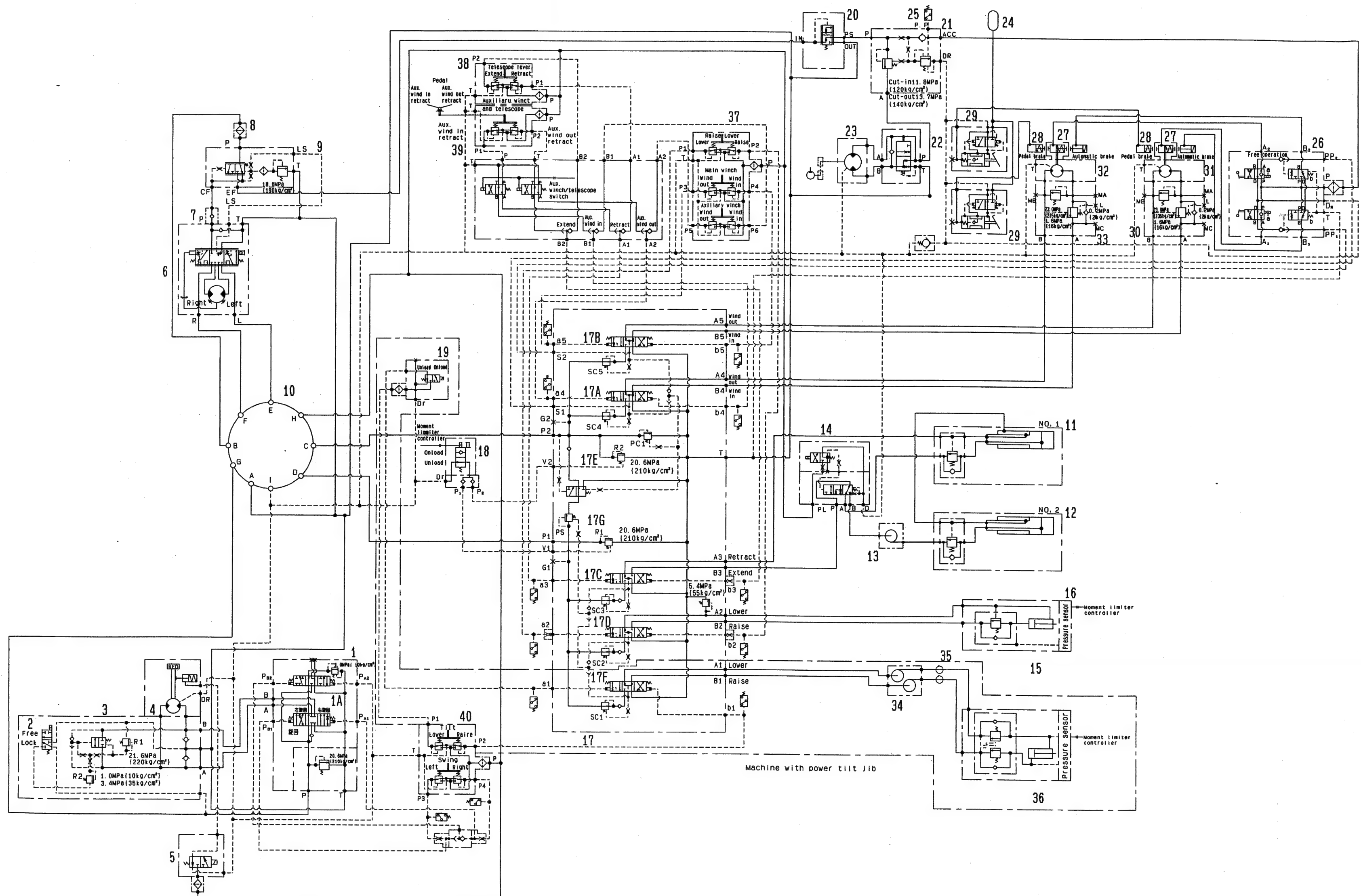


023S05

SEL00274

HYDRAULIC CIRCUIT DIAGRAM (STEERING, SWING, SUSPENSION, WORK EQUIPMENT)

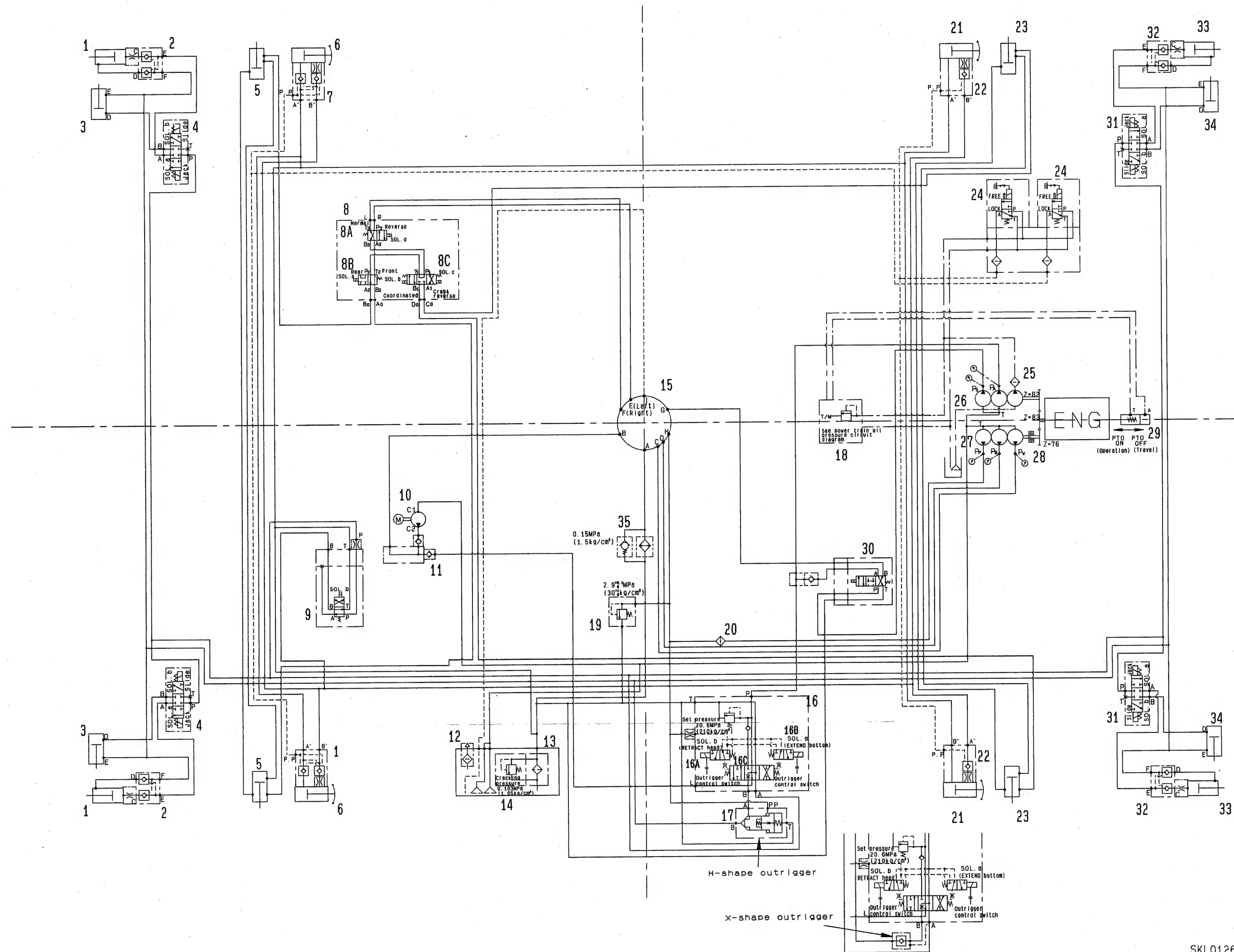
UPPER STRUCTURE



SVL01717

LOWER

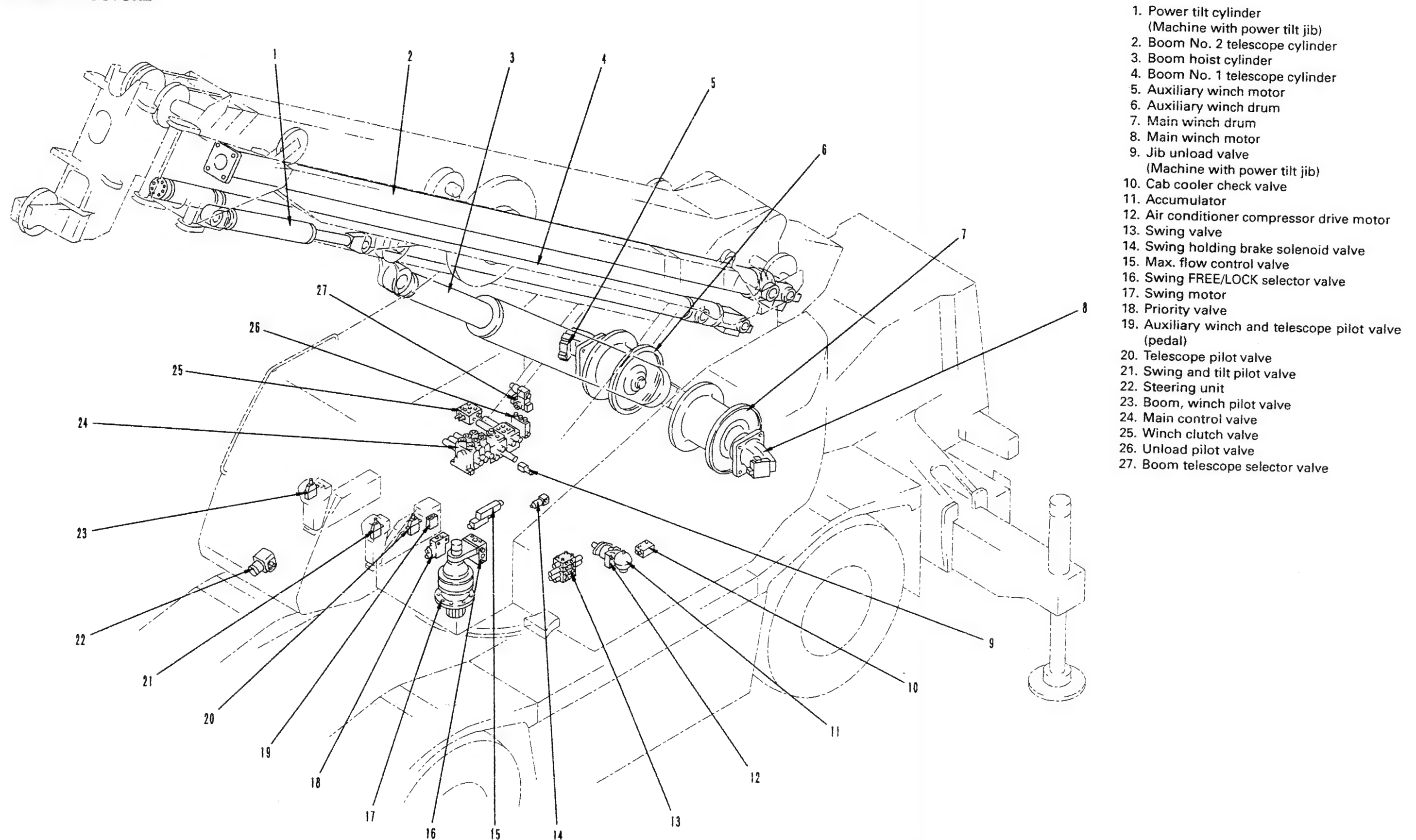
023S05



SKL01265

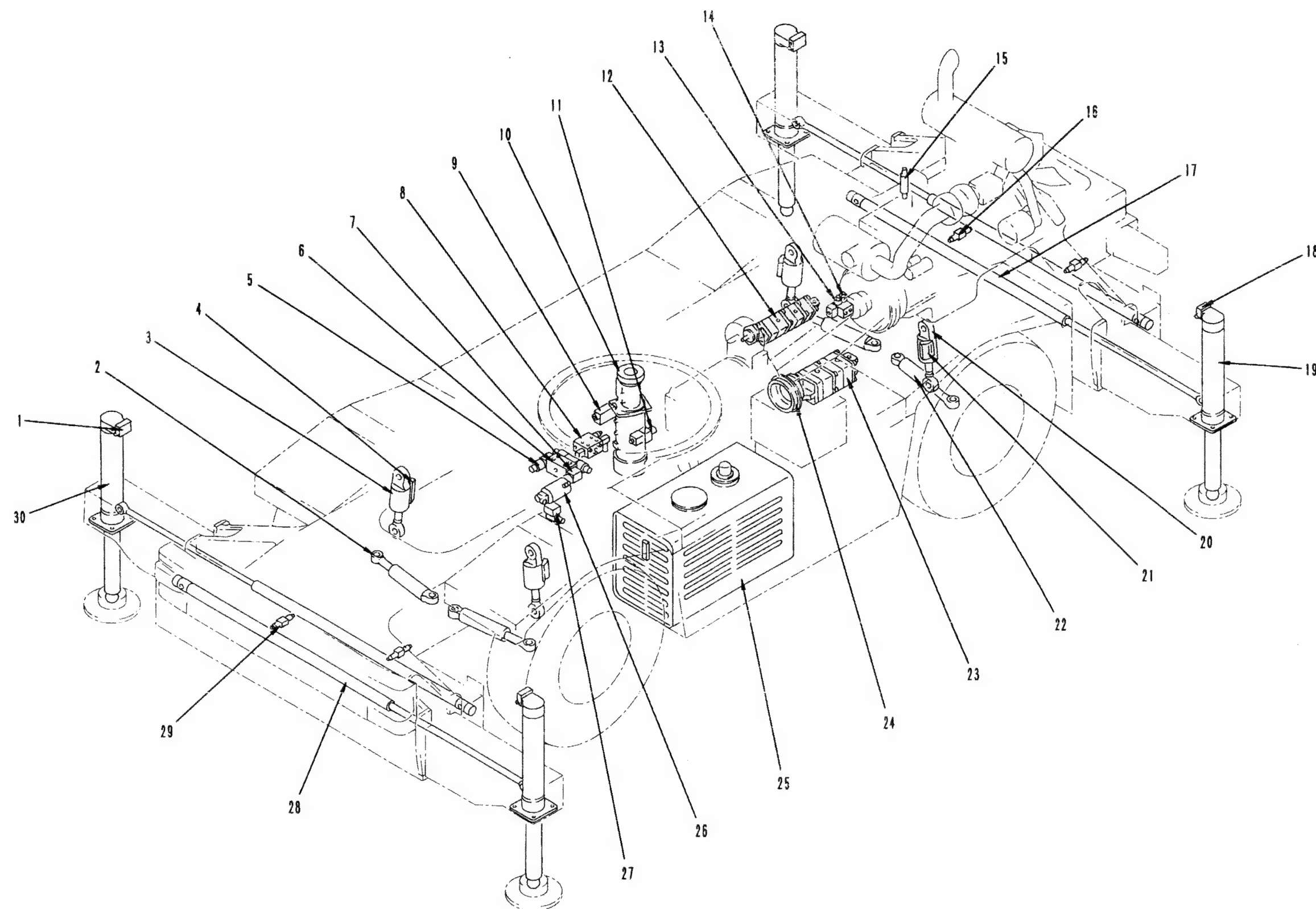
WORK EQUIPMENT, STEERING HYDRAULIC EQUIPMENT DRAWING (1/3)

UPPER STRUCTURE



SLL00321

WORK EQUIPMENT, STEERING HYDRAULIC EQUIPMENT DRAWING (2/3)

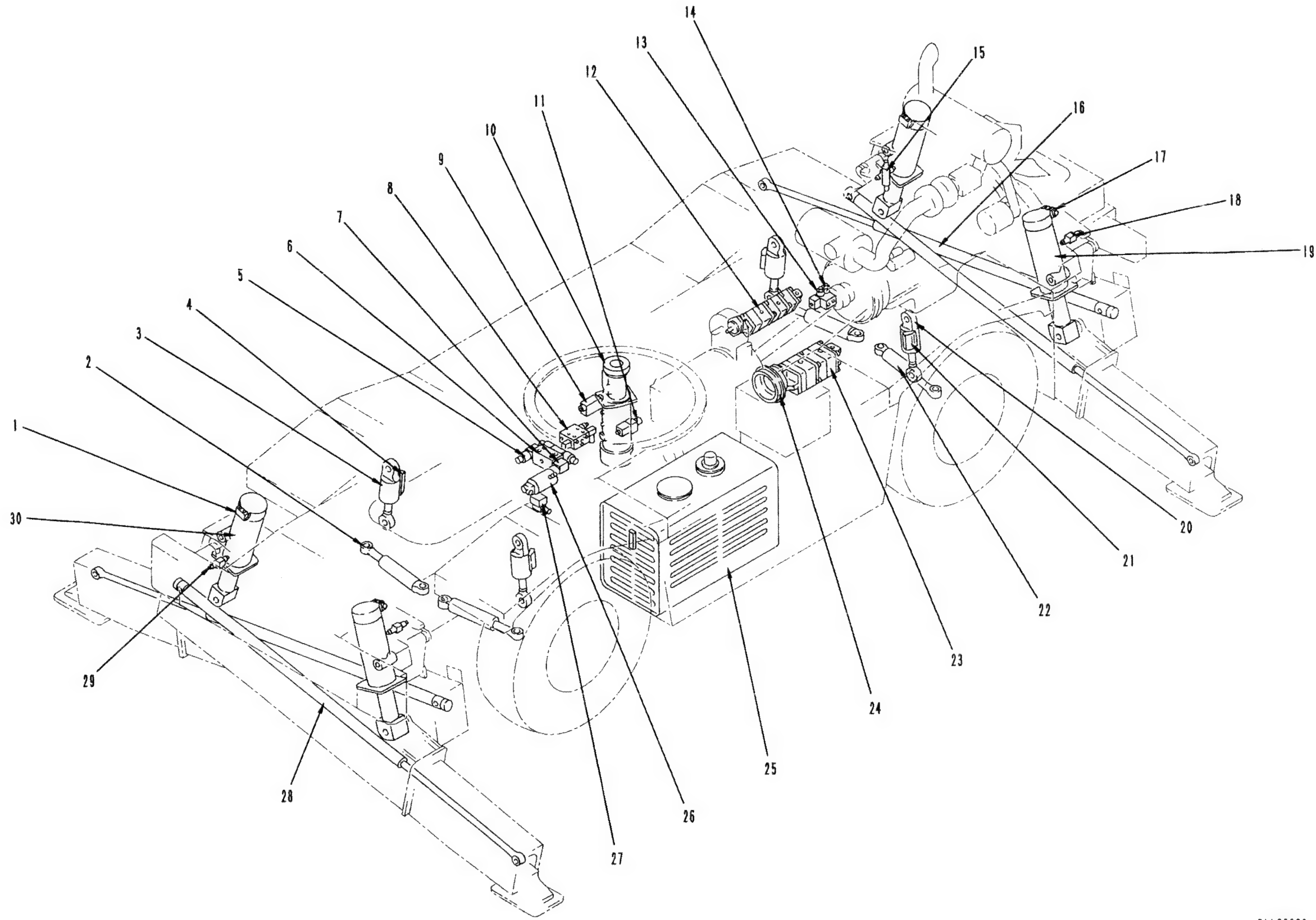
UNDERCARRIAGE
H-SHAPED OUTRIGGER SPECIFICATION

1. Outrigger jack pilot check valve
2. Steering cylinder
3. Suspension lock cylinder
4. Suspension lock double pilot check valve
5. Reverse steering selector valve
6. Steering mode selector valve
7. Rear wheel steering selector valve
8. Outrigger selector valve
9. Outrigger slide pilot check valve
10. Center swivel joint
11. Swing, outrigger merge selector valve
12. Transmission, steering, outrigger, swing pump
13. Suspension selector solenoid valve (front)
14. Suspension selector solenoid valve (rear)
15. Engine speed set cylinder
16. Outrigger individual valve
17. Outrigger slide cylinder
18. Outrigger jack pilot check valve
19. Outrigger jack cylinder
20. Suspension lock cylinder
21. Suspension lock pilot check valve
22. Steering cylinder
23. Hydraulic pump
24. PTO hydraulic clutch
25. Hydraulic tank
26. Emergency steering motor
27. Suspension selector solenoid valve
28. Outrigger slide cylinder
29. Outrigger individual valve
30. Outrigger jack cylinder

SLL00322

WORK EQUIPMENT, STEERING HYDRAULIC EQUIPMENT DRAWING (3/3)

UNDERCARRIAGE
X-SHAPED OUTRIGGER SPECIFICATION

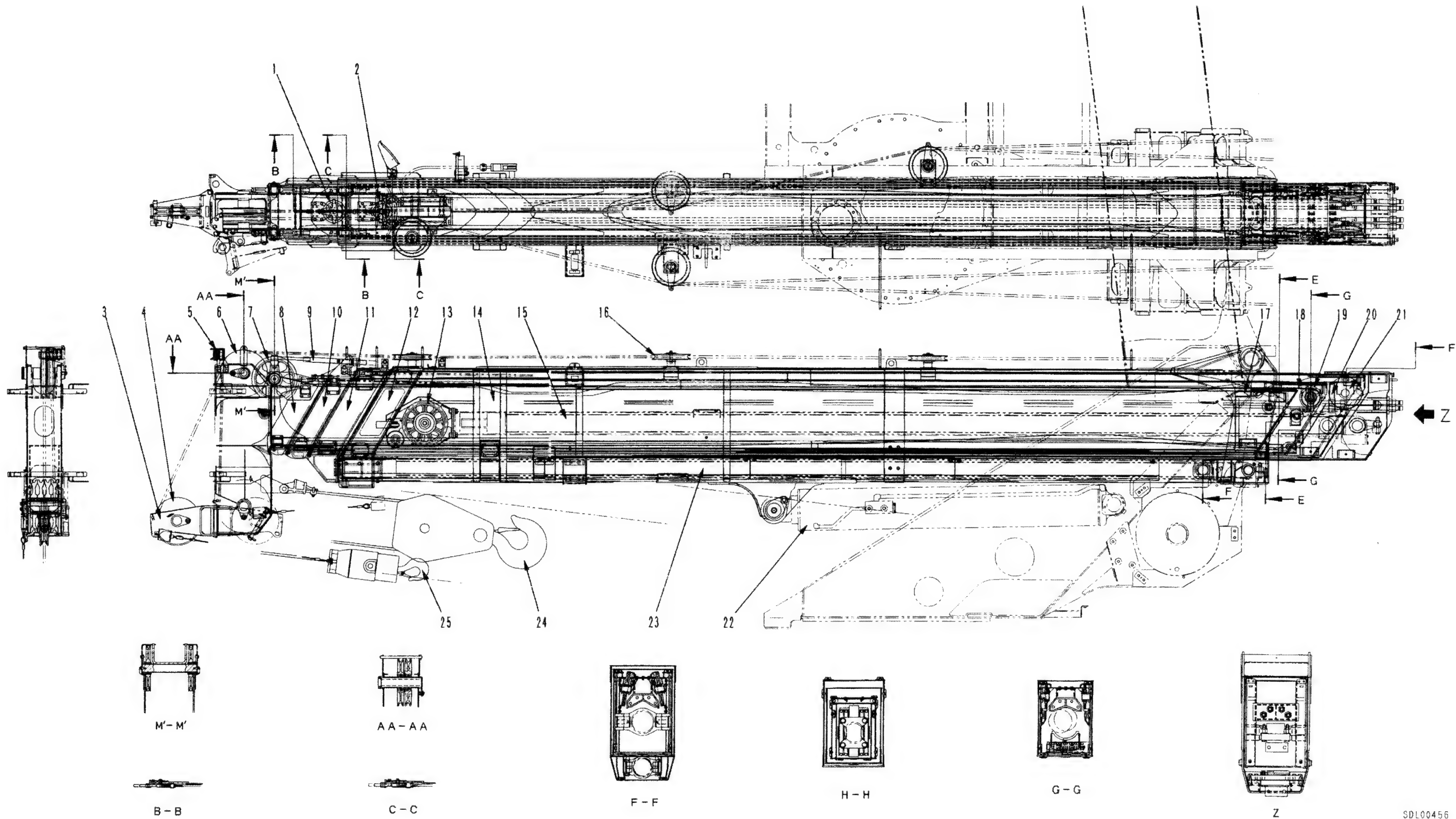


1. Outrigger jack pilot check valve
2. Steering cylinder
3. Suspension lock cylinder
4. Suspension lock double pilot check valve
5. Reverse steering selector valve
6. Steering mode selector valve
7. Rear wheel steering selector valve
8. Outrigger selector valve
9. Outrigger slide pilot check valve
10. Center swivel joint
11. Swing, outrigger merge selector valve
12. Transmission, steering, outrigger, swing pump
13. Suspension selector solenoid valve (front)
14. Suspension selector solenoid valve (rear)
15. Engine speed set cylinder
16. Outrigger slide cylinder
17. Outrigger jack pilot check valve
18. Outrigger individual valve
19. Outrigger jack cylinder
20. Suspension lock cylinder
21. Suspension lock pilot check valve
22. Steering cylinder
23. Hydraulic pump
24. PTO hydraulic clutch
25. Hydraulic tank
26. Emergency steering motor
27. Suspension selector solenoid valve
28. Outrigger slide cylinder
29. Outrigger individual valve
30. Outrigger jack cylinder

SLL00323

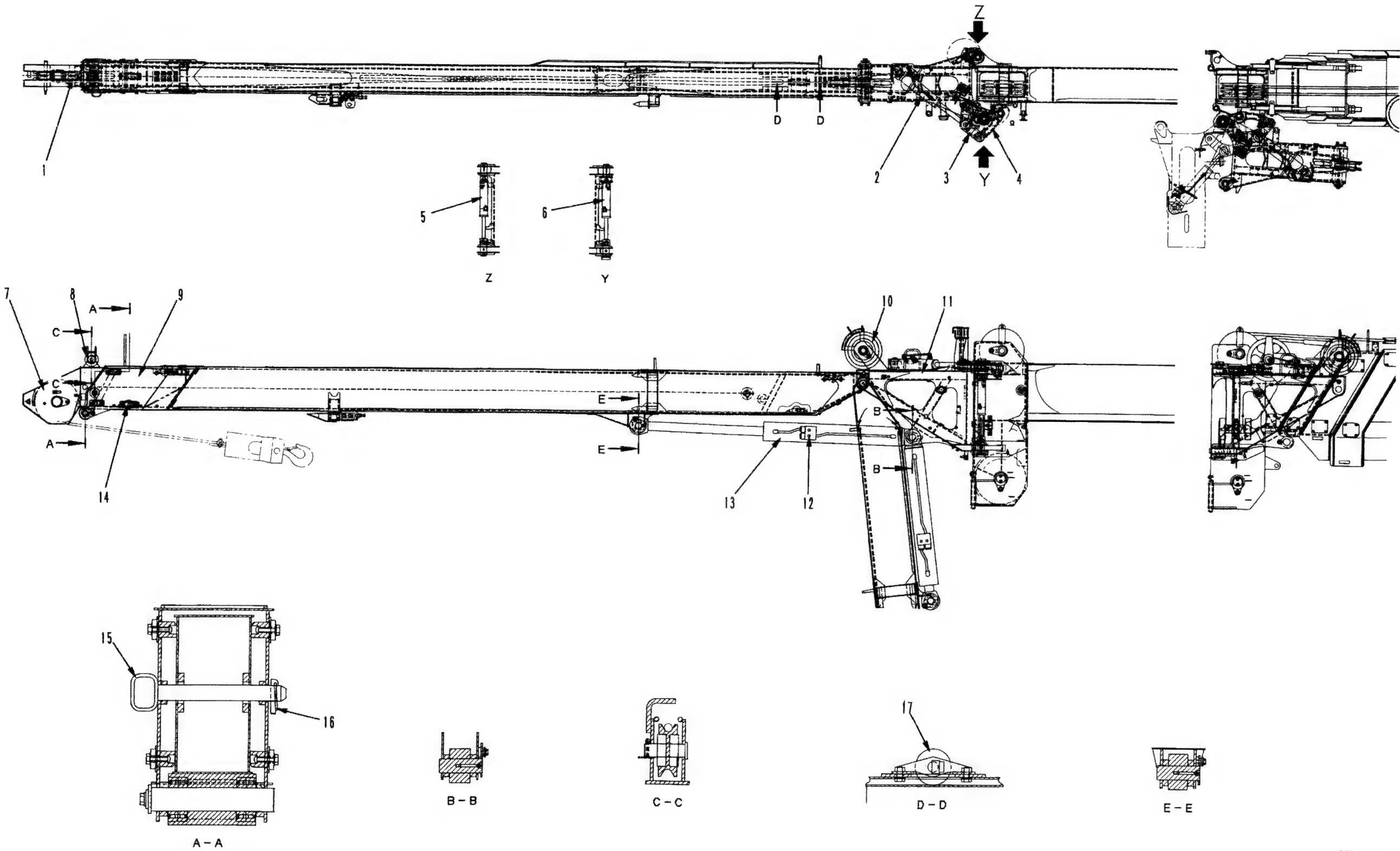
BOOM

023S05



SDL00456

JIB
(MACHINES WITH POWER TILT)

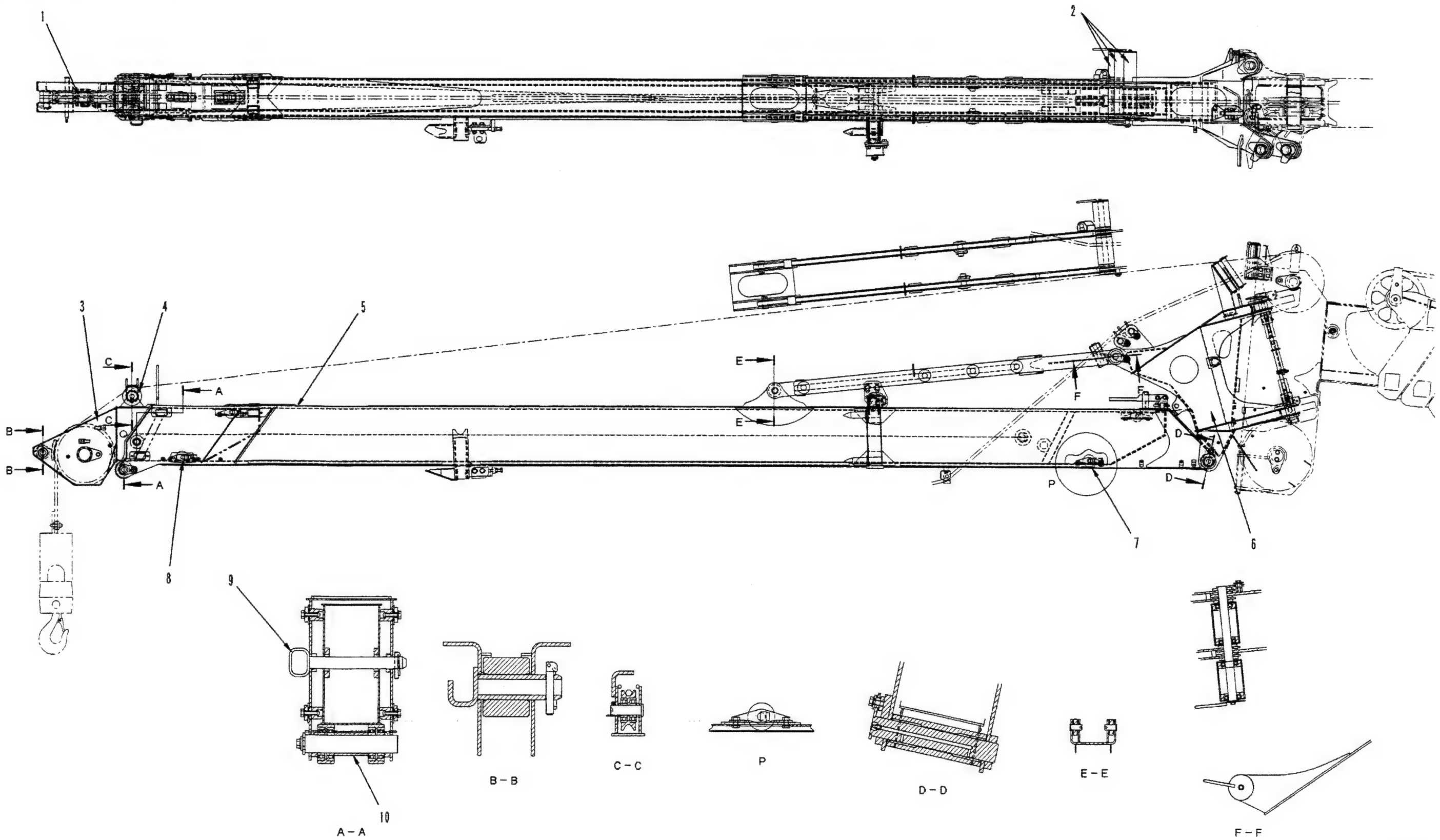


023S05

SDL00458

JIB
(MACHINE WITH MANUAL TILT JIB)

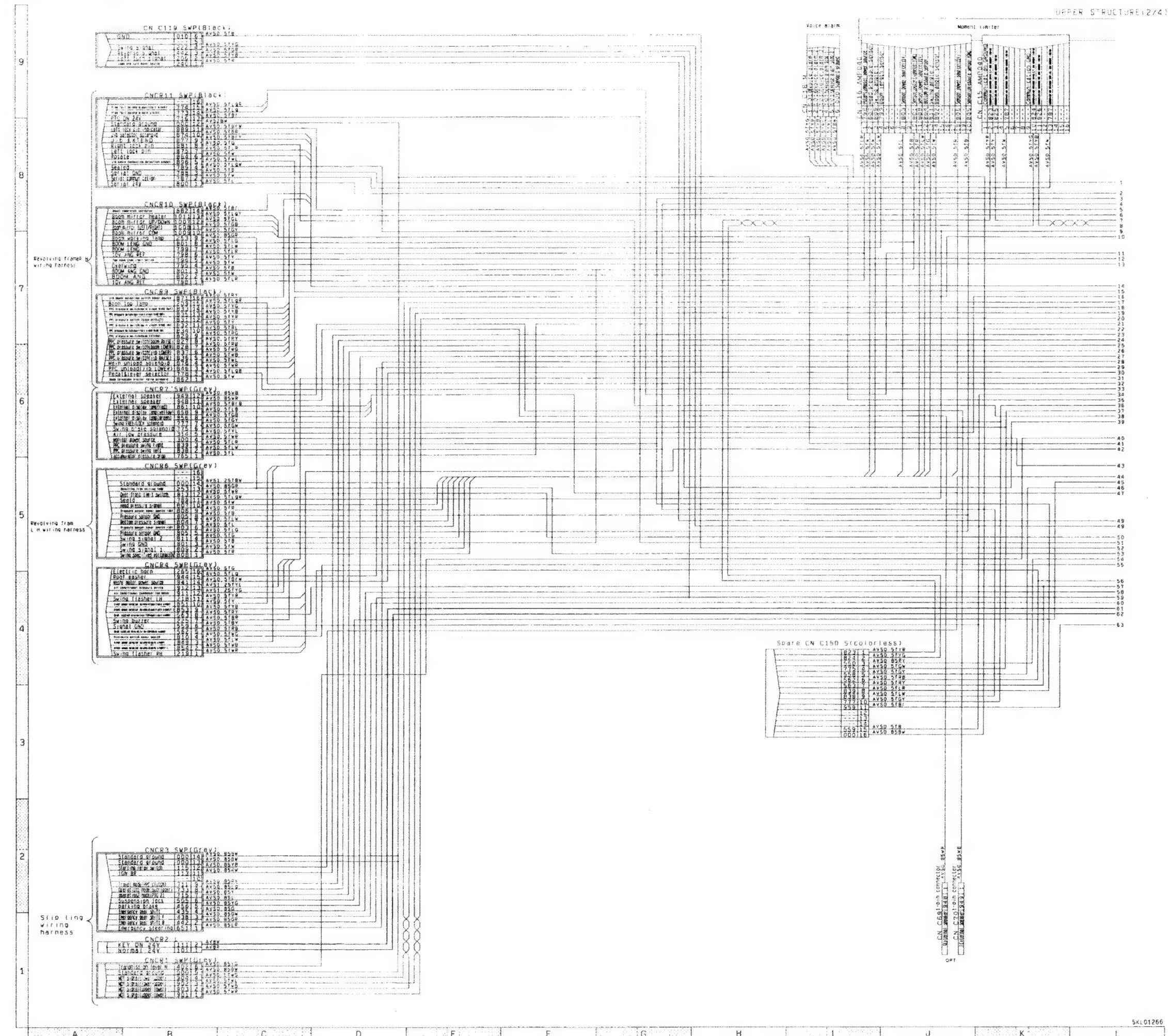
023S05



SKL01643

UPPER STRUCTURE (1/4)

UPPER STRUCTURE(2/4)



TO UPPER STRUCTURE(2/4)



UPPER STRUCTURE (3/4)



UPPER STRUCTURE (4/4)

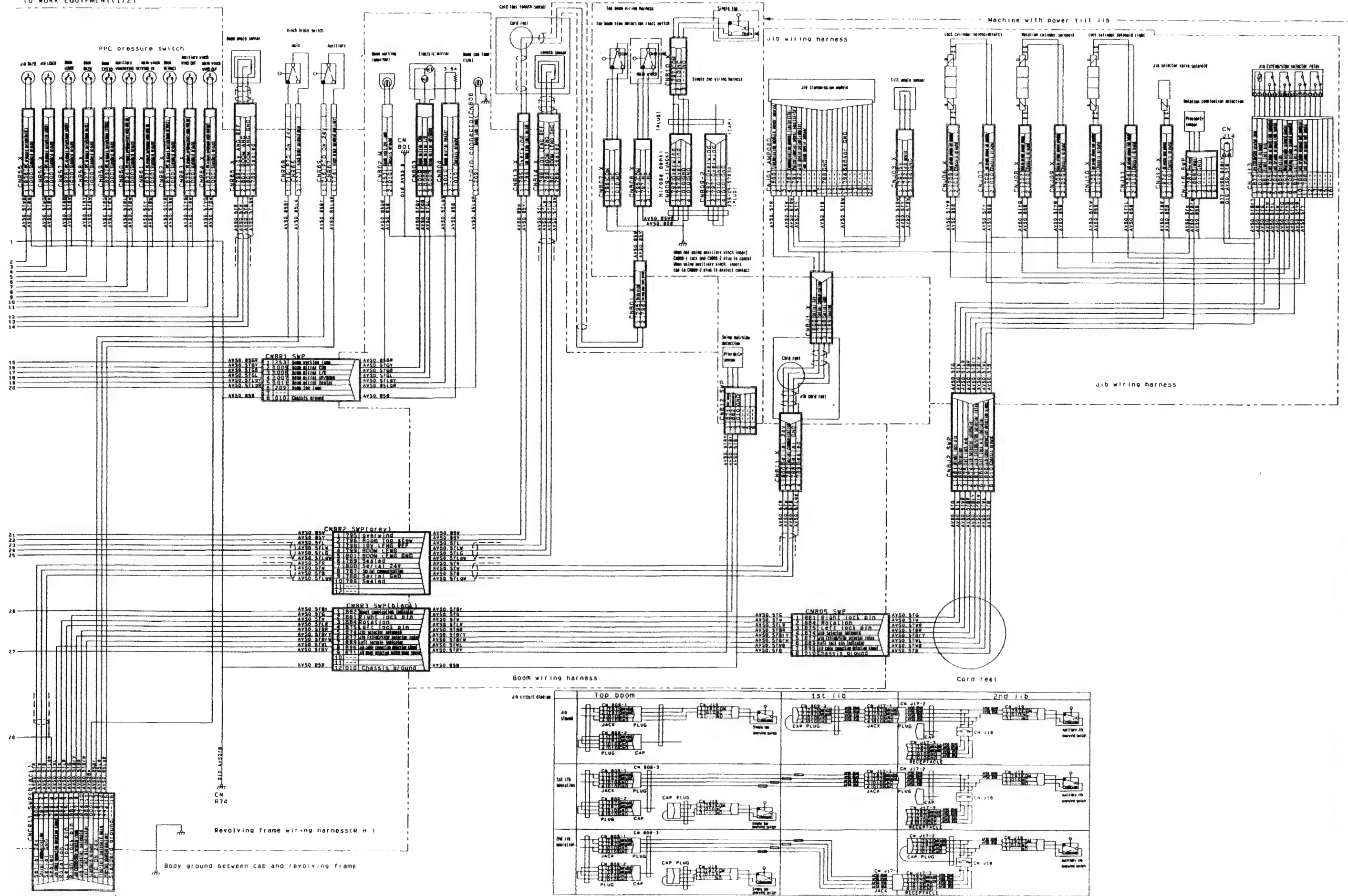


WORK EQUIPMENT (1/2)

SKL01270

ELECTRIC CIRCUIT DIAGRAM

WORK EQUIPMENT (2/2)
MACHINE WITH POWER TILT JIB
TO WORK EQUIPMENT (1/2)

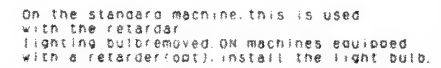


SVL01718

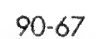
PANEL (1/2)



PANEL (2/2)

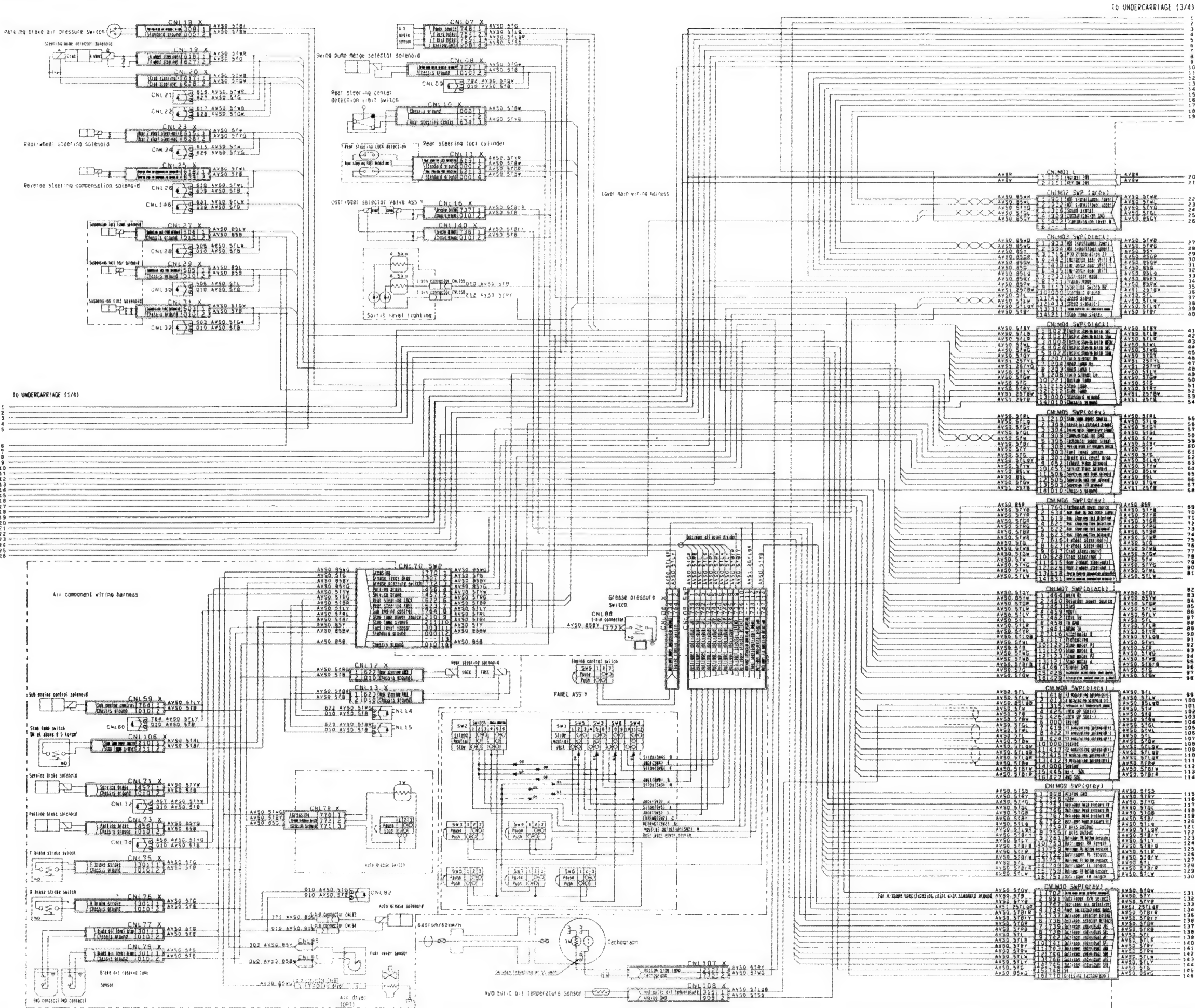


UNDERCARRIAGE (1/4)



ELECTRIC CIRCUIT DIAGRAM
UNDERCARRIAGE (2/4)

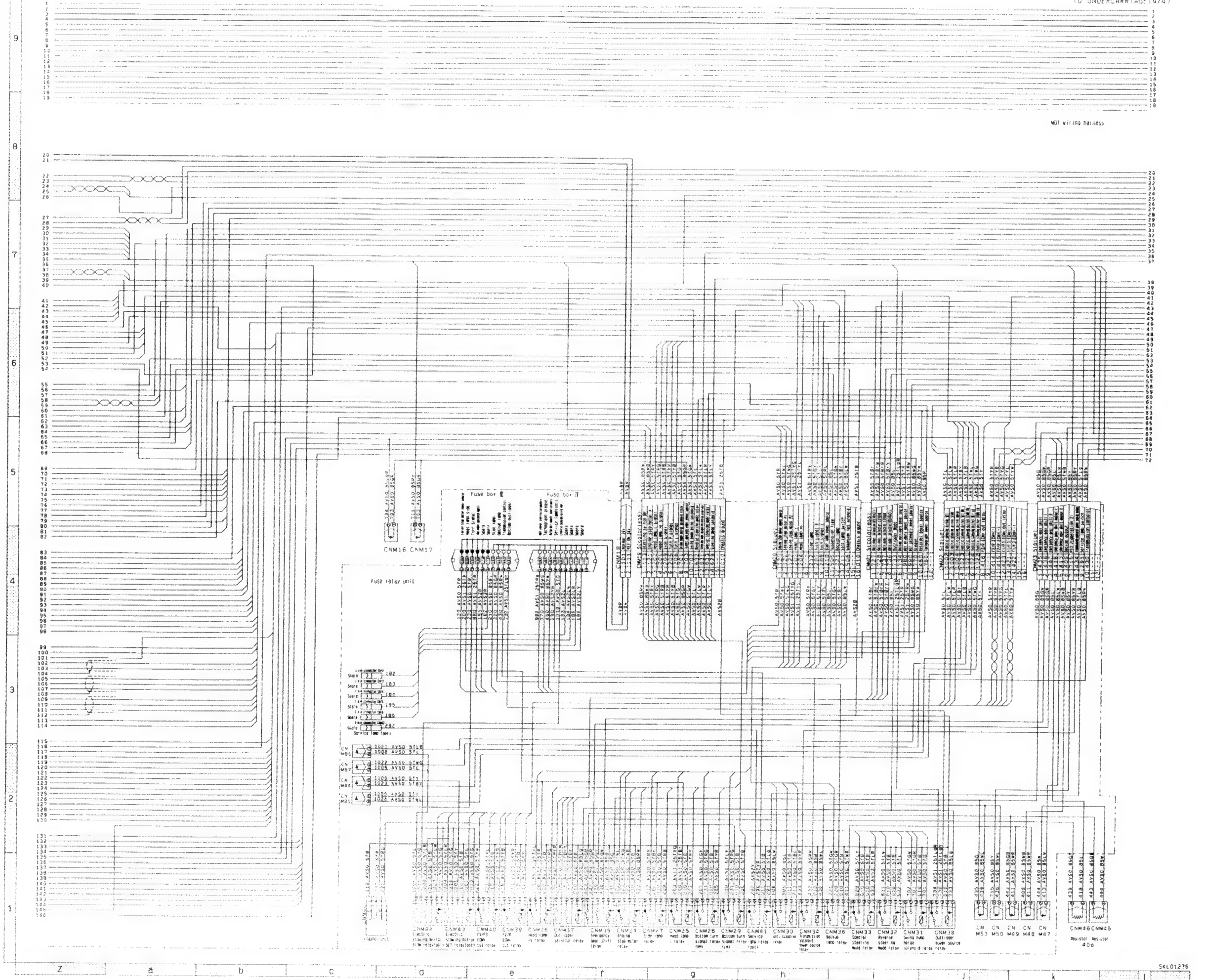
023S05



UNDERCARRIAGE (3/4)

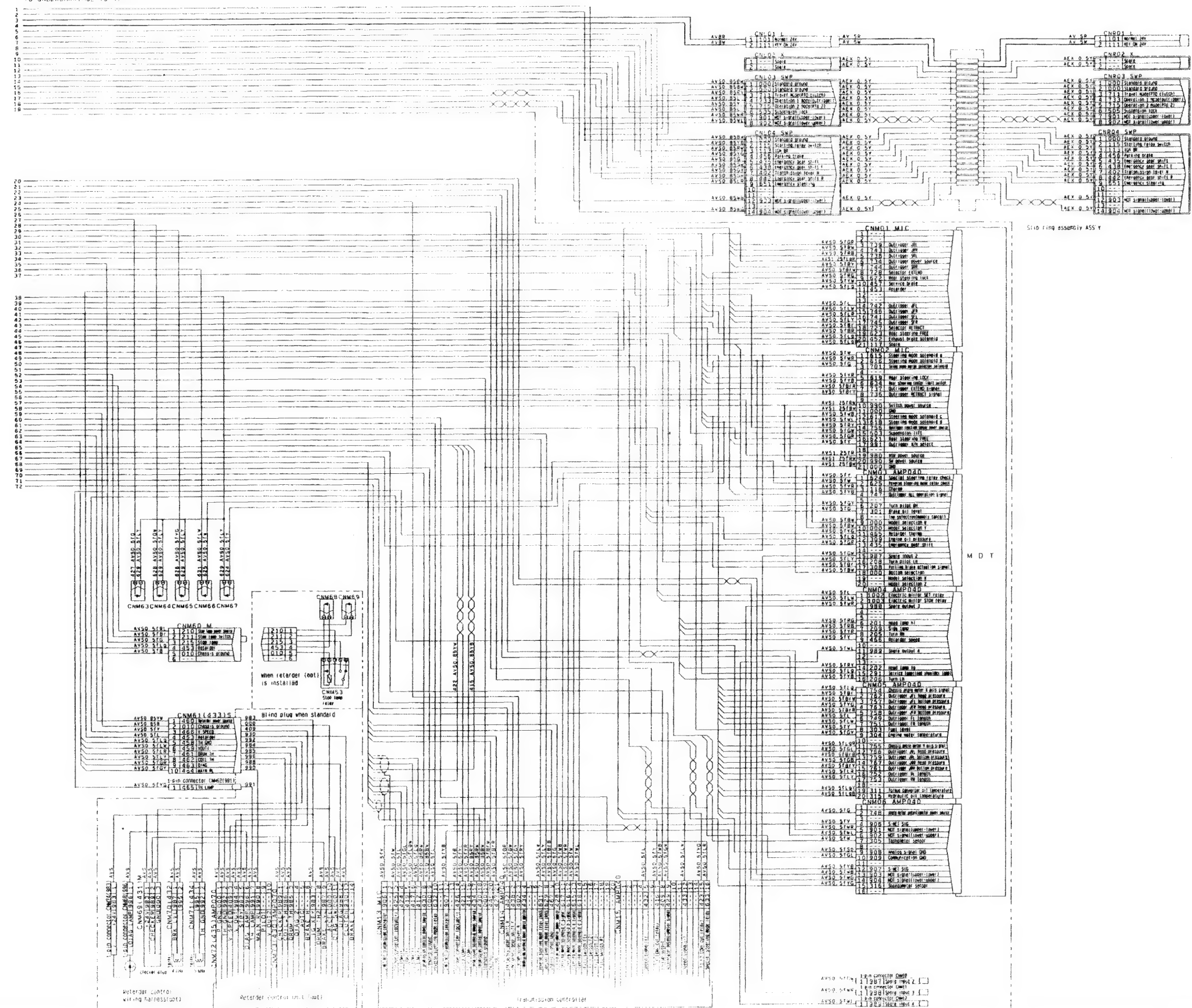
*O UNDERCARRIAGE (2/4)

TO UNDERCARRIAGE (4/4)



UNDERCARRIAGE (4/4)

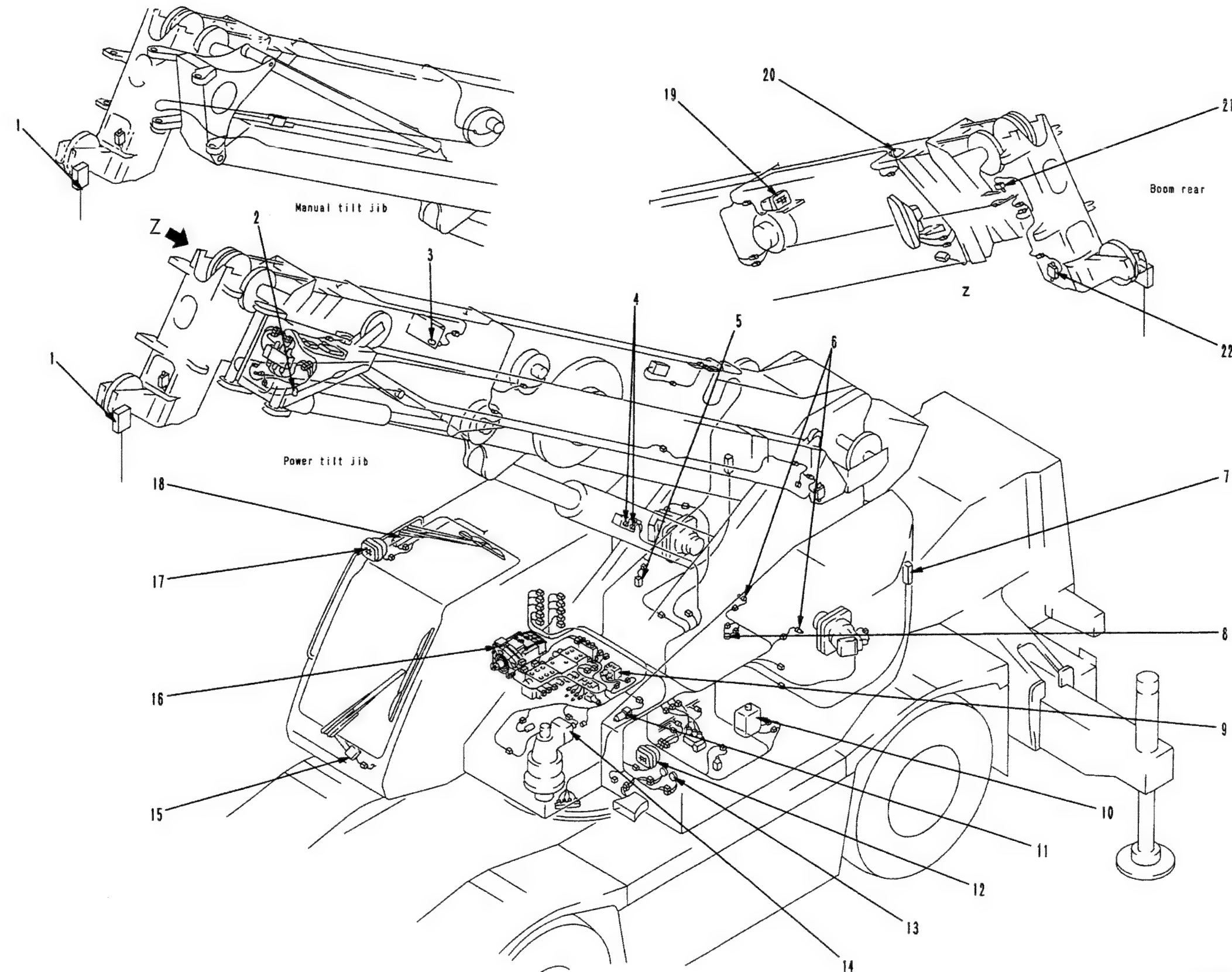
TO UNDERCARRIAGE (3/4)



5K1 01277

ELECTRICAL COMPONENT DIAGRAM (1/3)

UPPER STRUCTURE

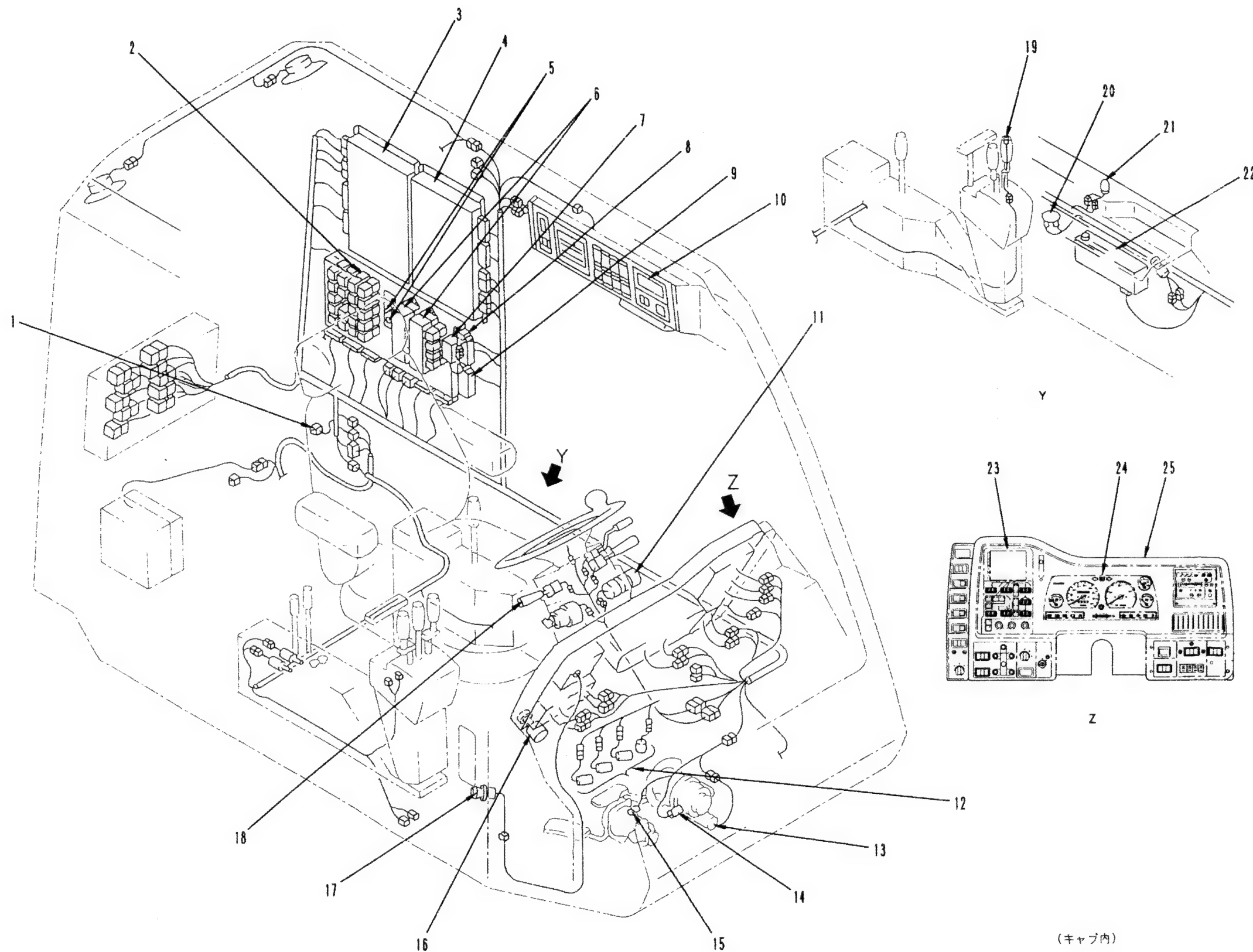


1. Single top overwind switch
2. Jib rotation completion detection switch
(Machine with power tilt jib)
3. Jib EXTEND/STOW detection switch
(Machine with power tilt jib)
4. Hoist cylinder pressure sensor
5. Boom telescope selector valve
6. Drum rotation proximity switch
7. Swing flasher lamp
8. Swing buzzer
9. Pedal selector valve
10. Washer tank
11. Front wiper relay
12. Working lamp
13. Electric horn
14. Swing FREE/LOCK valve
15. Front wiper motor
16. Cooler amp
(together with air conditioner unit)
17. Working lamp (top of cab)
18. Roof wiper motor

SVL01674

ELECTRICAL COMPONENT DIAGRAM (2/3)

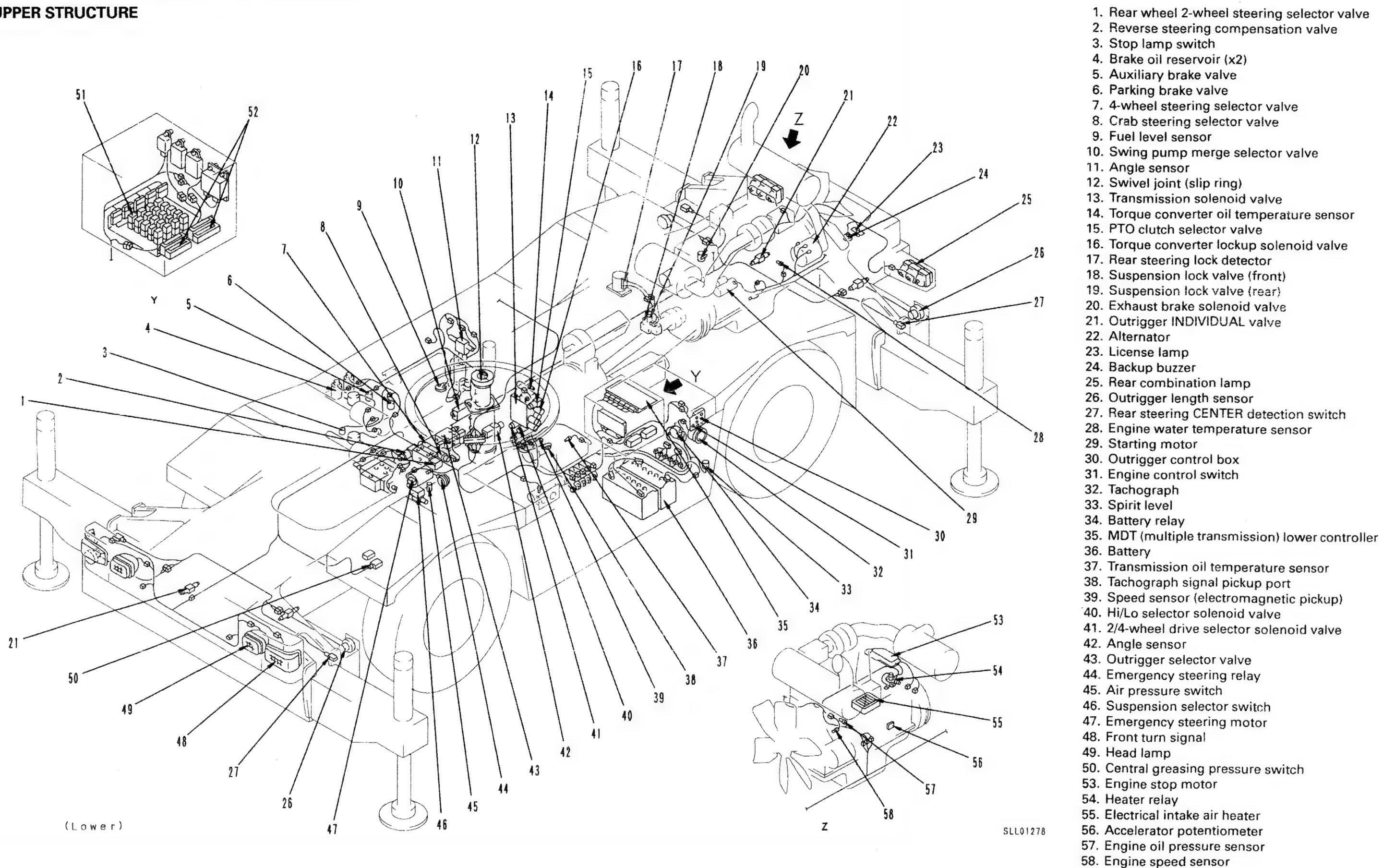
UPPER STRUCTURE



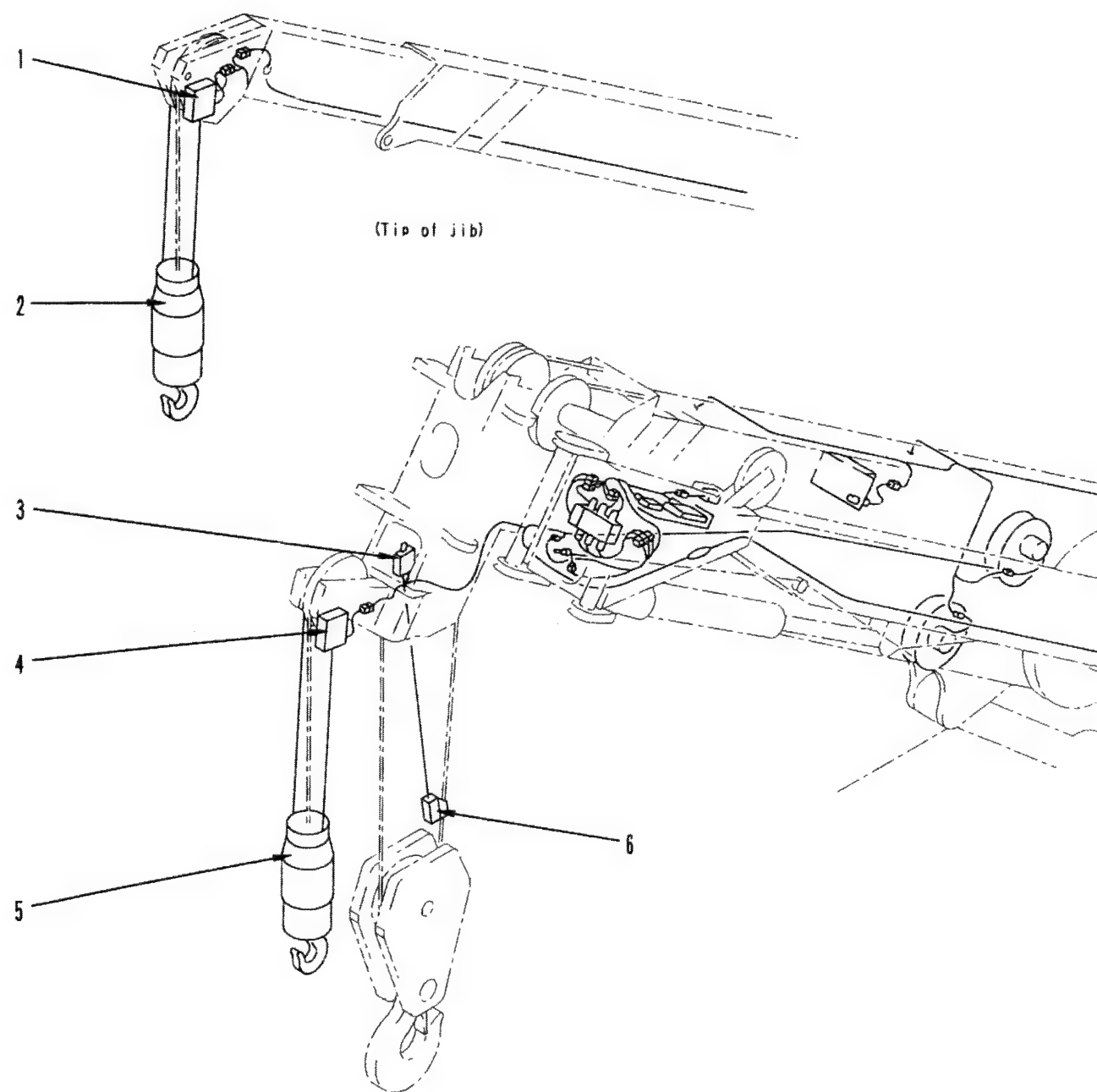
1. Voice alarm (moment limiter)
2. Side winker selector relay
3. MDT (multiple transmission) upper controller
4. Moment limiter controller
5. Emergency gear shift selector switch
6. Top fuse box
7. Flasher unit
8. Roof wiper relay
9. Front wiper relay
10. Top panel
11. Wiper switch
12. Alarm buzzer
13. Air pressure sensor
14. Low pressure sensor
15. Accelerator OFF switch
16. Cigarette lighter
17. Door switch
18. Combination switch
19. Swing horn switch
20. Spirit level (inside cab)
21. Left panel lighting
22. Radio
23. Moment limiter panel
24. Meter panel
25. Front panel assembly

ELECTRICAL COMPONENT DIAGRAM (3/3)

UPPER STRUCTURE



OVERWIND PREVENTION SYSTEM DRAWING



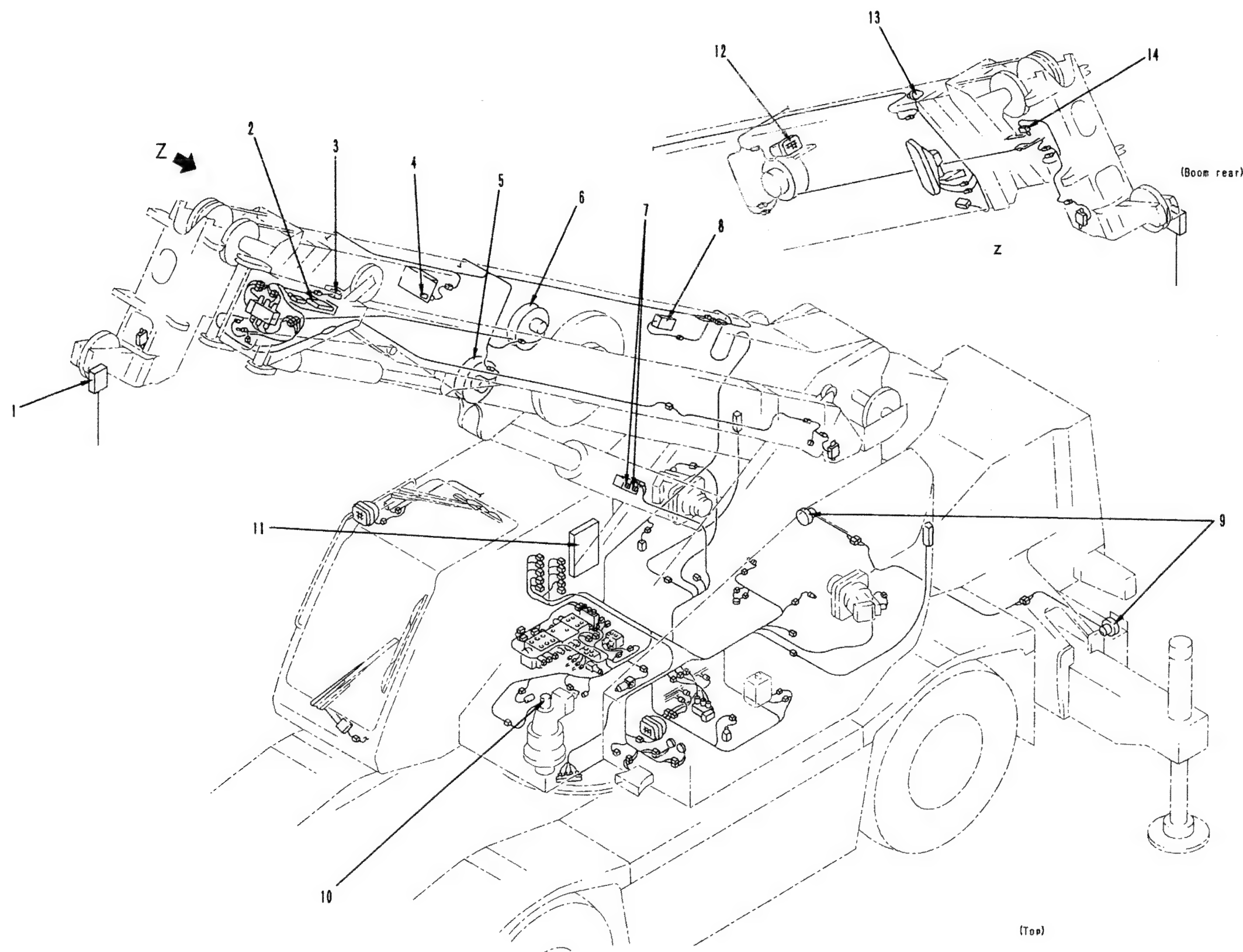
1. Overwind detection switch for auxiliary winch
2. Overwind weight for auxiliary winch
3. Overwind detection switch for main winch
4. Overwind detection switch for single top
5. Overwind weight for single top
6. Overwind weight for main winch

Outline

- Overwind detection switches (1) and (3) are actuated by overwind sensors (2) and (4). When there is an overwind condition, they are turned OFF by the return spring inside the switch, and when the condition returns to normal, the switches are turned ON by the weight of the overwind sensor.

SLL01205

OVERLOAD SAFETY SYSTEM DRAWING



1. Single top overwind limit switch
2. Jib angle transmission module (power tilt machines)
3. Jib angle detector
4. Jib angle cord reel (power tilt machines)
5. Boom length detector (power tilt machines)
6. Boom pressure detector
7. Boom angle detector
8. 2nd boom extension limit switch
9. Boom working lamp
10. Boom top lamp
11. Top boom stowing limit switch

Outline

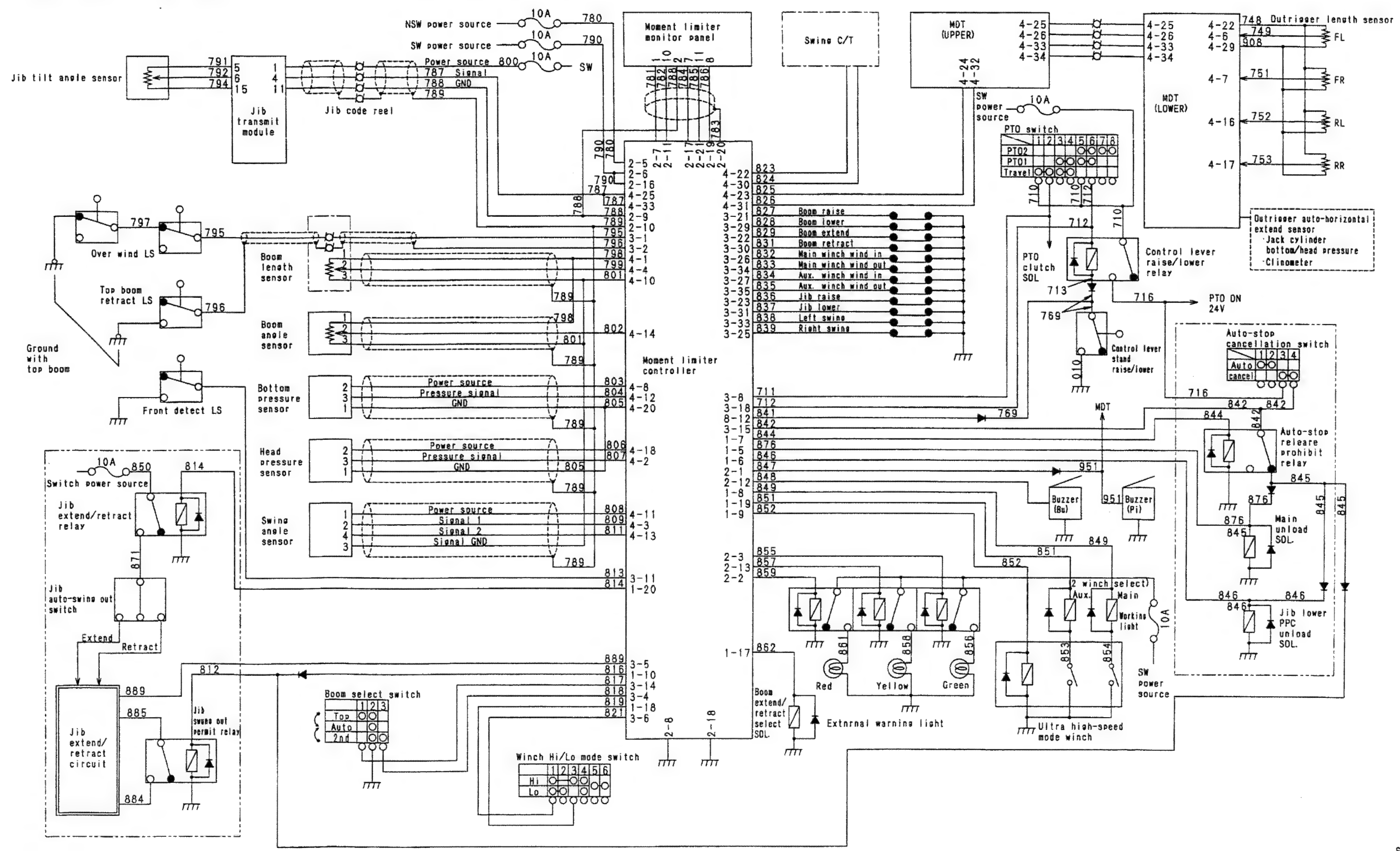
- Boom angle detector (8) is installed to the right side face of the boom and acts to detect the angle of the boom from the horizontal. The boom angle detector consists of a potentiometer and a bob. The bob is actuated in accordance with the movement of the boom, and this movement is transmitted to the potentiometer and detected as an electric voltage output.
- Boom length detector (6) forms one unit with the cord reel. It is installed to the right side face of the boom and acts to detect the change in the length of the boom during boom telescope operations. With boom length detector (6), the cable wound on to the cord reel is pulled out or wound back during boom telescope operations. The rotation of the cord reel shaft is transmitted to the potentiometer and detected as an electrical voltage output.
- Boom pressure detector (7) is installed to the top of the hoist cylinder and acts to detect the pressure that is applied to the boom hoist cylinder.

023S05

SLL01206

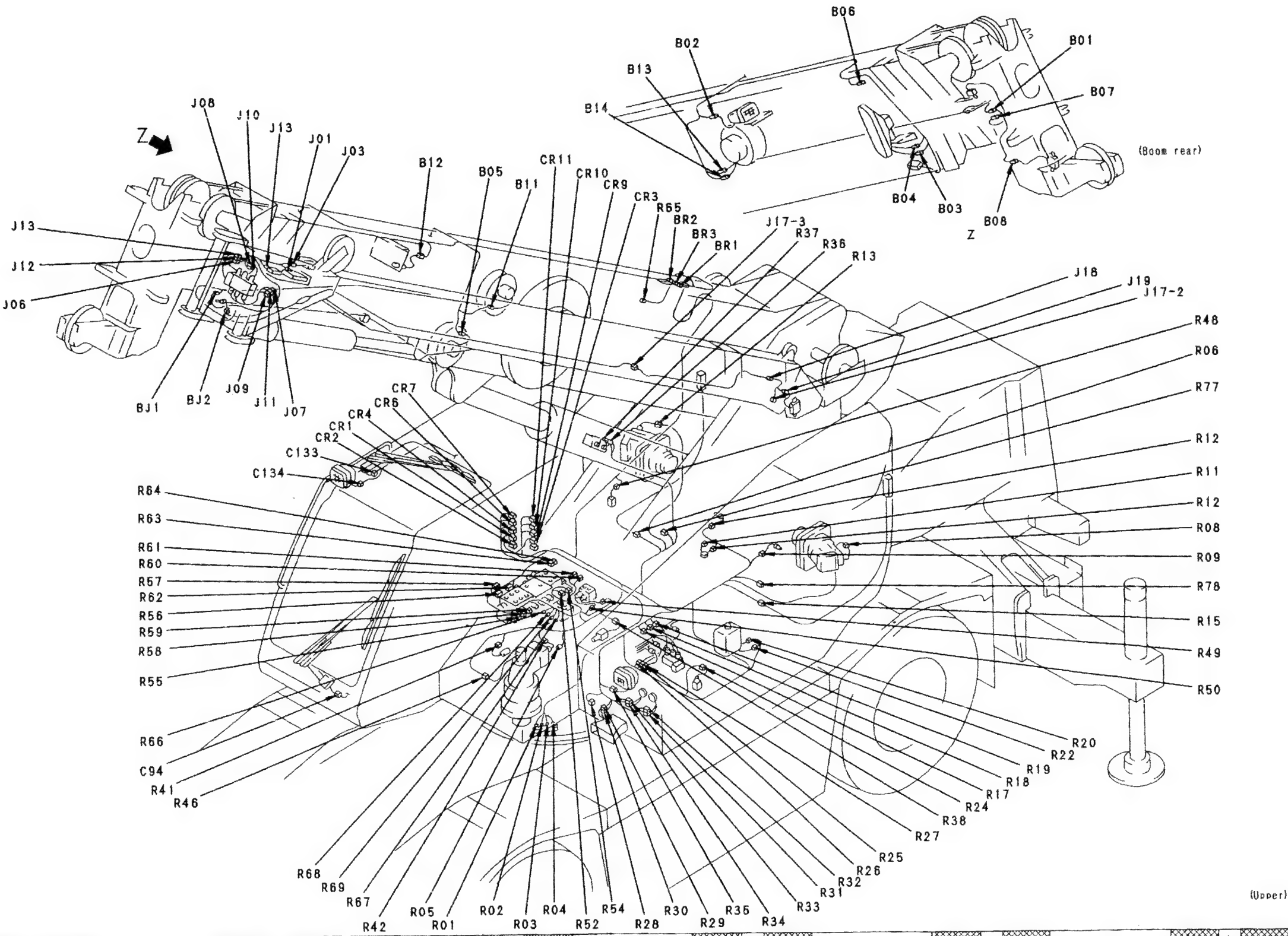
SYSTEM CONSTITUTION CHART

023S05



CONNECTOR ALLOCATION DIAGRAM

1/3

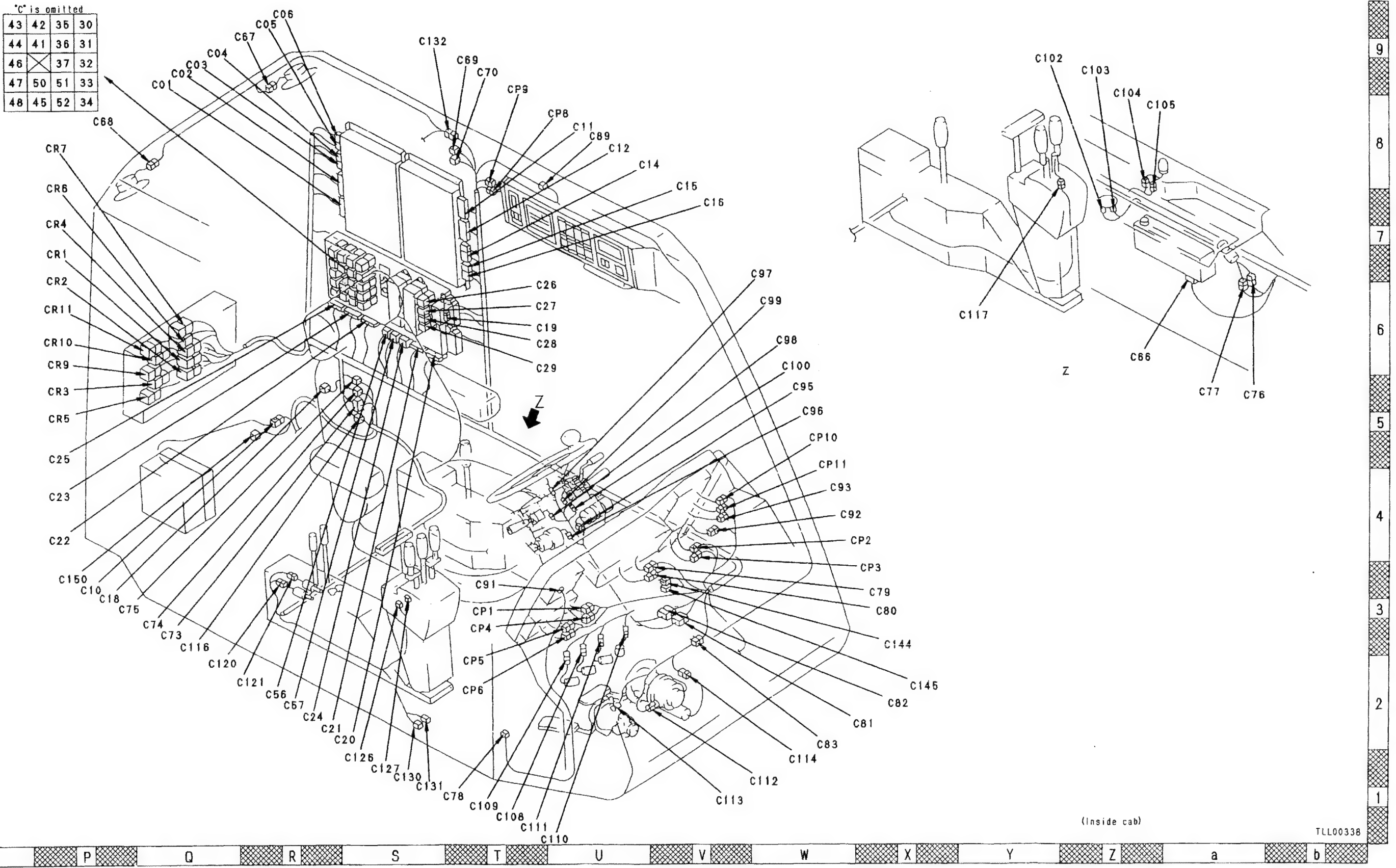


023S05

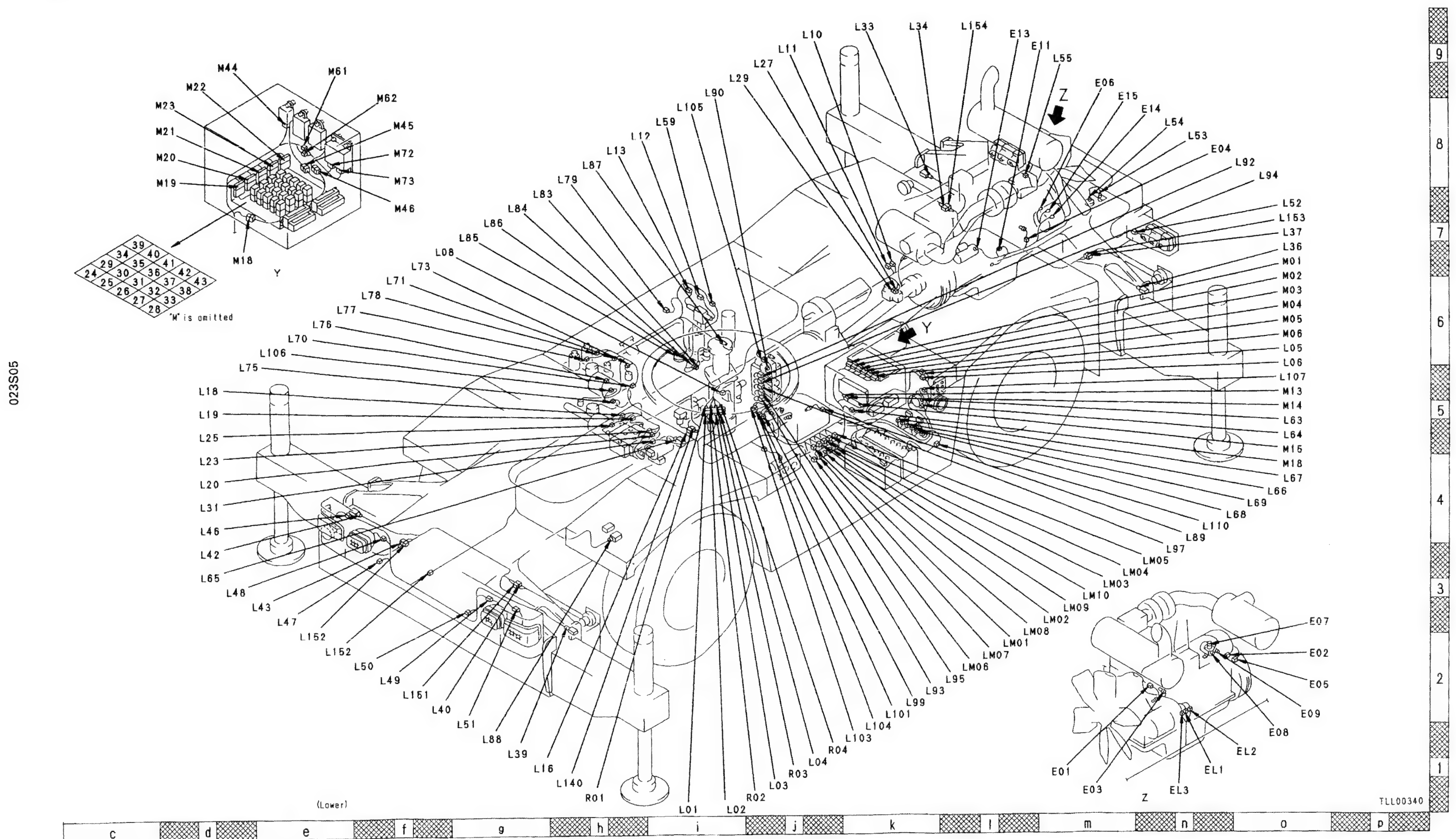
023S05

*C is omitted

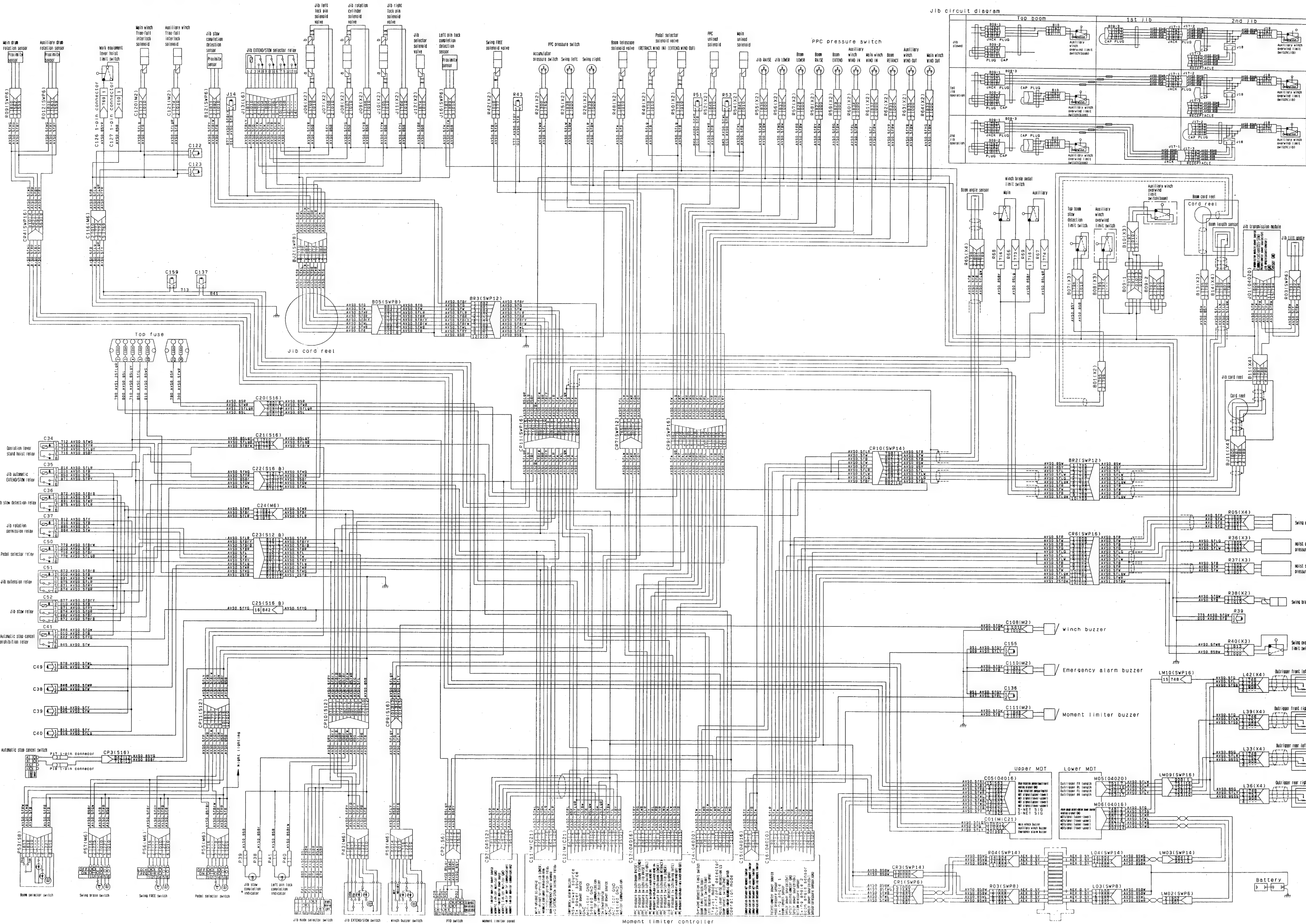
43	42	35	30
44	41	36	31
46	X	37	32
47	50	51	33
48	45	52	34



2/3

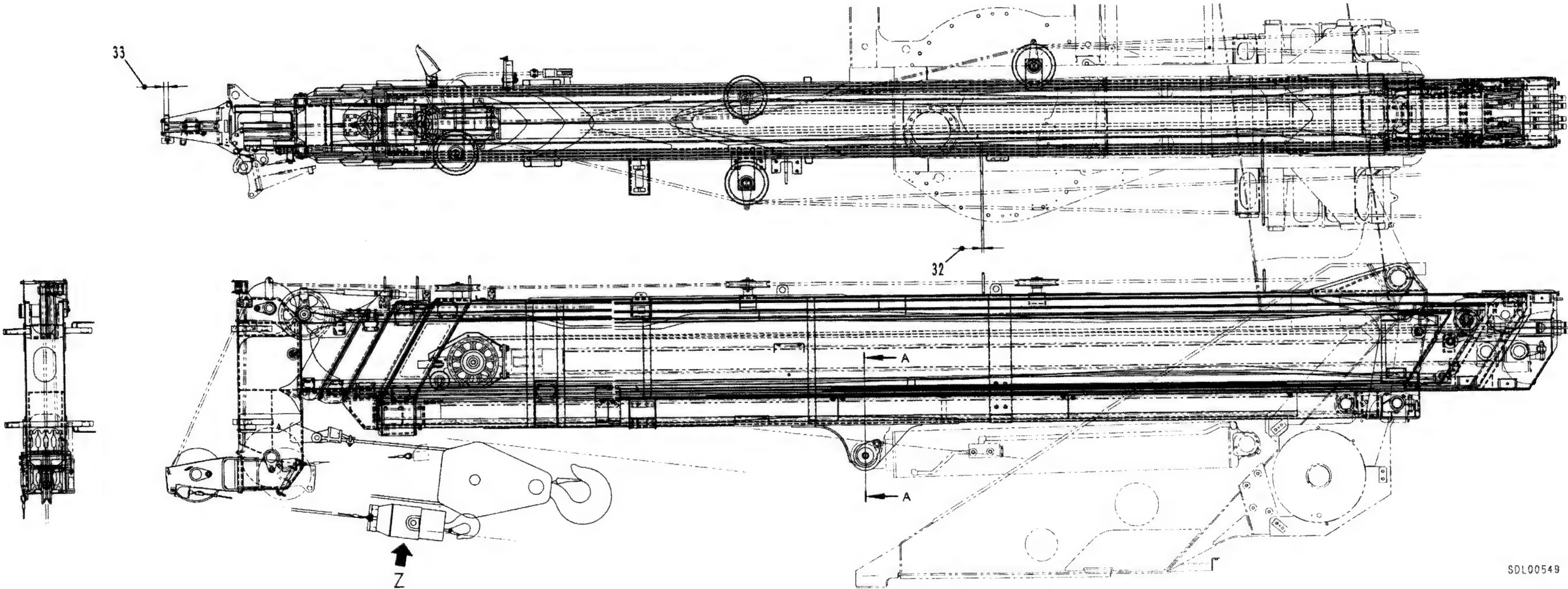


MOMENT LIMITER SYSTEM ELECTRICAL CIRCUIT DIAGRAM

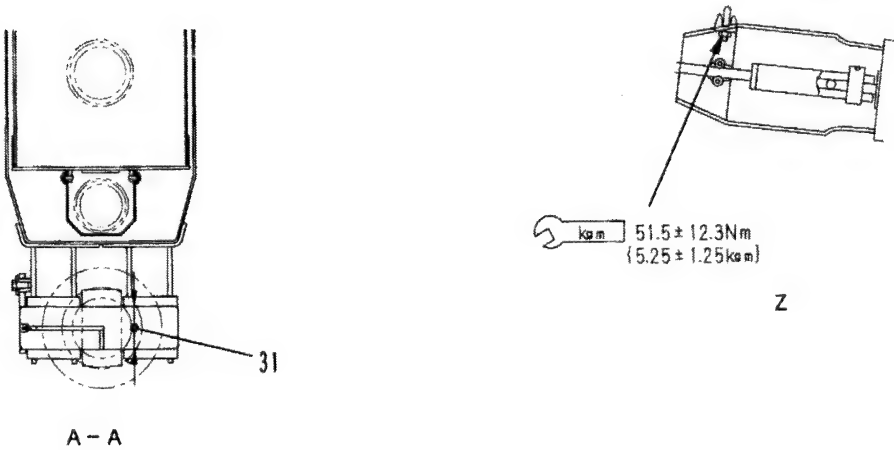


BOOM (1/3)

023S05

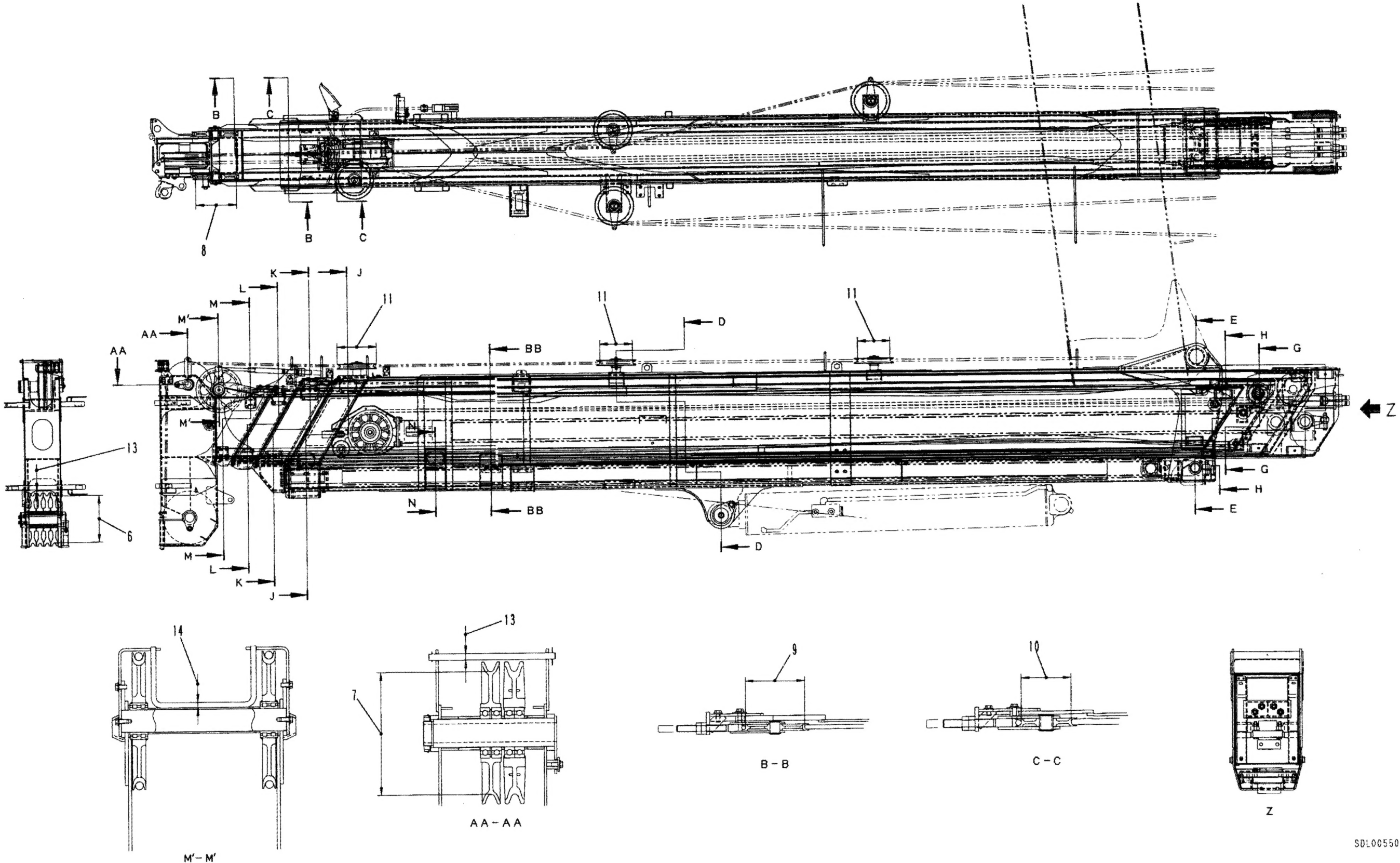


SDL00549



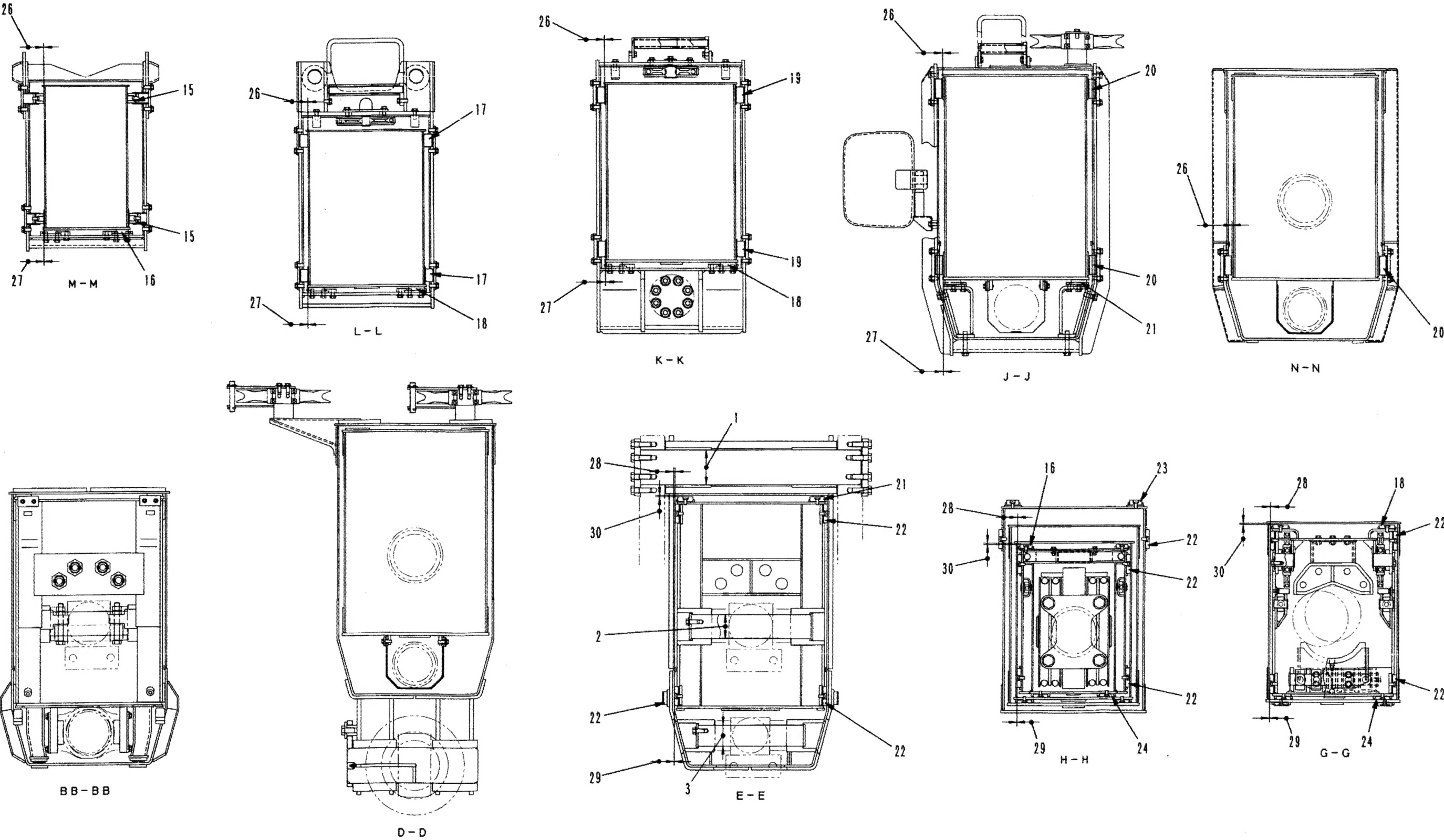
BOOM (2/3)

023S05



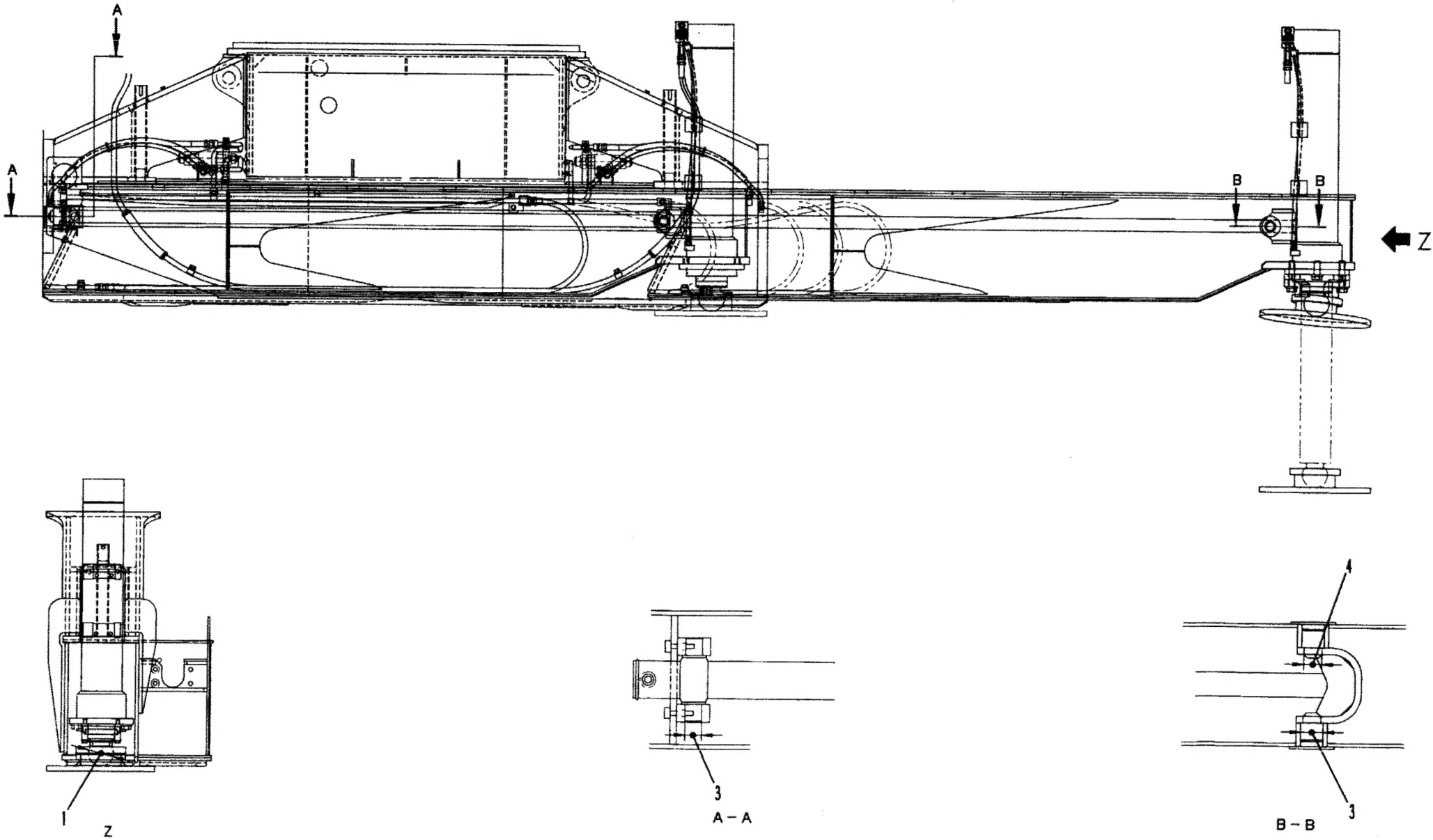
SDL00550

BOOM (3/3)



023S05

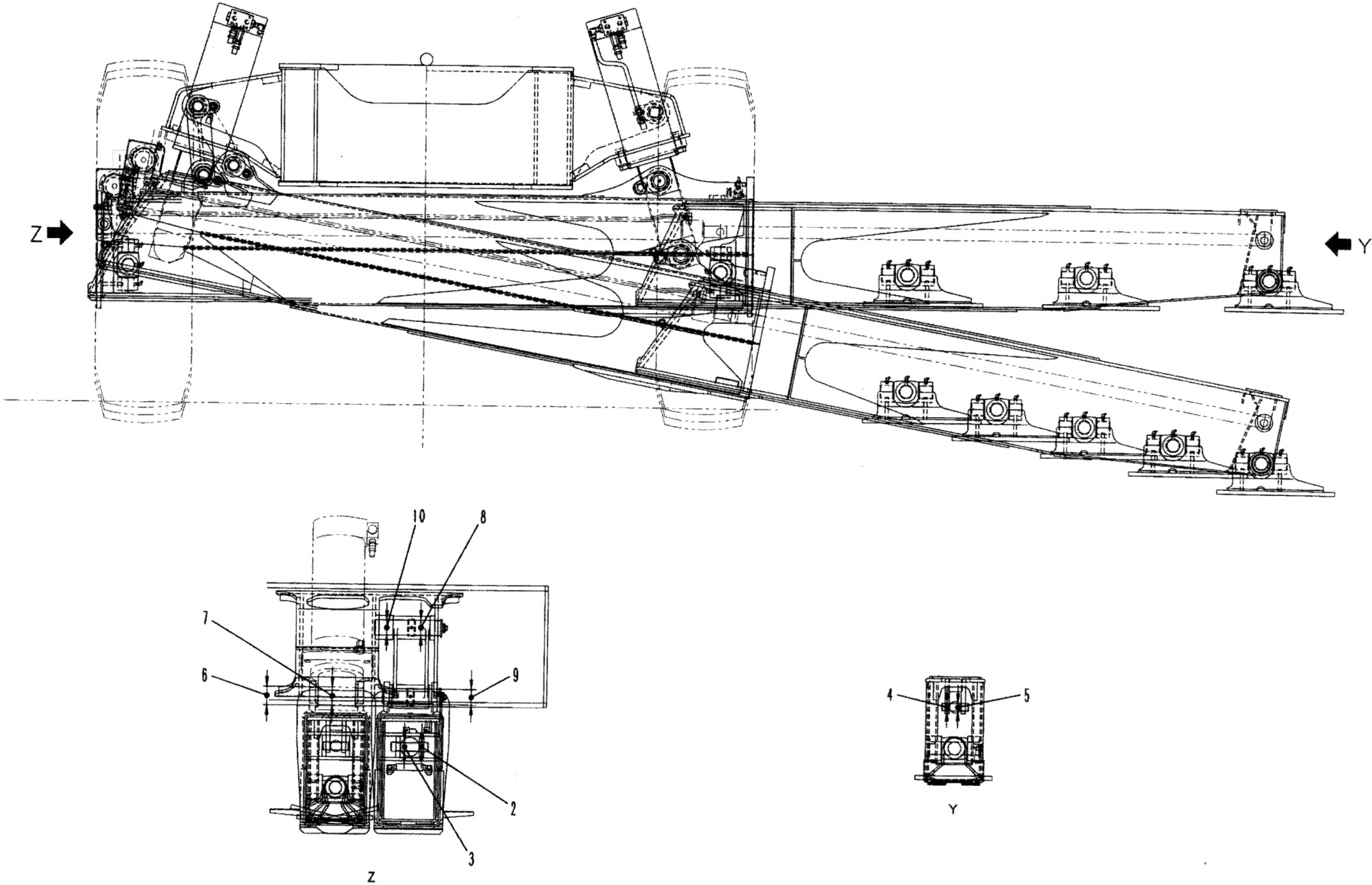
CHASSIS, H-SHAPED OUTRIGGER



SDL00558

023S05

CHASSIS, X-SHAPE OUTRIGGER



SDL00559